Cutaneous Gastro-intestinal Tract Stomata

Condensation of Surgical Information .

Essay

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Dedication

I dedicate my literature to my lovely son Ahmed who gave me hope and happiness in this life . It is for your mother Marwa my honest so kind wife , It is for your brother Arselsn who is memorizing me my time of challenge and it is for your sister Rofaida who assists her mother and gives us flower like sense in home . It is for your brother Marwan who is the biggest son loving his brothers and sister . It is for any of your brothers and sisters in future else . Allah bless you my family for ever .

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List of Abbreviations

Abbreviation	Abbreviation meaning
ABG	*Arterial blood gases*
ASIS	*Anterior superior iliac spine*
Ach	*Acetyl choline*
BMR	*Basal metabolic rate*
CCK	*Choecystokinine*
CT	*Computerized tomography*
ET nurse	*Emergency trained nurse or Enterostomy trained nurse*
ft.	*Feet = 30 cm*
GE	*Gastro eosophageal junction*

GIA stapler	***Gastro intestinal Anastomosing stapler***
GIP	***Glucosedependent insulinotropic peptide***
in.	***Inch = 2.54 cm***
Kcal	***Kilo calories***
KJ	***Kilo joul***
LES	***Lower eosophageal sphincter***
MALT	***Mucosa associated lymphoid tissue***
PEG	***Percutaneous endoscopic gastrostomy***
PSARP	***Postereior Sagittal Ano Recto Plasty***
Tof	***Tracheo-eosophageal fistula***
UES	***Upper eosophageal sphincter***

UK	***United kingdom***

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Introduction

Stoma in surgery means abnormal opening in human body which either saves life or ends it . More than one stoma called STOMATA. It can be a write about stoma type , benefit , hazards , time ,indications, care , surgical access and closure if most be . Diffrentiating between OSTOMY , otomy and ectomy . We will consider OSTOMY not else .

Stoma is either aquired or congenital , external(cutaneous) or internal(anastomosis) , permanent or transient(temporary) , pathological or physiological . The physiological openings are not considerd in this literature .

. *Ostomy surgery* is the target to be foccuced on . Stoma saves life or ends it according to many variants. Types and hazards are considerd to determine which fate will occures . For example , external aquired stoma like colostomy in bowel obstruction saves life . But if there is no post operative care of ABG and Electrolyte loss from it , it may ends life like in ileostomy done due to severe massive inflammatory bowel disease . That is the loss of electrolytes from ileostomy is massive than that of colostomy and so on .

Stomata like oesophagostomy , gastrostomy , ileostomy , uretrostomy , colostomy , choledocoportostomy , vaginostomy , PSARP , vesicostomy ,tof, gastrodeudenostomy ,ectopia vesica, nephrostomy , tracheostomy , internal shunts in short bowel syndrome , colon by pass , ventriculostomy , dacryocystorhinostomy , trephine , maxillostomy , hepatoportoenterostomy , cholecystostomy , gastroenterostomy , rectovesical fistula , branchial fistula , thyroglossal fistula , perianal fistula , all of the above STOMATA are classified either to be aquired , congenital , temporary , permanent , ,pathological(as a surgical complication or a congenital result) , either cutaneos(external), or internal(anastomosis) .

Each Stomata group has its own complications which will be discussed considering Care , Solloutions , and Prevention .

Stoma is either a management of an insult or of type that it is an insult it self that must be managed . e.g. colostomy is either transient or permanent management , psarp is permanent management of imperforate anus . Also , vesicostomy is either temporary or perminant , But fistulas are an insult themselves that must be managed like tof and rectovesical fistula . Actually and theoretically we can consider even canula , open CVP , MAGPI and TIP repair of hypospadias as stomata .

We will concentrate our literature on the ***CUTANEOUS. G.I.T. STOMATA* . Also , we will write about each stoma in human body as possible but in less details than the above mentioned stomata .

Dictionary:

stoma

[stō'mə] *pl.* stomas, stomata

Etymology: Gk, mouth

1 a pore, orifice, or opening on a surface.

2 an artificial opening of an internal organ on the surface of the body created surgically, such as for a colostomy, ileostomy, or tracheostomy.

3 a new opening created surgically between two body structures, such as for a gastroenterostomy, pancreaticogastrostomy, pancreatoduodenostomy, or pyeloureterostomy. [1]

A stoma is a surgically formed opening from the inside of an organ to the outside [2] . In general the beginning of the name explains where the opening originates. The bowel that is attached to the abdomen is referred to as a stoma or an ostomy.

There are three main types of stoma that are formed using the bowel: the colostomy, ileostomy and urostomy. There are other variations such as the rare jejunostomy. There are a reported 100 000 ostomates (people with stomas) in the UK [3] . This fi gure remains largely unchanged over recent times [4]. The number of newly formed stomas in the UK appears to have remained fairly constant for the last ten years. In 2006 there were 21 351 stomas formed, in 2001 fi gures were 19 911 and in 1996 they stood at 19 806 [5] . To assist those with less experience of stomas the various terms for stomas are explained more fully. [6] .

End stomas

An end stoma is formed when one end of the bowel is brought through the surface of the abdomen. The edges of the bowel are turned back and stitched to the abdominal skin with absorbable sutures. The other end of the bowel might be removed, as in an abdominoperineal resection of the rectum, or over-sewn such as in a Hartmann's procedure. An end stoma can be temporary or permanent but generally is permanent. [6] .

Loop stomas

Loop stomas are formed when the distal bowel is defunctioned, for example to protect an anastomosis. A loop of bowel is brought through the surface of the abdomen. A rod or bridge may be used under the bowel to reduce the risk of retraction, but this is not always required. The bowel loop is partially opened and the bowel edges are folded back and sutured to the skin with dissolvable sutures . [7] . resulting in two openings. Through the proximal (afferent) loop will pass faeces. Through the distal (efferent) loop will pass either nothing or a little mucus . [2].

As two loops of bowel are brought to the skin, loop stomas tend to be larger than end stomas. Loop stomas are generally temporary stomas, formed to make easy access to the distal bowel limb for rejoining at a later stage. [6] .

Split/divided stomas (Devine operation)

Split stomas are formed when both ends of the bowel are brought to the skin surface, but at different incision sites . [3] . This may be following a subtotal colectomy when the ileum is formed into an ileostomy and the rectum into a colostomy (mucous fistula). A split stoma is usually temporary. [6] .

Double-barrelled stomas (Bloch-Paul-Miculicz)

A double-barrelled stoma may be used following resection of diseased bowel. The proximal stoma will pass faeces and the distal bowel will be non-functioning but both ends are exteriorised. This can appear like a loop stoma, but no rod is required. Closure of the temporary stoma will require further surgery.[6] .

Defunctioning stoma

A defunctioning stoma is intended only to be present for about three to six months and is used to defunction an anastomosis, for example. This can be as a loop stoma or an end stoma with closure of the distal limb. A loop stoma will not fully defunction the distal bowel, as it is possible for faeces to pass from the proximal to the distal bowel and not into the appliance. However a loop stoma does well enough in most cases . [8] . to prevent complications. [6] .

Trephine stoma

A trephine stoma is created laparoscopically through an incision on the abdomen prior to the abdomen being opened. This means that the stoma is formed on secure muscles . [8]. Often a midline abdominal incision is not required for a trephine colostomy, such as one formed for faecal incontinence. [6] .

Temporary stomas

In 2006 the number of temporary stomas formed was 10 301 which was a rise from 9067 in 2001 and an increase from 7925 in 1996 .[5]. It should be noted that the number of temporary ileostomies has more than doubled in a ten-year period to 5749 in 2006 and the number of temporary transverse colostomies has more than halved to 760 in the same time period . [5] . There are a variety of situations that

may require the formation of a temporary stoma, in the emergency situation where there is sepsis, for example, and thus a risk to an anastomosis . [9]. A temporary stoma may be formed to protect an anastomosis until healing has occurred. Generally a temporary stoma is reversed or closed three or more months after the initial surgery in a smaller operation. [6] .

Permanent stomas

The number of permanent stomas has remained stable at about 11 000 newly formed each year . [5] . Permanent stomas are generally formed if anal sphincters will be compromised during surgery. This could be in situations where incontinence may follow resection of a low rectal tumour, for example. A permanent stoma is also formed when the distal portion of the bowel or urinary tract is removed, for example in an abdominoperineal resection of the rectum. [6] .

Stoma care nursing

The first mention of stoma care was in the 1930s when Plumley described how a patient worked out the care of his own ileostomy as there was no one to advise him . [10] . At this time the only help available was from other patients or to use one's own ingenuity . [11].
The issue of support for ostomates was first addressed in 1958 by an ileostomate Norma Gill . [12] .

Ms Gill was not a health care professional but assisted Dr Turnbull in Cleveland, USA as anostomy technician . [13] . Ms Gill helped to organise the United Ostomy Association and form the World Council of Enterostomal Therapists . [11].

Dr Turnbull and Ms Gill started the first training programme for professionals in 1961, designed to assist ostomates to adjust to their stoma. In 1969 a UK ward sister, Barbara Saunders at St Bartholomew's Hospital, London, set up a stoma clinic with her surgeon Ian Todd. Ms Saunders became the fi rst stoma specialist nurse in the UK in 1971 . [10] .

In 1977 the Royal College of Nursing formed the Stoma Care Forum. Nurses with an interest in stoma care could, and still can, belong to this forum . [10] . This has now been expanded to include any nurse working in gastrointestinal nursing . [11] .

A year later the Department of Health and Social Services brought out 'The Provision of Stoma Care', a paper detailing to health authorities how to appoint a trained stoma specialist nurse. It was considered important to care for the small number of ostomates, as it was felt that this group faced signifi cant problems coming to terms with their stoma. Stoma care nursing is both acute and long-term, therefore patients are never discharged from the service. Patients can range from neonates to the elderly and the primary aim of the stoma specialist nurse is to promote independent living if possible. The advent of specialist nurses to improve the care for ostomates [14] has resulted in over 400 stoma specialist nurses in the UK . [15].

The WCET (World Council of Enterostomal Therapy) is a world wide stoma care forum to support stoma specialist nurses. Every few years the council meets in different countries to exchange stoma care experience and knowledge. There is also the ECET (European Council of Enterostomal Therapy) in Europe and the WCET UK with meetings across Europe and the UK respectively. [6] .

Present day stoma care

Stoma care, along with nursing in general and the National Health Service (NHS), are rapidly altering. Money and its effective use are more important than ever before. However, patients' expectations are also increasing and standards need to be maintained and improved. There are many generic nursing issues that affect stoma care, but specific areas include sponsorship of stoma nurse posts and the regulation of this.

The *Essence of Care* document (Department of Health 2001) discussed benchmarking to help improve the quality of care given to patients. Over the years those working in stoma care have attempted to achieve this by setting guidelines within their work remit. *Principle* was developed and published in conjunction with the Royal College of Nursing (RCN) and was designed as a framework for nurses to meet the needs of ostomates . [16].

Wallace (2002) provided a more up-to-date set of competencies and nursing role with a booklet entitled *Competencies in Nursing: Caring for People with Colorectal Problems*. [6] .

Support groups

The fi rst ostomy support groups were set up in America. Currently in the UK, professionals and ostomates run both national and local support groups for people with stomas. The practical advice and help that these groups provide to the ostomates is invaluable. The ones mentioned below are some of the support groups and the list is not exhaustive. [6] .

National support groups for colostomates

The Colostomy Welfare Group was formed in 1966 . [17] . This later became the British Colostomy Association (BCA), which folded 31 December 2005, partially due to funding problems . [18]. A new organisation named the Colostomy Association was launched in November 2005, the website is www.colostomyassociation.org.uk. The association aims to support people with, or about to have, a colostomy and their families and carers . [19] .

National support groups for ileostomates

The ileostomy association of Great Britain and Ireland *(ia)* was formed in 1956 . [17] . This association changed its name and function slightly to incorporate small bowel pouches such as the ileoanal pouch. The name is currently the Ileostomy and Internal Pouch Support Group; the website is www.the-ia.org.uk. The association aims to support people who require surgery to remove their colon and have an ileostomy or ileoanal pouch formed. [6] .

National support groups for urostomates

The Urostomy Association aims to support people who are to undergo, or have undergone, surgery to divert urine. The association was formed in 1971 as the Urinary Conduit Association. In 1984 the name changed to the Urostomy Association (UA). The website is www.uagbi.org. [6] .

National support groups for pouch patients

The Red Lion Group is a UK charity for people who have, or who are considering having, a pouch operation. The website is www.redliongroup. org. [6] .

The future of stoma care

The government regularly updates and alters its policies related to health care provision. There have been, on various occasions, proposals to revise the way that the NHS supplies and delivers stoma appliances. In many cases provision of personal assistance to patients may be lost for ostomates under the proposals that took effect in Scotland in 2005. More analysis of the situation is being undertaken before fi nal decisions are made in the UK. [6] .

The NHS spends more than £630 million each year in England on products such as stoma appliances, incontinence pads and dressings. The reimbursements system for over 200 suppliers requires review. However, some people are concerned that company-sponsored nurses will only promote their own companies' products which compromises patient choice . [18].

However, it can be argued that in the current climate sponsorship of nurse posts actually saves the Trusts' money . [20] .

Additionally most specialist nurses consider that choice is important. In a survey of stoma specialist nurses, it was demonstrated that there were strong feelings from the nurses about the quality of products available to stoma patients. The research also showed that many of the newer products are far superior to the older products, and comparisons on a cost basis alone were short-sighted and jeopardise product availability and the current high standards of stoma care . [21] .

Patient empowerment is desirable if not essential. [22] . Nurses are in the ideal position to facilitate patient empowerment. Appropriately informed autonomous patients can therefore be responsible for their own health decisions. What is the future for nurses? Currently nurses are discovering it difficult to find new jobs, with potential budgets cuts and posts not being replaced . [23] . Nurses need to remain fl exible and adapt to change as they have for many years . [24] .

There are, however, fears about the ability of nursing to continue to evolve in a situation where many hospital jobs including specialist nurse posts have been cut [25], downgraded or are under threat [26]. The RCN magazine stated that the Health Service could not afford to lose specialist nursing posts [27] but many nursing jobs are still at risk. To conclude, it is a huge change in an ostomate's life to have stoma forming surgery. However with appropriate support and advice the ostomate can enjoy a good quality of life. [6] .

Aim Of The Work

The aim of the work is to condensate surgical informations about THE CUTANEOUS G.I.T. STOMATA .Focusing on surgical indications , techniques , post operative care and management of complications .

GASTROSTOMY

Definition and History :

Cutaneous Gastrostomy is a surgical opening of the stomach to the skin . Gastrostomy was one of the first operations performed by surgeons on the abdominal cavity . Sedillot was the first to perform the operation on a human being in 1849 . The patient died of peritonitis .
[186]

The **stomach** is a J-shaped enlargement of the GI tract directly inferior to the diaphragm in the epigastric, umbilical, and left hypochondriac regions of the abdomen . The stomach connects the esophagus to the duodenum, the first part of the small intestine . Because a meal can be eaten much more quickly than the intestines can digest and absorb it, one of the functions of the stomach is to serve as a mixing chamber and holding reservoir. At appropriate intervals after food is ingested, the stomach forces a small quantity of material into the first portion of the small intestine. The position and size of the stomach vary continually; the diaphragm pushes it inferiorly with each inhalation and pulls it superiorly with each exhalation. Empty, it is about the size of a large sausage, but it is the most distensible part of the GI tract and can accommodate a large quantity of food. In the stomach, digestion of starch continues, digestion of proteins and triglycerides begins, the semisolid bolus is converted to a liquid, and certain substances are absorbed. [28] .

Anatomy of the Stomach (Macroscopic)

The stomach has four main regions: the cardia, fundus, body, and pylorus . The **cardia** (CAR-de¯-a) surrounds the superior opening of the stomach. The rounded portion superior to and to the left of the cardia is the **fundus** (FUN-dus). Inferior to the fundus is the large central portion of the stomach, called the **body.** The region of the stomach that connects to the duodenum is the **pylorus** (pı¯-LOR-us; *pyl-* _ gate; *-orus* _ guard); it has two parts, the **pyloric antrum** (AN-trum _ cave), which connects to the body of the stomach, and the **pyloric canal,** which leads into the duodenum. When the stomach is empty, the mucosa lies in large folds, called **rugae** (ROO-ge¯ _ wrinkles), that can be seen with the unaided

eye. The pylorus communicates with the duodenum of the small intestine via a smooth muscle sphincter called the **pyloric sphincter.** The concave medial border of the stomach is called the **lesser curvature,** and the convex lateral border is called the **greater curvature.** [28] .

The principal role of the stomach is to store and prepare ingested food for digestion and absorption through a variety of motor and secretory functions.

The stomach can be divided into five regions based on external landmarks: the cardia, the region just distal to the gastroesophageal (GE) junction; the fundus, the portion of the stomach above and to the left of the GE junction; the body, or corpus, the largest portion of the stomach; the antrum, the distal 25% to 30% of the stomach, located between the incisa angularis and the pylorus; and the pylorus, a thickened ring of smooth muscle forming the distal boundary of the stomach.

The arterial blood supply to the lesser curvature of the stomach is from the left gastric artery, a branch of the celiac axis, and the right gastric artery, a branch of the common hepatic artery. The greater curvature is supplied by the short gastric and left gastroepiploic arteries, branches of the splenic artery, and the right gastroepiploic artery, a branch of the gastroduodenal artery.

Venous drainage of the stomach parallels arterial supply, with the left gastric (coronary) and right gastric veins draining into the portal vein, the left gastroepiploic vein draining into the splenic vein, and the right gastroepiploic draining into the superior mesenteric vein.

The principal innervation to the stomach is derived from the right and left vagal trunks. [29] .

Histology of the Stomach (Microscopic)

The stomach wall is composed of the same basic layers as the rest of the GI tract, with certain modifications. The surface of the **mucosa** is a layer of simple columnar epithelial cells called **surface mucous cells** . The mucosa contains a **lamina propria** (areolar connective tissue) and a **muscularis mucosae** (smooth muscle) . Epithelial cells extend down into the lamina propria, where they form columns of secretory cells called **gastric glands.** Several gastric glands open into the bottom of narrow channels called **gastric pits.** Secretions from several gastric glands flow into each gastric pit and then into the lumen of the stomach. The gastric glands contain three types of *exocrine gland cells* that secrete their products into the stomach lumen: mucous neck cells, chief cells, and parietal cells. Both surface mucous cells and **mucous neck cells** secrete mucus . [30] .

Parietal cells produce intrinsic factor (needed for absorption of vitamin B12) and hydrochloric acid. The **chief cells** secrete pepsinogen and gastric lipase. The secretions of the mucous, parietal, and chief cells form **gastric juice,** which totals 2000–3000 mL (roughly 2–3 qt.) per day. In addition, gastric glands include a type of enteroendocrine cell, the **G cell,** which is located mainly in the pyloric antrum and secretes the hormone gastrin into the bloodstream. This hormone stimulates several aspects of gastric activity. Three additional layers lie deep to the mucosa.

The **submucosa** of the stomach is composed of areolar connective tissue. The **muscularis** has three layers of smooth muscle (rather than the two found in the esophagus and small and large intestines): an outer longitudinal layer, a middle circular layer, and an inner oblique layer. The oblique layer is limited primarily to the body of the stomach. The **serosa** is composed of simple squamous epithelium (mesothelium) and areolar connective tissue; the portion of the serosa covering the stomach is part of the visceral peritoneum. At the lesser curvature of the stomach, the visceral peritoneum extends upward to the liver as the lesser omentum. At the greater curvature of the stomach, the visceral peritoneum continues downward as the greater omentum and drapes over the intestines. [30] .

Physiology :

Mechanical and Chemical Digestion in the Stomach

Several minutes after food enters the stomach, gentle, rippling, peristaltic movements called **mixing waves** pass over the stomach every 15 to 25 seconds. These waves macerate food, mix it with secretions of the gastric glands, and reduce it to a soupy liquid called **chyme** (KI¯M _ juice). Few mixing waves are observed in the fundus, which primarily has a storage function. As digestion proceeds in the

stomach, more vigorous mixing waves begin at the body of the stomach and intensify as they reach the pylorus. The pyloric sphincter normally remains almost, but not completely, closed. As food reaches the pylorus, each mixing wave periodically forces about 3 mL of chyme into the duodenum through the pyloric sphincter, a phenomenon known as **gastric emptying.** Most of the chyme is forced back into the body of the stomach, where mixing continues. The next wave pushes the chyme forward again and forces a little more into the duodenum. These forward and backward movements of the gastric contents are responsible for most mixing in the stomach. [31] .

Foods may remain in the fundus for about an hour without becoming mixed with gastric juice. During this time, digestion by salivary amylase continues. Soon, however, the churning action mixes chyme with acidic gastric juice, inactivating salivary amylase and activating lingual lipase, which starts to digest triglycerides into fatty acids and diglycerides. Although parietal cells secrete hydrogen ions (H+) and chloride ions (Cl_) separately into the stomach lumen, the net effect is secretion of hydrochloric acid (HCl). **Proton pumps** powered by H+/K+ ATPases actively transport H_ into the lumen while bringing potassium ions (K+) into the cell . At the same time, Cl_ and K+ diffuse out into the lumen through Cl_ and K+ channels in the apical membrane. The enzyme *carbonic anhydrase,* which is especially plentiful in parietal cells, catalyzes the formation of carbonic acid (H2CO3) from water (H2O) and carbon dioxide (CO2). As carbonic acid dissociates, it provides a ready source of H+ for the proton pumps but also generates bicarbonate ions (HCO3 _). As HCO3 _ builds up in the cytosol, it exits the parietal cell in exchange for Cl_ via Cl_/HCO3 _ antiporters in the basolateral membrane (next to the lamina propria). HCO3 _ diffuses into nearby blood capillaries.

This “alkaline tide” of bicarbonate ions entering the bloodstream after a meal may be large enough to elevate blood pH slightly and make urine more alkaline. HCl secretion by parietal cells can be stimulated by several sources: acetylcholine (ACh) released by parasympathetic neurons, gastrin secreted by G cells, and histamine, which is a paracrine substance released by mast cells in the nearby lamina propria. Acetylcholine and gastrin stimulate parietal cells to secrete more HCl in the presence of histamine. In other words, histamine acts synergistically, enhancing the effects of acetylcholine and gastrin. Receptors for all three substances are present in the plasma membrane of parietal cells. The histamine receptors on parietal cells are called H2 receptors; they mediate different responses than do the H1 receptors involved in allergic responses. The strongly acidic fluid of the stomach kills many microbes in food. HCl partially denatures (unfolds) proteins in food and stimulates the secretion of hormones that promote the

flow of bile and pancreatic juice. Enzymatic digestion of proteins also begins in the stomach. [31]

The only proteolytic (protein-digesting) enzyme in the stomach is **pepsin,** which is secreted by chief cells. Pepsin severs certain peptide bonds between amino acids, breaking down a protein chain of many amino acids into smaller peptide fragments. Pepsin is most effective in the very acidic environment of the stomach (pH 2); it becomes inactive at a higher pH. What keeps pepsin from digesting the protein in stomach cells along with the food? First, pepsin is secreted in an inactive form called *pepsinogen;* in this form, it cannot digest the proteins in the chief cells that produce it. Pepsinogen is not converted into active pepsin until it comes in contact with hydrochloric acid secreted by parietal cells or active pepsin molecules. Second, the stomach epithelial cells are protected from gastric juices by a 1–3 mm thick layer of alkaline mucus secreted by surface mucous cells and mucous neck cells. Another enzyme of the stomach is **gastric lipase,** which splits the short-chain triglycerides in fat molecules (such as those found in milk) into fatty acids and monoglycerides. [31] .

A monoglyceride consists of a glycerol molecule that is attached to one fatty acid molecule. This enzyme, which has a limited role in the adult stomach, operates best at a pH of 5–6. More important than either lingual lipase or gastric lipase is pancreatic lipase, an enzyme secreted by the pancreas into the small intestine. Only a small amount of nutrients are absorbed in the stomach because its epithelial cells are impermeable to most materials. However, mucous cells of the stomach absorb some water, ions, and short-chain fatty acids, as well as certain drugs (especially aspirin) and alcohol. Within 2 to 4 hours after eating a meal, the stomach has emptied its contents into the duodenum. Foods rich in carbohydrate spend the least time in the stomach; high-protein foods remain somewhat longer, and emptying is slowest after a fat-laden meal containing large amounts of triglycerides. [31] .

Indications :

Gastrostomy is used widely to prevent distention of the stomach or to feed the patient . The increasing application of endoscopic or percutaneous techniques for accomplishing this not with standing , the techniques described here in are essential components of the general surgeons armamentarium , and knowledge about them and skill in performing them should beccome second nature . [32] .

The indications for all four techniques of cutaneous gastrostomy , open Stamm gastrostomy, percutaneous placement of a catheter without endoscopy,or with fluoroscopy guided catheter, or by laparoscopically placed gastrostomy tubes are virtually the same , namely , the permanent or temporary need for entral feeding access, the need for gastric decompression, and an access rout to the esophagus for controlled dilatation. All four procedures have been performed in all age groupes without significant diffrences.

Contraindications to performing a gastrostomy are also similar for all methods. No gastrostomy should be placed in the presence of uncontrollable ascites, coagulopathy, or gastric wall pathology. The percutaneous techniques, however, have their own contraindications. Although previous surgery may be a relative contraindication, a percutaneous approach can still be used with appropriate caution. The inability to appose the stomach against the abdominal wall is a contraindication in both percutaneous techniques, a problem recognised either via flouroscopy or by the inability to transilluminate the wall with the gastroscope during PEG placement. Oropharyngeal and esophageal pathology that limits the ability to perform endoscopy is also a contraindication with regard to the PEG. [33] .

In infants and children, gastrostomies are indicated primarily for long-term enteral feedings and less frequently for decompression or a combination of both. In the last three decades, advances in peri-operative management have led to a more

selective use of gastrostomies in patients with various typical paediatric surgical conditions such as congenital anomalies of the gastrointestinal tract and the abdominal wall. On the other hand, there has been a markedly increased utilization of gastrostomies in infants and children without surgical pathology.

The main indication for direct gastric access in these patients is an inability to swallow, usually secondary to central nervous system impairment

.An additional indication for a gastrostomy is the need to provide feeding supplementation in children unable or unwilling to consume adequate calories orally. Other uses of gastric stomas include access for oesophageal bougienage and the longterm administration of unpalatable diet or medications. When feeding is the main indication, two important questions must be addressed. First, *nasogastric tube or gastrostomy?* Nasogastric tubes should be preferred if the expected duration of enteral access is less than 1 or 2 months, because the newer small feeding tubes are highly biocompatible and remain smooth and soft for prolonged periods of time. [34] .

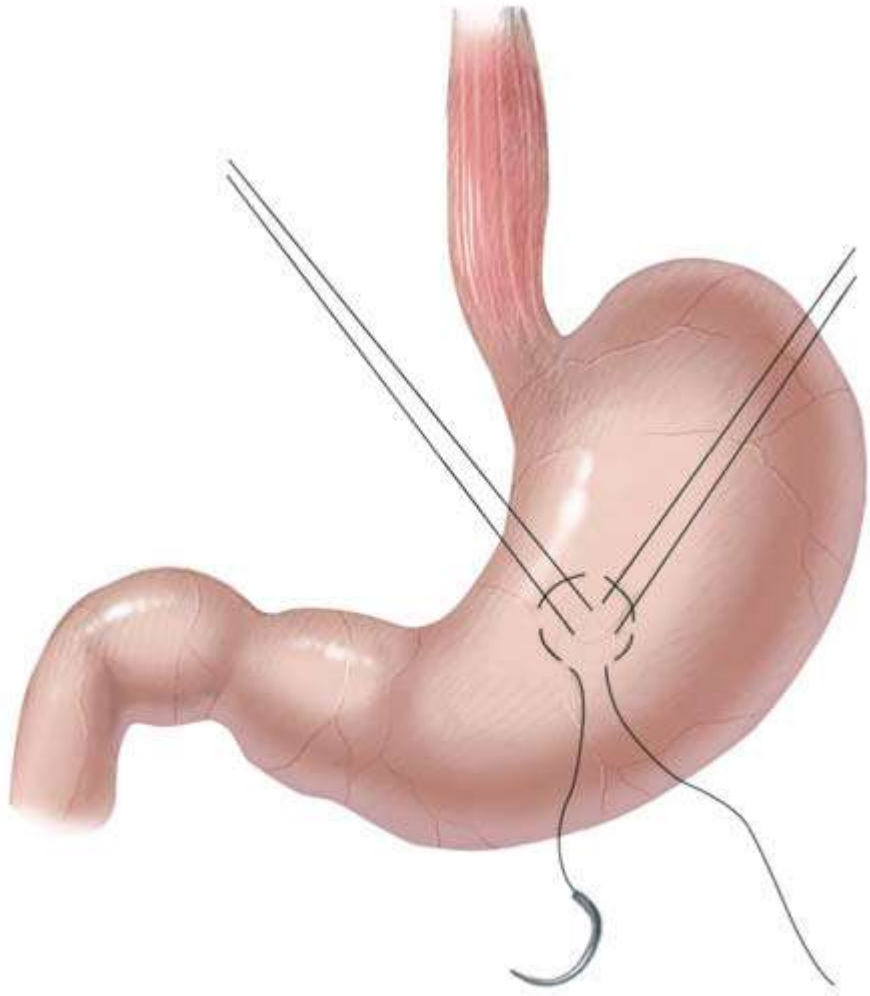

figure (1) purse string suture in gastrostomy (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 185 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

Surgical Technique :

STAMM Technique : A high midline incision is best because it can be made and closed swiftly and easily , it provides adequate access , and it can be enlarged if necessary . The skin incision is made overlying the body of the stomach , and a hemostate is forced from within to the outside to grasp the tip of the Foley catheter , which is pulled in to the abdominal cavity . The gastric entry site is selected and grasped on either side with Babcock forceps .A purse-string suture of 2-0 silk is

applied and the intended puncture site electrocoagulated . figure (1) . A hemostate is passed through the coagulate site down to the mucosa , at which point the hemostate is spread and advanced to grasp the mucosa , this too is electrocoagulated . Taking these steps obliterate any potential bleeding points . With the Babcock forceps to hold the stomach up and suction at the ready , the mucosa is then perforated with the hemostate .The Foley cathetre is inserted and the purse string suture drawn and tied . figure (2) . Annchoring stitches are placed between the stomach and the parietal peritoneum at the cephalad and caudal side of the gastrostomy . The Foley ballon is now inflated . The anchoring stitches are drawn and tied as the Foley pulled , these snugs the stomach to the parietal peritoneum. A stitch is used to anchor the Foley cathetre to the skin . [32] .

Janeway technique : A Janeway technique in gastrostomy is preferred over a Stamm gastrostomy when more permanent access to the stomach is needed . With the abdomen opened and in preparation for creation of the gastrostomy , two Babcock forceps are used to grasp the stomach in a transverse fashion , they will delineate the direction and length of the tube . The GIA instrument is applied with the tip of it at three cm from the greater curvature .The instrument is closed and the staples fired . The tip of tube is included in the staple line , this seals it and lessens the degree of contamination . The tube is oversewn with a continuous stitch of catgut . A counterincision is made in the skin , and the tube is brought to the surface . When the tube is brought to the surface , the pointed tip is cut off , creating and opening , which then is sewn as shown both to anchor the tube and to tent it open for easy cannulation. The abdominal cavity is closed in a preferred manner. [32] .

Gastrostomies should be considered when gastric access is expected to last more than several months. Second, *gastrostomy only or gastrostomy plus antireflux operation?*

Neurologically impaired children, the main candidates for a gastrostomy, frequently have foregut dysmotility and associated gastro-oesophageal reflux. Because gastrostomies can unmask reflux, these children should be evaluated prior to placing a stoma, usually with an upper gastrointestinal contrast series and a pH probe study.

Endoscopy with biopsy, manometry and gastric emptying studies may be added, if deemed necessary. [34] .

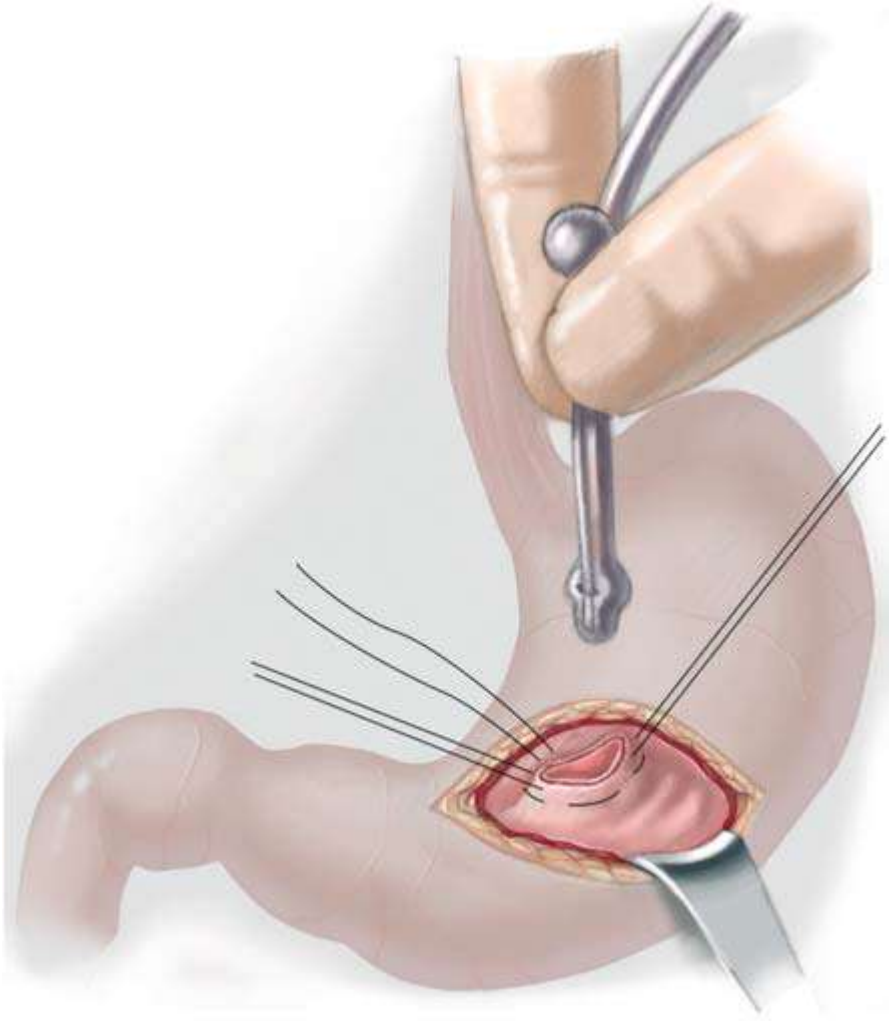

Figure (2) opening gastrostomy hole in the ring of purse string suture (P. Puri · M. E. Höllwarth , springer surgery atlas series page 185 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)

Unfortunately, these studies are not particularly helpful in predicting post-gastrostomy reflux. For this reason, we employ a trial of nasogastric tube feedings for 1 to 2 weeks. If these are well tolerated, The gastrostomy is placed only. If, on the other hand, they are not, an anti-reflux operation is done in conjunction with the gastrostomy. If the need to control reflux surgically arises at a later date, an anti-reflux operation may be added, usually without taking down the gastrostomy. There are three *basic methods* of constructing a gastrostomy. First is the formation of a serosa-lined channel from the anterior gastric wall around a catheter. This catheter is placed in the stomach and made to exit either parallel to the serosa as in the Witzel technique, or vertically as in the Stamm or Kader methods. The anterior gastric serosa is apposed to the peritoneal surface of the anterior abdominal wall with sutures. The Stamm technique is the most widely employed gastrostomy with celiotomy. It can be used in children of any size and even on the smallest stomach (e.g., in newborns with oesophageal atresia without fistula). Second is the formation of a tube from a fullthickness gastric flap, leading to the skin surface where it is anchored with sutures. A catheter is then introduced intermittently for feeding. The construction of a gastric wall tube is seldom used in children. The technique is more time consuming, difficult to perform in small children, not suited for the passage of dilators and is more prone to leakage at the skin level unless an anti-reflux manoeuvre is added, further complicating this approach. This method also interferes with reoperations on the stomach, because part of the gastric wall has been used for the conduit. The third method consists of percutaneous techniques in which the introduced catheter holds the gastric and abdominal walls in apposition. [34] .

These procedures are based on the principle of sutureless approximation of a hollow viscus to the abdominal wall. In addition to the original method, in which gastroscopy was employed, the catheter may also be placed with radiological or, more recently, laparoscopic assistance. Laparoscopic control can also be employed to enhance the safety of percutaneous gastrostomy placement in selected patients with abnormal upper abdominal anatomy in whom injury to adjacent organs, such as the colon, is a concern. Percutaneous endoscopic gastrostomy (PEG) was initially developed for high-risk paediatric patients to allow precise tube placement with endoscopic assistance, without celiotomy. Depending on how the catheter is inserted, the three main variations are: *pull* (Gauderer-Ponsky), *push* (Sachs-Vine) and *introducer* or "*poke*" (Russell) methods.

The first gastrostomy without celiotomy, the Gauderer pull PEG remains the most widely employed gastrostomy,both in adult and paediatric patients. The

procedure time is short and there is practically no postoperative ileus, potential for gastric bleeding or wound disruption. There is only minimal interference with subsequent operations on the stomach. The likelihood of an infection is very small and similar to that of the Stamm procedure. PEG is not generally suited for the passage of dilators. With certain modifications, either one of these basic interventions can be performed by minimally invasive techniques or in conjunction with laparoscopy. [34] .

Details of Tehniques :

The Stamm gastrostomy operation is performed using general endotracheal anaesthesia. A single dose intravenous antibiotic is administered. A nasogastric tube may be inserted to evacuate the contents and help identify the stomach in children with abnormal upper abdominal anatomy.

The child is positioned with a small roll behind the back to elevate the epigastrium, then prepared and draped.

In infants, a thin plastic, small-aperture drape is used to help with temperature maintenance. It is preferred to use silicone rubber de Pezzer-type catheters ranging in size from 12F (full-term neonates) to 20F for adolescents, or PEG-type catheters in which the “dome” has been modified to allow insertion with a stylet. For preterm infants or neonates with a very small stomach, a 10F T-tube or Malecot catheter is employed. The procedure may be modified slightly to accommodate the initial placement of a skin-level device or “button”. The stomach is approached through a short transverse supra-umbilical incision. Fascial layers are incised transversely and the muscle retracted or transected. The catheter exit site should be approximately at the junction of the lower two-thirds and the upper one-third of a line drawn from the umbilicus to the mid-portion of the left rib cage, over the midrectus muscle. A vertical incision may be useful in children with a high-lying stomach or a narrow costal angle. The catheter exit site should not be too close to the rib cage because,with the child’s growth, this distance tends to become shorter. A gastric access device that is too close to the ribs will cause discomfort and interfere with care.

Additionally, the excessive pivoting motion resulting from breathing and moving will lead to stoma enlargement and leakage. Catheters should not be brought out through the incision because this approach predisposes the site to wound complications and leakage. The linea alba tends to be broad and very thin in small children and should also be avoided as an exit site. [35] .

Post-Operative Care :

Enteral feedings are begun following an open gastrostomy once the ileus has resolved, and on the day after the operation following a PEG or a laparoscopic gastrostomy.

Although it has been shown that enteral feedings following PEG can be started as early as a few hours post-procedure. The original,more conservative approach Is maintained. The dressing is removed after 24–36 h, the wound is examined and the external retaining crossbar loosened if necessary. Thereafter, the wound is cleaned with mild soap and water only. Granulation tissue tends to form after a few weeks and is controlled with silver nitrate sticks. If excessive, the area is anaesthetized locally, the granulation tissue excised and the tract cauterized. If the problem is recurrent, It had good results with a cream containing a mixture of topical steroid and an anti-fungal. The abnormal growth ceases once the skin rim grows inward creating a lined gastro- cutaneous tract. If a long catheter needs to be removed in order to be replaced by another catheter or a skin-level device other than the port-valve, this manoeuvre should be done with great care. This is particularly true for the initial change following a PEG. The time required to form a firm adherence between the gastric serosa and the abdominal wall peritoneum following percutaneous techniques, varies. It was used 3 months as a guideline, but shorter periods may be adequate, provided appropriate safeguards are used. Patients on steroids or children with cyanotic heart disease are at particular risk of separation during early catheter change. [36] .

Complications.

Although generally considered a basic procedure, gastrostomy is associated with a long list of complications related to technique, care and catheter use. Serious technique-related problems include separation of the stomach from the abdominal wall, wound separation, haemorrhage, infection, injury to the posterior gastric wall or other organs, and placement of the tube in an inadequate site. The most common and potentially lethal complication is early complete or partial gastric separation. If the stomach was initially secured to the abdominal wall as in the Stamm procedure or secured with T-fasteners (advocated by some surgeons managing adults as a supplement in the introducer-type PEG technique), it is acceptable to insert a balloon-type catheter in the stomach and obtain an immediate water-soluble contrast study to ascertain the correct position. However, if no fixation was used, as in the case of the described PEG, a more aggressive approach is needed and a celiotomy

usually indicated. Laparoscopy may be used as a safe alternative. A re-do PEG alternative has also been described. Fortunately, accidental PEG catheter removal is very rare in children. Most separations stem from a catheter change. [36] .

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Pneumoperitoneum following a percutaneous gastrostomy is common but, fortunately, without sequelae. One of the most troublesome long-term problems is severe leakage from the gastrostomy tract. Initially, this should be managed using conservative measures, such as using smaller catheters to allow the widened fistula to contract. If these fail, the stoma may be relocated using a simple non-endoscopic variation of the percutaneous endoscopic gastrostomy. A new stoma site is selected and a small incision made. A large curved needle is placed through the leaking stoma, exiting through the new site. The suture is pulled through, establishing a tract. The catheter follows the tract, entering through the malfunctioning stoma and exiting through the new one. Once the catheter is in place – as following the described pull PEG here – the leaking stoma is closed extraperitoneally. If a long-standing gastrostomy is no longer needed, the gastric access device is simply removed. If the tract is roughly less than 1 year old, it will usually close fully spontaneously. However, well-established, skin- and mucosa-lined older gastro-cutaneous fistulae will continue to drain. Simple, extraperitoneal excision of the tract with a few sutures in the fascia, subcutaneous layer and skin suffice to close the communication. [36] .

Other Complications :

There were three major early complications. In one patient, the PEG procedure was preceded by an oesophageal dilatation to allow the endoscope to pass an obstructing cancer; this led to an oesophageal perforation and subsequent death. A second patient developed severe respiratory distress, some 12 h after PEG and died soon after. In the third patient, leakage of PEG feeding into the peritoneum caused severe peritonitis and required urgent laparotomy within 24 h of the PEG insertion; the patient was discharged well some 10 days after surgery. [37] .

It is noted that only three direct complications of PEG placement: one an oesophageal perforation attributed to the need to dilate the oesophagus (cancer) prior to the PEG; severe peritonitis soon after the first PEG feed due to a direct leak into the peritoneal cavity; and a gastro-colic fistula requiring surgical correction. Complications of PEG are infrequent, with a procedure-related mortality rate of 1–2% and morbidity of 3–12% in the largest reported series

Reported complications include wound infection, necrotizing fascitis, peritonitis, aspiration, septicaemia, peristomal leakage, device dislodgement, bowel perforation and gastrocolic or colicocutaneous fistulae. Pneumoperitoneum occurs commonly after PEG and is of little clinical significance unless accompanied by signs of peritonitis. The commonest complication is wound infection. Preventing wound infection is important, particularly as so many PEG patients, by the very nature of their underlying medical illness, have poor healing due to associated malnutrition .

[37].

Follow-up.

All children with gastrostomies must be carefully followed to prevent long-term gastric access device-related complications and monitored for adequate nutritional management as well as manifestations of foregut dysmotility, particularly gastrooesophageal reflux. [36] .

Management of Gastrostomy Complications :

Summary Guidelines to Avoid Complications Associated with PEG Placement

Procedure Related Complications

Aspiration
- Avoid over-sedation
- Minimize air insufflation
- Perform procedure efficiently

Bleeding
- Correct coagulopathy
- Consider any alteration of anatomy secondary to prior surgery

Perforation
- Early recognition
- Consider any alteration of anatomy secondary to prior surgery

Prolonged ileus
- Wait 3–4 hours before beginning feeding post-PEG placement
- If gastric distension occurs, uncap the PEG tube for easy decompression

Post Procedure Complications

Care of PEG site
- Use mild soap and water—NOT hydrogen peroxide
- Place drain sponges over, not under, external bumper
- Avoid the use of occlusive dressings

- For excessive granulation tissue, topical silver nitrate may be beneficial

PEG site infection
- Prophylactic antibiotics
- Adequate preoperative skin sterilization
- Consider introducer technique
- Set/maintain proper tension between internal and external bolsters

PEG site leakage/irritation
- Prevent infection
- Avoid local administration of hydrogen peroxide
- Prevent excessive side torsion on the PEG tube

Buried Bumper Syndrome
- Avoid excessive tension between internal and external bolsters
- Account for nutritional weight gain

Gastric ulceration
- Acid suppression
- Avoid lateral traction on the tube

Fistulous tracts
- Elevate the head of the bed during placement
- Utilize the "safe track technique"

Inadvertent removal
- Consider use of an abdominal binder
- Utilize low profile button at initial placement

[38] .

Care and Feeding :

The aim of feeding via a gastrostomy tube is to administer a liquid formula containing sufficient macronutrients and micronutrients to meet a person's needs. Assessment of the person's needs by a dietitianis important to determine which formula to use and how much of the formula is needed each day to meet the person's nutritional needs. [39] .

A dietitian usually undertakes the nutritional assessment. This includes consideration of:
• the person's medical and surgical history; • the person's dietary history; • current health issues that influence the person's nutritional intake and requirements; • pathology results (if relevant and available); • anthropometry—weight, weight history, height, and physical assessments of the person's fat stores and muscle; and • the person's risk of developing 'refeeding syndrome'. The term 'refeeding syndrome' refers to a range of metabolic complications that can arise from refeeding a malnourished person.

The syndrome occurs as a result of the body's adaptation to prolonged fasting or chronic underfeeding. The syndrome involves severe electrolyte and fluid shifts, and is associated with significant morbidity and mortality. The metabolic irregularities of refeeding syndrome can cause cardiac arrhythmias, cardiac failure, neuromuscular dysfunction, and respiratory failure . [40] .

People who are at risk of developing refeeding syndrome should be closely monitored with regular and frequent checks of their serum potassium, phosphate, and magnesium levels. Prompt supplementation should be provided if needed. Feeding is usually introduced slowly and cautiously in such people. [39] .

Nutritional requirements
In assessing nutritional requirements, dietitians estimate an individual's needs in terms of: • energy requirements; • macronutrient requirements (carbohydrate, protein, and fats) • micronutrient requirements (vitamins, minerals, and trace elements); and • fluid requirements. Energy is required to support normal metabolic functions, tissue growth and repair, and physical activity. About two-thirds of the energy spent each day by the average person supports the body's basic functions—

such as the production of blood cells, maintaining the heart beat, and breathing. The energy used by a person over a 24-hour period is largely determined by that person's basal metabolic rate (BMR). The BMR is the energy expenditure of a person lying at physical and mental rest in a comfortably warm environment at least 12 hours after the last meal . [41] .
Dietitians use one of several available equations to calculate a person's BMR. To determine the person's overall energy requirements, dietitians then take into account the person's activity level and any catabolic processes . [39] .

An example of such a calculation is as follows:
Estimated energy requirement = BMR X activity factors X stress factors Different estimation equations take into account different parameters—depending on the individual involved. Complex equations take into account such measurements as arterial blood oxygen saturation or the carbon dioxide concentration of expired air. These might be used in intensive-care units or for research purposes. More commonly, equations rely on practical clinical parameters—such as age, sex, height, actual body weight, and ideal body weight. [39] .

The standard international unit of energy is the joule. However, because one joule is a very small unit of energy, the kilojoule (kJ) is more commonly used in nutritional contexts. Many people continue to express energy in kilocalories (kcal or Cal). One Calorie (1 kcal) is equal to 4.184 kJ. After determining the basal metabolic requirements for energy using such an equation, a dietitian must also take into account other factors that influence an individual's energy requirements. These factors include: • activity level; • body composition; • hormonal state; • climate; • psychological state; • pharmacological agents; and • metabolic stresses and disease states (such as fever, wounds, surgery, fractures, burns, infection, inflammation, cirrhosis, tachycardia, and respiratory distress).

Some conditions can reduce a person's metabolic requirements. For example, mechanical ventilation can result in a decreased BMR because it reduces the work of breathing (although it should be noted that many ventilated people have other physiological stresses that can result in an overall increase in energy needs).

Other examples of conditions that decrease BMR include paralysis or other severe incapacity. Paralysed or severely incapacitated people can have a lower energy requirement than a person with a very sedentary lifestyle. [42] .

Macronutrients

Protein

Protein requirements are determined by taking into account the recommended daily amounts, any increased requirements, any increased losses, and any disease-specific needs. Some of the factors that influence protein needs are:
• age; • fistula losses; • wounds (including surgical wounds, traumatic wounds, and pressure wounds); • infection; • fractures; • burns; • liver disease;
• renal impairment; and • dialysis. [43] .

Carbohydrate

Because most commercial formulae contain a suitable proportion of energy from carbohydrate, dietitians do not routinely calculate carbohydrate requirements. Specific carbohydrate targets are usually reserved for individuals with a metabolic disorder—such as impaired glucose tolerance. In these cases, a review of carbohydrate requirements and the amount of carbohydrate provided might be necessary. Another instance in which the carbohydrate content of a formula might be manipulated is for people with chronic obstructive airways disease. Carbohydrate metabolism results in the production of carbon dioxide (CO_2). This is expelled in expired air via the lungs. Some people with compromised respiratory function are unable to expel enough CO_2. In this situation, it might be appropriate to use a lower carbohydrate formula to reduce CO_2 production—thereby reducing the person's respiratory effort. [43].

Fats

Most commercial preparations contain an appropriate proportion of fat (and a suitable ratio of saturated to unsaturated fats) for most people. In determining an enteral formula, the amount of fat is therefore not usually an issue. In most cases, dietitians consider a specific fat requirement only if there is a specific metabolic abnormality or clinical requirement. An example of such a situation is the presence of steatorrhea (fat malabsorption). In this case, medium-chain triglycerides might be required, and a specialised formula has been developed for the purpose.[43] .

Micronutrients

The provision of micronutrients (vitamins, minerals, and trace elements) needs to be taken into account when long-term tube feeding is required. International bodies have developed guidelines for the levels of micronutrient intake that are scientifically judged to meet the nutritional needs of most healthy people. However, individuals vary in their nutritional needs, and these reference values are only guides in assessing the adequacy of a diet. For example, the iron requirements of a wellnourished person are quite different from those of a person who has depleted body stores of iron (and who therefore requires additional iron to correct for the deficiency). Some medical conditions produce an increased need for certain nutrients. For example, a person experiencing prolonged diarrhoea might need additional potassium and magnesium to make up for the loss of these nutrients. Medications can also affect nutritional requirements. Some drugs are known to affect uptake, absorption, or utilisation of certain nutrients. [43] .

Fluids

Some conditions increase fluid requirements, whereas others lead to decreased requirements. The Box on page 68 provides examples of these. If any of these factors arise (or change) after initial assessment by a dietitian, nutrition and hydration needs should be reassessed. Feeding regimens might need to be adjusted accordingly. [43]

Selection of formulae

Once the nutritional requirements have been determined, the dietitian selects a formula that best suits an individual's nutrient needs and absorptive capacity.

Volume of formula

If a person with a gastrostomy tube is able to take some nourishment by mouth, the nutrient content of this oral intake should be taken into account when determining how much formula is needed. The required intake via the gastrostomy tube is calculated by subtracting the oral intake from the total required intake. [44] .

Types of formula

Enteral formulae are readily available in both liquid and powder forms. Most formulae provide all the essential nutrients and are described as 'nutritionally complete'. They contain protein, carbohydrate, fat, vitamins, minerals, and trace elements. However,different formulae contain different ratios of energy to protein, and carbohydrate to fat. They also contain various levels of micronutrients. Commercially available formulae are typically free of lactose and gluten. If there are several formulae available that meet the nutritional and gastrointestinal needs of a person, factors such as cost and local availability can be taken into account in determining which formula is most appropriate. Although there are many different formulae on the market, they can be classified into one or more of the following categories:

• standard; • hypercaloric; • fibre-enriched; • speciality; • elemental (or semi-elemental); and • modular. [44] .

Standard formulae

Standard formulae usually contain 4.2 kJ/mL (1 kcal/mL). These formulations are iso-osmolar (or isotonic). This means that they have roughly the same osmolarity as other body fluids and are less likely to cause gastrointestinal upset. People who require more concentrated formulae are often commenced on a standard formula before progressing to the 'target' formula. [44] .

Hypercaloric formulae

Hypercaloric formulae contain 5–8.4 kJ/mL (1.2–2 kcal/mL). They are also known as 'nutrient-dense' formulae—because they have more energy per litre (and often a larger proportion of protein) than standard preparations. These formulations are hyper-osmolar (or hypertonic). This means that they have a greater osmolarity than body fluids. These formulae are useful for providing nutrition to people on fluid restrictions. They are also useful for supplementary feeding when some nourishment can be taken orally. Hypercaloric formulae are also helpful in meeting very high nutritional needs in people who would otherwise need very large volumes of a formula. [44] .

Hypercaloric formulae are often of thicker consistency than standard formulae. This can influence the choice of administration method. Fibre-enriched formulae Most tube formulae are low in residue. In contrast, fibre-enriched formulae have added soy or oat polysaccharides. Fibre formulae can be useful for people with constipation. Unless contraindicated, they are commonly used to provide the benefits of dietary fibre. Examples include the normalising of stool consistency, the lowering of cholesterol levels, and the prevention of some cancers. These factors are especially important if tube feeds are the sole source of fibre for a person.Fibre-enriched formulae are available in both isocaloric and hypercaloric forms. They are generally thicker than their low-residue counterparts.As with the introduction of dietary fibre in orally fed persons, it might be necessary to introduce fibre-enriched tube formulae gradually to tube-fed people. This helps to avoid bloating or distension in people not accustomed to fibre. Apart from using fibre-enriched formulae, additional fibre can be supplied by adding a soluble fibre supplement to any liquid formula. Alternatively, a soluble fibre supplement can be administered as a bolus.
[44] .

Speciality formulae

Specialty formulae are designed for specific medical conditions, organ dysfunction, or metabolic stress. Examples include formulae for renal disease, hepatic disease, pulmonary disease, glucose intolerance, compromised immune systems, wound healing, or the cachexia of cancer. [44] .

Elemental (or semi-elemental) formulae These formulae are partially or fully hydrolysed using enzymes that break macronutrients into smaller components. In an *elemental* formula, complex protein structures are reduced to individual amino acids. In a *semi-elemental* preparation, complex protein structures are reduced to small peptides. In both cases, these smaller nutrients are more easily digested and absorbed by people with digestive or absorptive problems—such as pancreatic insufficiency or severe gut impairment (for example, short bowel syndrome). Caution is needed with these formulae because they are of a high osmolarity—largely because of their free amino acid content. [44] .

Modular formulae

Modular formulae contain only single nutrients—such as carbohydrate, protein, or fat. They are usually added to a formula to tailor it to individual nutritional needs. In rare cases, such as metabolic disorders, commercial enteral formulae are not available to meet nutritional needs. In these cases, a mixture of modular formulae and micronutrient supplementation might
be required. [44] .

Closure of Gastrostomy :

A gastrostomy device is removed from the gastrostoma when no longer needed. The aim is to test the hypothesis of whether it is possible for the surgeon to decide which stoma has to be closed with a gastroraphy and which to leave for a spontaneous closure within a reasonable period of time. Out of a cohort of 321 patients, who had been operated with a video-assisted gastrostomy, we included all the 48 patients having had their gastrostomy button removed. These patients were carefully followed and the closure of the gastrostoma was registered. According to the institutional routine . It is waited at least 3 months after the removal of the gastrostomy device before suggesting to the child's guardians an operative closure of the stoma. In 26 patients the stoma closed within 3 months, whereas in 22 patients a surgical gastroraphy was performed. We found no differences between the two groups regarding the patients' diagnoses, the duration of the gastrostoma use or patient's age at the time of removal of the gastrostomy device. This study rejected the hypothesis of predictability of the gastrostoma closure. A recommended routine expectance after the removal of a gastrostomy device for at least 1 month. If no spontaneous closure occurs, then a gastroraphy should be performed. [45] .

Oesophagostomy

Anatomy

The **esophagus** (e-SOF-a-gus _ eating gullet) is a collapsible muscular tube, about 25 cm (10 in.) long, that lies posterior to the trachea. The esophagus begins at the inferior end of the laryngopharynx and passes through the mediastinum anterior to the vertebral column. Then it pierces the diaphragm through an opening called the **esophageal hiatus,** and ends in the superior portion of the stomach . Sometimes, part of the stomach protrudes above the diaphragm through the esophageal hiatus. This condition, termed a **hiatus hernia** (HER-ne¯ -a), . [46] .

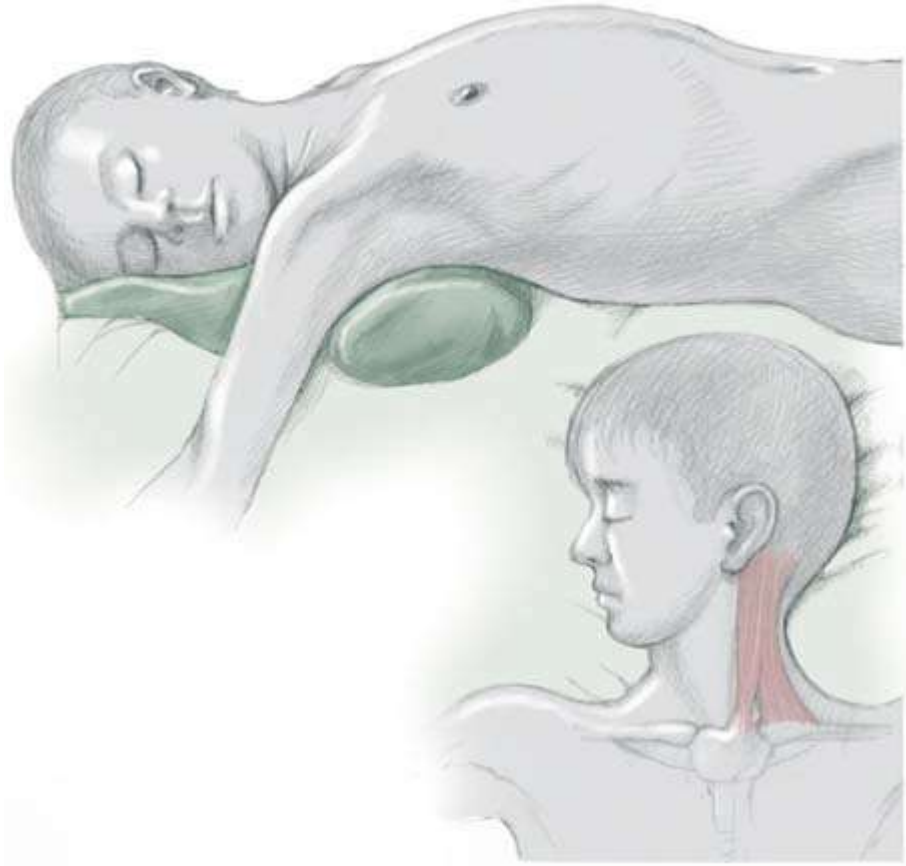

Figure (3) patient position during oesophagostomy (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 69 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

Histology of the Esophagus

The **mucosa** of the esophagus consists of nonkeratinized stratified squamous epithelium, lamina propria (areolar connective tissue), and a muscularis muscosae (smooth muscle). Near the stomach, the mucosa of the esophagus also contains mucous glands. The stratified squamous epithelium associated with the lips, mouth, tongue, oropharynx, laryngopharynx, and esophagus affords considerable protection against abrasion and wear-and-tear from food particles that are chewed, mixed with secretions, and swallowed. The **submucosa** contains areolar connective tissue, blood vessels, and mucous glands. The **muscularis** of the superior third of the esophagus is skeletal muscle, the intermediate third is skeletal and smooth muscle, and the inferior third is smooth muscle. At each end of the esophagus, the muscularis becomes slightly more prominent and forms two sphincters—the **upper esophageal sphincter (UES)** (e-sof_-a-JE¯ -al), which consists of skeletal muscle, and the **lower esophageal sphincter (LES),** which consists of smooth muscle. [46]
.

The upper esophageal sphincter regulates the movement of food from the pharynx into the esophagus; the lower esophageal sphincter regulates the movement of food from the esophagus into the stomach. The superficial layer of the esophagus is known as the **adventitia** (ad-ven-TISH-a), rather than the serosa as in the stomach and intestines, because the areolar connective tissue of this layer is not covered by mesothelium and because the connective tissue merges with the connective tissue of surrounding structures of the mediastinum through which it passes. The adventitia attaches the esophagus to surrounding structures.

Physiology of the Esophagus

The esophagus transports food into the stomach and secretes mucus. It does not produce digestive enzymes, and it does not carry on absorption. The movement of food from the mouth into the stomach is achieved by the act of swallowing, or **deglutition** (de¯-gloo- TISH-un) . [46] .

Deglutition is facilitated by the secretion of saliva and mucus and involves the mouth, pharynx, and esophagus. Swallowing occurs in three stages: (1) the voluntary stage, in which the bolus is passed into the oropharynx; (2) the pharyngeal stage, the involuntary passage of the bolus through the pharynx into the esophagus; and (3) the esophageal stage, the involuntary passage of the bolus through the

esophagus into the stomach. Swallowing starts when the bolus is forced to the back of the oral cavity and into the oropharynx by the movement of the tongue upward and backward against the palate; these actions constitute the **voluntary stage** of swallowing. With the passage of the bolus into the oropharynx, the involuntary **pharyngeal stage** of swallowing begins . The bolus stimulates receptors in the oropharynx, which send impulses to the **deglutition center** in the medulla oblongata and lower pons of the brain stem. The returning impulses cause the soft palate and uvula to move upward to close off the nasopharynx, which prevents swallowed foods and liquids from entering the nasal cavity. In addition, the epiglottis closes off the opening to the larynx, which prevents the bolus from entering the rest of the respiratory tract. The bolus moves through the oropharynx and the laryngopharynx. Once the upper esophageal sphincter relaxes, the bolus moves into the esophagus. The **esophageal stage** of swallowing begins once the bolus enters the esophagus. During this phase, **peristalsis** (per_-i- STAL-sis; *stalsis* _ constriction), a progression of coordinated contractions and relaxations of the circular and longitudinal layers of the muscularis, pushes the bolus onward .
[46] .

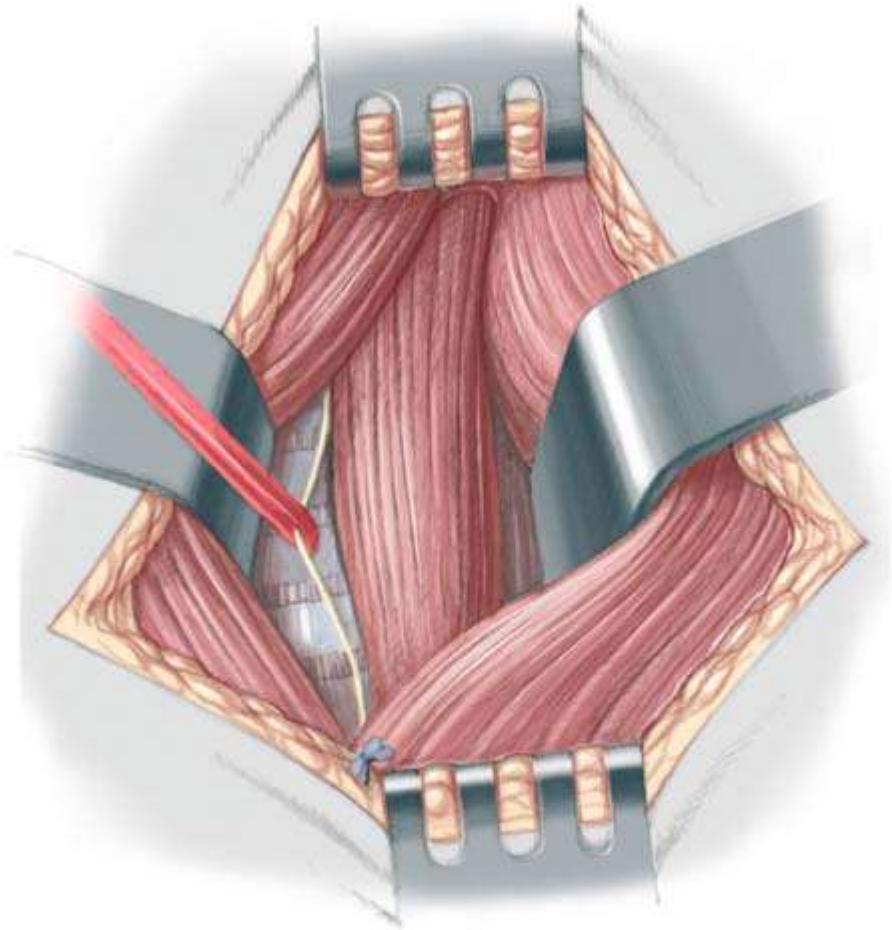

Figure (4) exposure of the oesophagus (P. Puri · M. E. Höllwarth , springer surgery atlas series page 69 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)

Peristalsis occurs in other tubular structures, including other parts of the GI tract and the ureters, bile ducts, and uterine tubes; in the esophagus it is controlled by the medulla oblongata.) In the section of the esophagus just superior to the bolus, the circular muscle fibers contract, constricting the esophageal wall and squeezing the bolus toward the stomach. Meanwhile, longitudinal fibers inferior to the bolus also contract, which shortens this inferior section and pushes its walls outward so it can receive the bolus. The contractions are repeated in waves that push the food toward the stomach. As the bolus approaches the end of the esophagus, the lower esophageal sphincter relaxes and the bolus moves into the stomach. Mucus secreted by esophageal glands lubricates the bolus and reduces friction. The passage of solid or semisolid food from the mouth to the stomach takes 4 to 8 seconds; very soft foods and liquids pass through in about 1 second. [46]

Indications:

Diverting cervical esophagostomy is a surgical procedure generally reserved for extremely ill patients as a life-saving maneuver. However, it is also a procedure that is infrequently performed, such that most centers have limited experience with the operation. To investigate the indications and outcomes of cervical esophagostomy, It is reviewed the use of this operation at UCLA Medical Center over the last 20 years as employed for esophageal leaks. Eighteen patients underwent this procedure for the following indications: leak with malignant tracheoesophageal fistula (11%), anastomotic leak (44%), endoscopic injury (18%), gunshot wound (5.5%), operative injury (11%), corrosive ingestion (11%), and spontaneous rupture (5.5%). Overall mortality directly attributable to sepsis was 33 per cent. Of the surviving patients, 67 per cent later underwent reconstruction. Seventy-two per cent of patients had end esophagostomies, and the remainder had loop diversions. The primary indication for operation in these patients was persistent sepsis after initial surgical management of esophageal spillage into the mediastinum or neck. This series suggests that cervical esophagostomy, when applied to the appropriate patient population, can decrease mortality and allow subsequent alimentary reconstruction. [47] .

Surgical technique and access :

The patient is placed in the supine position with a small sandbag under the shoulder with the neck extended and turned to the right side. figure (3) . A tube is placed through the nose into the oesophagus to allow easy dissection. Skin preparation includes neck, chest and abdomen. Left transverse supraclavicular incision is made, which can be extended upwards in a hockey stick manner over the anterior border of the sternomastoid. .Dissection of the oesophagus should not extend proximally more than 4–5 cm to avoid ischaemic injury to the wall.After incising the skin, subcutaneous tissue and platysma the cervical fascia is opened along the anterior border of the sternomastoid. Dissection continues with the strap muscles either divided (easier for dissection) or retracted. figure (4) . Internal jugular vein and the common carotid artery all retract laterally. The oesophagus is identified and the dissection distal to the stricture is started to avoid proximal devascularization. Isolation of the oesophagus is done after visualising the recurrent laryngeal nerve and retracting it medially. If the oesophagus is severely adherent to the trachea, distal dissection and identification of the nerve at its entry to the neck is important to avoid nerve injury.Now the oesophagus is encircled with a tape and

mobilized proximal to the strictured segment for only 2–3 cm to prevent devascularization injury of the blood supply.Distal dissection, around the oesophagus is usually done bluntly through the posterior mediastinum. [48] .

Colostomy

Definition and History :

Cutaneous Colostomy means a surgical opening of the colon on the skin . The pioneering work in the stoma surgery started in France. Slowly pushed by the development to countries such as Germany and Austria, England and the Netherlands, with England especially gaining an advantage. In the period between the two world wars were major developments in the United States and after the Second World War the Americans took the lead in the field of stoma, stoma care and aftercare.
[187]

Anatomy of the Large Intestine

The **large intestine,** which is about 1.5 m (5 ft) long and 6.5 cm (2.5 in.) in diameter, extends from the ileum to the anus. It is attached to the posterior abdominal wall by its **mesocolon,** which is a double layer of peritoneum . Structurally, the four major regions of the large intestine are the cecum, colon, rectum, and anal canal . The opening from the ileum into the large intestine is guarded by a fold of mucous membrane called the **ileocecal sphincter (valve),** which allows materials from the small intestine to pass into the large intestine. Hanging inferior to the ileocecal valve is the **cecum,** a small pouch about 6 cm (2.4 in.) long. Attached to the cecum is a twisted, coiled tube, measuring about 8 cm (3 in.) in length, called the **appendix** or **vermiform appendix** (*vermiform* _ worm-shaped; *appendix* _ appendage). [49] .

The mesentery of the appendix, called the **mesoappendix,** attaches the appendix to the inferior part of the mesentery of the ileum. The open end of the cecum merges with a long tube called the **colon** (_ food passage), which is divided into ascending, transverse, descending, and sigmoid portions. Both the ascending and descending colon are retroperitoneal; the transverse and sigmoid colon are not.

True to its name, the **ascending colon** ascends on the right side of the abdomen, reaches the inferior surface of the liver, and turns abruptly to the left to form the **right colic (hepatic) flexure.** The colon continues across the abdomen to the left side as the **transverse colon.** It curves beneath the inferior end of the spleen on the left side as the **left colic (splenic) flexure** and passes inferiorly to the level of the iliac crest as the **descending colon.** The **sigmoid colon** (*sigm-* _ S-shaped) begins near the left iliac crest, projects medially to the midline, and terminates as the rectum at about the level of the third sacral vertebra. The **rectum,** the last 20 cm (8 in.) of the GI tract, lies anterior to the sacrum and coccyx. The terminal 2–3 cm (1 in.) of the rectum is called the **anal canal**. The mucous membrane of the anal canal is arranged in longitudinal folds called **anal columns** that contain a network of arteries and veins. The opening of the anal canal to the exterior, called the **anus,** is guarded by an **internal anal sphincter** of smooth muscle (involuntary) and an **external anal sphincter** of skeletal muscle (voluntary). Normally these sphincters keep the anus closed except during the elimination of feces. [49] .

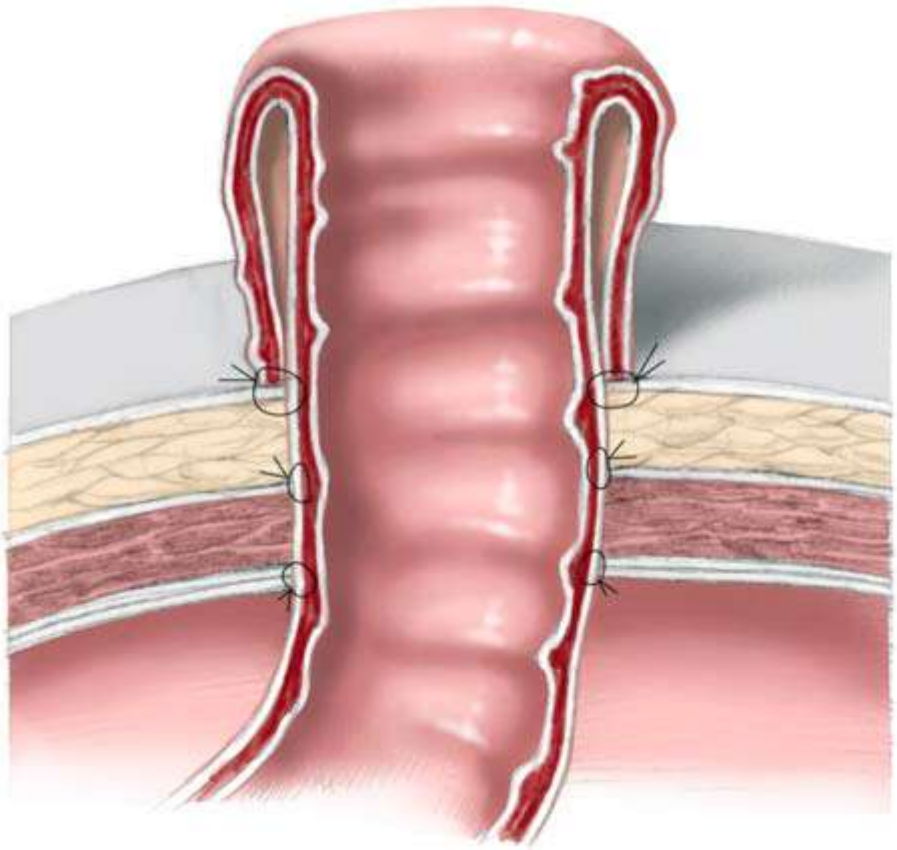

Figure (5) suturing edges of colon to layers of anterior abdominal wall (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 237 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

Histology of the Large Intestine

The wall of the large intestine contains the typical four layers found in the rest of the GI tract: mucosa, submucosa, muscularis, and serosa. The **mucosa** consists of simple columnar epithelium, lamina propria (areolar connective tissue), and muscularis mucosae (smooth muscle). The epithelium contains mostly absorptive and goblet cells . The absorptive cells function primarily in water absorption; the goblet cells secrete mucus that lubricates the passage of the colonic contents. Both absorptive and goblet cells are located in long, straight, tubular **intestinal glands (crypts of Lieberkühn)** that extend the full thickness of the mucosa. Solitary lymphatic nodules are also found in the lamina propria of the mucosa and may extend through the muscularis mucosae into the submucosa. Compared to the small intestine, the mucosa of the large intestine does not have as many structural adaptations that increase surface area. There are no circular folds or villi; however, microvilli are present on the absorptive cells. Consequently, much more absorption occurs in the small intestine than in the large intestine. [49] .

Figure (6) Micklwicz colostomy (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 236 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

The **submucosa** of the large intestine consists of areolar connective tissue. The **muscularis** consists of an external layer of longitudinal smooth muscle and an internal layer of circular smooth muscle. Unlike other parts of the GI tract, portions of the longitudinal muscles are thickened, forming three conspicuous bands called the **teniae coli** (TE¯ -ne¯ -e¯ KO¯ -lı¯; *teniae* _ flat bands) that run most of the length of the large intestine . The teniae coli are separated by portions of the wall with less or no longitudinal muscle. Tonic contractions of the bands gather the colon into a series of pouches called **haustra** (HAWS-tra _ shaped like pouches; singular is **haustrum**), which give the colon a puckered appearance. A single layer of circular smooth muscle lies between teniae coli. The **serosa** of the large intestine is part of the visceral peritoneum. Small pouches of visceral peritoneum filled with fat are attached to teniae coli and are called **omental (fatty) appendices.** [49] .

Physiology :

Mechanical Digestion in the Large Intestine

The passage of chyme from the ileum into the cecum is regulated by the action of the ileocecal sphincter. Normally, the valve remains partially closed so that the passage of chyme into the cecum usually occurs slowly. Immediately after a

meal, a **gastroileal reflex** intensifies peristalsis in the ileum and forces any chyme into the cecum. The hormone gastrin also relaxes the sphincter. Whenever the cecum is distended, the degree of contraction of the ileocecal sphincter intensifies. Movements of the colon begin when substances pass the ileocecal sphincter. Because chyme moves through the small intestine at a fairly constant rate, the time required for a meal to pass into the colon is determined by gastric emptying time. As food passes through the ileocecal sphincter, it fills the cecum and accumulates in the ascending colon. One movement characteristic of the large intestine is **haustral churning.** In this process, the haustra remain relaxed and become distended while they fill up. When the distension reaches a certain point, the walls contract and squeeze the contents into the next haustrum. **Peristalsis** also occurs, although at a slower rate (3–12 contractions per minute) than in more proximal portions of the tract. A final type of movement is **mass peristalsis,** a strong peristaltic wave that begins at about the middle of the transverse colon and quickly drives the contents of the colon into the rectum. Because food in the stomach initiates this **gastrocolic reflex** in the colon, mass peristalsis usually takes place three or four times a day, during or immediately after a meal. [49] .

Chemical Digestion in the Large Intestine

The final stage of digestion occurs in the colon through the activity of bacteria that inhabit the lumen. Mucus is secreted by the glands of the large intestine, but no enzymes are secreted. Chyme is prepared for elimination by the action of bacteria, which ferment any remaining carbohydrates and release hydrogen, carbon dioxide, and methane gases. These gases contribute to flatus (gas) in the colon, termed *flatulence* when it is excessive. Bacteria also convert any remaining proteins to amino acids and break down the amino acids into simpler substances: indole, skatole, hydrogen sulfide, and fatty acids. Some of the indole and skatole is eliminated in the feces and contributes to their odor; the rest is absorbed and transported to the liver, where these compounds are converted to less toxic compounds and excreted in the urine. Bacteria also decompose bilirubin to simpler pigments, including stercobilin, which gives feces their brown color. Bacterial products that are absorbed in the colon include several vitamins needed for normal metabolism, among them some B vitamins and vitamin K. [49] .

Absorption and Feces Formation in the Large Intestine

By the time chyme has remained in the large intestine 3–10 hours, it has become solid or semisolid because of water absorption and is now called **feces.** Chemically, feces consist of water, inorganic salts, sloughed-off epithelial cells from the mucosa of the gastrointestinal tract, bacteria, products of bacterial decomposition, unabsorbed digested materials, and indigestible parts of food. Although 90% of all water absorption occurs in the small intestine, the large intestine absorbs enough to make it an important organ in maintaining the body's water balance. Of the 0.5–1.0 liter of water that enters the large intestine, all but about 100–200 mL is normally absorbed via osmosis. The large intestine also absorbs ions, including sodium and chloride, and some vitamins. [49]

CLINICAL Occult Blood

The term **occult blood** refers to blood that is hidden; it is not detectable by the human eye. The main diagnostic value of occult blood testing is to screen for colorectal cancer. Two substances often examined for occult blood are feces and urine. Several types of products are available for at-home testing for hidden blood in feces. The tests are based on color changes when reagents are added to feces. The presence of occult blood in urine may be detected at home by using dip-and-read reagent strips. [49] .

The Defecation Reflex

Mass peristaltic movements push fecal material from the sigmoid colon into the rectum. The resulting distension of the rectal wall stimulates stretch receptors, which initiates a **defecation reflex** that empties the rectum. The defecation reflex occurs as follows: In response to distension of the rectal wall, the receptors send sensory nerve impulses to the sacral spinal cord. Motor impulses from the cord travel along parasympathetic nerves back to the descending colon, sigmoid colon, rectum, and anus. The resulting contraction of the longitudinal rectal muscles shortens the rectum, thereby increasing the pressure within it. This pressure, along with voluntary contractions of the diaphragm and abdominal muscles, plus parasympathetic stimulation, opens the internal anal sphincter. The external anal sphincter is voluntarily controlled. If it is voluntarily relaxed, defecation occurs and the feces are expelled through the anus; if it is voluntarily constricted, defecation can be postponed. [49] .

Voluntary contractions of the diaphragm and abdominal muscles aid defecation by increasing the pressure within the abdomen, which pushes the walls of the sigmoid colon and rectum inward. If defecation does not occur, the feces back up into the sigmoid colon until the next wave of mass peristalsis stimulates the stretch receptors, again creating the urge to defecate. In infants, the defecation reflex causes automatic emptying of the rectum because voluntary control of the external anal sphincter has not yet developed. The amount of bowel movements that a person has over a given period of time depends on various factors such as diet, health, and stress. The normal range of bowel activity varies from two or three bowel movements per day to three or four bowel movements per week. **Diarrhea** (dı¯-a-RE¯-a; *dia*- _ through; *rrhea* _ flow) is an increase in the frequency, volume, and fluid content of the feces caused by increased motility of and decreased absorption by the intestines. When chyme passes too quickly through the small intestine and feces pass too quickly through the large intestine, there is not enough time for absorption. Frequent diarrhea can result in dehydration and electrolyte imbalances. Excessive motility may be caused by lactose intolerance, stress, and microbes that irritate the gastrointestinal mucosa. [49] .

Constipation

(kon-sti-PA¯ -shun; *con*- _ together; *stip*- _ to press) refers to infrequent or difficult defecation caused by decreased motility of the intestines. Because the feces remain in the colon for prolonged periods, excessive water absorption occurs, and the feces become dry and hard. Constipation may be caused by poor habits (delaying defecation), spasms of the colon, insufficient fiber in the diet, inadequate fluid intake, lack of exercise, emotional stress, and certain drugs. A common treatment is a mild laxative, such as milk of magnesia, which induces defecation. However, many physicians maintain that laxatives are habit-forming, and that adding fiber to the diet, increasing the amount of exercise, and increasing fluid intake are safer ways of controlling this common problem. [49] .

Figure (7) Bishop Koop colostomy (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 236 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

Figure (8) Modified Bishop Koop colostomy (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 236 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

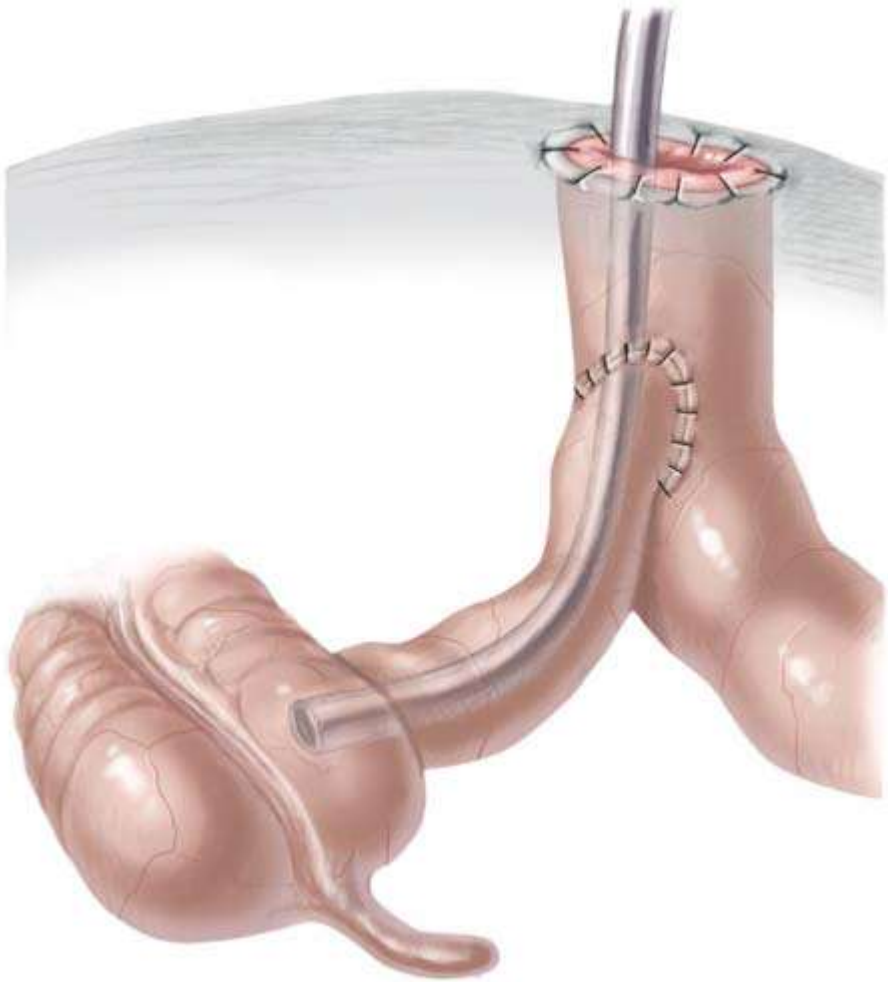

Figure (9) Santolly colostomy (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 236 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

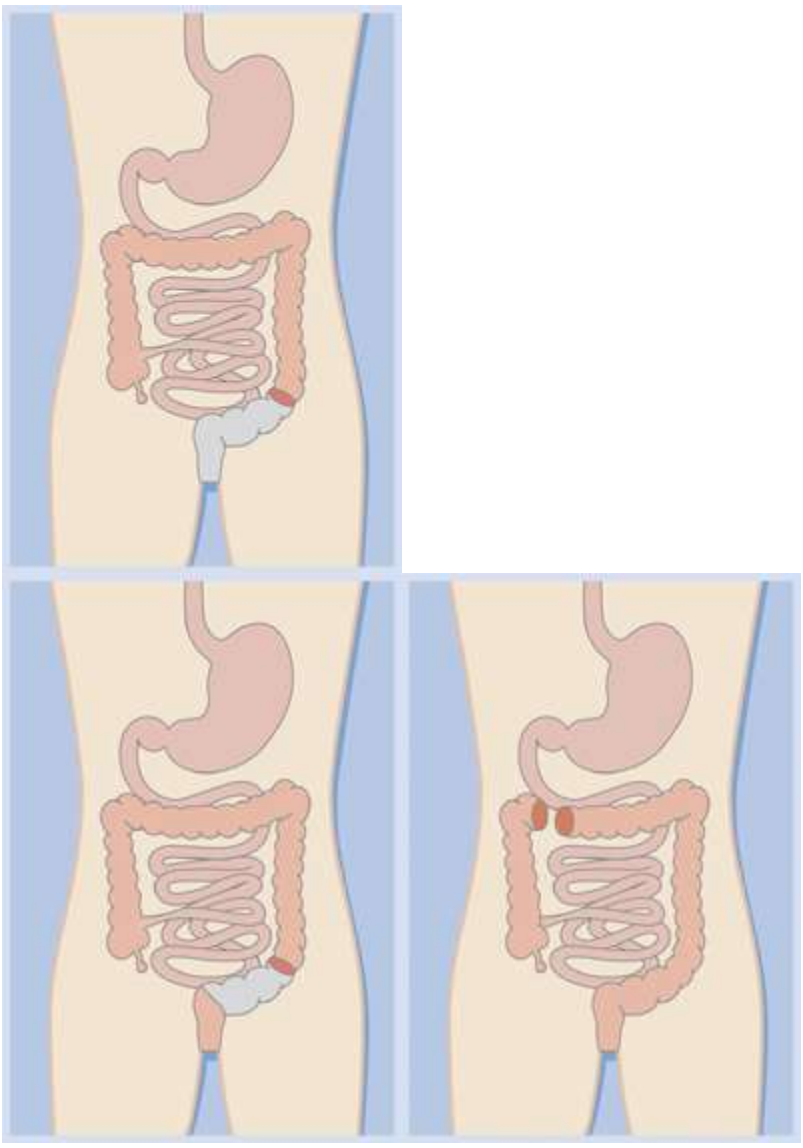

Figure (10) descending colon colostomy with out leaving rectum , descending colon colostomy with leaving rectum , transverse colon colostomy (google internet figure searching 2013)

The ability to create a healthy, well-functioning, easily manageable colostomy is essential for all abdominal surgeons. Colostomy creation was one of the first abdominal operations performed historically. It is a frequent part of emergent colonic surgery, and almost any abdominal procedure carries some risk of requiring a colostomy or ileostomy. Historically, in the case of emergent colonic surgery, a transverse colostomy was created for proximal diversion . figure (12) .

Types

Currently, end sigmoid colostomies are the most frequent diversions in the case of sigmoid perforation. This itself is diminishing with the increasing frequency of single-stage resection for acute diverticulitis. If a distal anastomosis or surgical site requires proximal fecal diversion, a loop or end-loop ileostomy is growing in popularity .[50] .

INDICATIONS:

Colostomies are created to be permanent or temporary; they are created electively, emergently, or incidentally due to an unexpected event in surgery.

An elective, permanent end sigmoid colostomy is created as part of an abdominoperineal distal rectal resection for cancer. Alternatively, one creates the same stoma for improved hygiene in a paraplegic or an individual with permanent fecal incontinence. Here, a laparoscopic approach is frequently employed. An elective but temporary sigmoid colostomy is indicated in a patient with a near obstructing rectal cancer who is undergoing preoperative radiation therapy prior to curative resection. A sigmoid colostomy may be indicated in association with complex sphincter/perineal procedures. However, many surgeons prefer an ileostomy for elective temporary fecal diversion. End sigmoid colostomies are frequently created as part of emergent colonic surgery for obstruction, perforation, or trauma. After resection of a diseased rectosigmoid, the remaining colon or the local environment may not be suitable for immediate reconstruction. The classic example is Hartmann's two-stage procedure for acute and/or perforated diverticulitis.[50] .

Lastly, one may need to create a rapid colostomy even if the tissue is adequate in order to complete a procedure expeditiously in an unstable patient. There are no contraindications to end colostomy creation per se other than complete resection of the colon. [50]

Precautions

Certainly bowel that is of questionable viability or overly manipulated should not be used to create a colostomy. There is little documented evidence in the literature to support the avoidance of stoma creation in an individual with portal hypertension. However, portosystemic shunting will frequently occur, creating a peristomal caput medusae. This can result in gastrointestinal hemorrhage that is difficult to control. Surgical judgment will dictate whether the risks associated with an anastomosis outweigh the potential for anastomotic complications. Consideration should be given to the patient's ability to care for the colostomy, especially when the location is being chosen. Examples include but are not limited to visual impairment and severe arthritis. [50] .

OPERATIVE TECHNIQUE AND ACCESS :

Mobilization and Preparation of the Colon

The necessity of a colostomy should not alter the technique or extent of resection. Once oncologic or infection control requirements are met, the remaining colon is prepared for colostomy creation. figure (5) . It is preferred to fully mobilize and prepare the colon prior to creation of the trephine. In this way there will be adequate time for any compromise of the distal bowel to present itself prior to maturation. Use of a liner stapler for proximal division of the colon is helpful in limiting contamination and provides a closed end of bowel that is easy to manipulate through the abdominal wall. At this point, the sigmoid attachments to the pelvis should be divided if not already done. Frequently the left lateral peritoneal reflection of Toldt must be incised as well. The posterior retroperitoneal plane is dissected to free up the left colon and sigmoid mesenteries. Care should be taken to avoid injury to the left ureter and gonadal vessels, as is done during all dissection in this area. Dissection and mobilization should be limited to only that which is necessary to bring the end of the colon 3–4 cm past the skin without tension. Excessive mobilization may compromise blood supply or contribute to stomal prolapse. In the event of complete sigmoid resection, splenic flexure take-down will frequently be required. In this case the artery should be divided as close to the aorta as is feasible so as to preserve blood flow through the proximal arcade. If there is significant fat surrounding the end of the colon, it is helpful to clear it at this time. A distance of up to 4 cm of serosa can be cleared circumferentially without vascular compromise.
[51] .

- The colostomy construction technique depends on whether the goal is decompression or diversion. Ongoing surveillance of the remaining colon is necessary but often overlooked in patients with colostomies.
    - A decompressing colostomy vents the distal and proximal bowel limbs while maintaining continuity between the limbs. A blow hole is used for massively dilated colon. The anterior wall of the transverse colon is sewn in two layers to the abdominal fascia and the skin. Typically, blowhole colostomies are reserved for patient palliation.
    - Diverting colostomies, such as end-colostomy and mucous fistula, are used following distal resection or perforation so that the distal limb is completely separated from the fecal stream. All colostomies are matured in the operating room. If a stoma rod is used, it is removed 1 week after surgery. [61] .

Laparoscopic stomas

The advantages of laparoscopic surgery include early recovery, reduced hospital stay, reduced postoperative intra-abdominal adhesions and avoidance of large, painful incisions. Laparoscopic stomas have advantages over trephine stomas because they may permit an adequate inspection of the peritoneal cavity, detection of concurrent pathology, assessment of the extent of Crohn's disease or malignancy, division of adhesions and, more importantly, the orientation of proximal and distal ends of the bowel. The following are main indications for laparoscopic stomas:

• Patients with severe Crohn's disease who are not candidates for total proctocolectomy. • Patients with advanced, obstructing, distal carcinomas who are not candidates for resection because of general debility • Patients with faecal incontinence.

The only absolute contraindication is diffusefaecal peritonitis, whereas relative contraindications include recent low pelvic anastomosis, diffuse carcinomatosis with bowel obstruction , previous multiple laparotomies and patients with enterocutaneous fistulas. [62] .

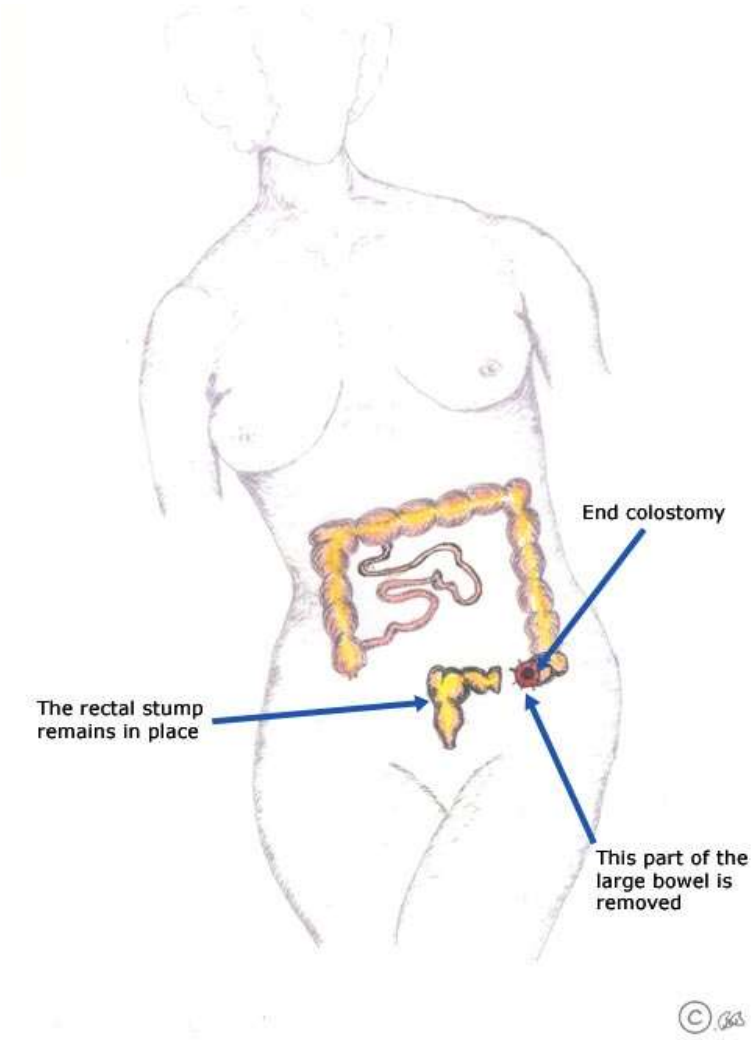

Figure (11) End colostomy (Google search figure 2013)

Siting the Colostomy

If at all possible, the site of the colostomy on the anterior abdominal wall should be chosen preoperatively and marked by an enterostomal therapist. In the case of an emergent or unplanned colostomy, figure (10) . The following is a helpful rule in patients of almost any body habitus . figure (5) . A triangle is defined from the symphasis pubis to the umbilicus to the anterosuperior iliac spine (ASIS). This triangle is bisected by a transverse line at the ASIS. Choose the location at or slightly above the center of the upper triangle. Alternatively, in a significantly obese patient, a stoma may be sited superiorly to the umbilicus through the rectus abdominis. This is only a rough guide. If an ET nurse is not available to site the stoma, the surgeon

should mark the patient preoperatively. Beginning with the technique above, an appliance is then placed on the patient. The patient is then evaluated sitting and standing as well as supine. If the proposed site overlies a skin fold or falls out of sight, the mark should be adjusted appropriately.
[51] .

End colostomy
This can be permanent or temporary. figure (11) .

Permanent end colostomy
Indications
• Malignncy, e.g. rectal cancer that is too low or too bulky for restorative resection. In advanced low rectal neoplasms, particularly those that are fixed and have been treated initially by radiotherapy, abdominoperineal resection and end-colostomy formation are indicated. In frail elderly patients with rectal cancer, where anterior resection is not justified, end colostomy is preferred • In some children with anorectal agenesis • Some case of faecal incontinence or pelvic floor disorders (e.g. anismus) • Occasionally, in severe anorectal Crohn's disease requiring proctectomy. [56] .

Temporary end colostomy
Indications
• Faecal peritonitis, e.g. in perforated colonic cancer or perforated diverticular disease of the colon • Trauma: temporary end colostomy may be appropriate for some penetrating colonic injuries • Imperforate anus • Hirschsprung's disease in infants to deflate the bowel.

Loop colostomy
This may be temporary or permanent. figures (6 – 7 – 8 – 9) .
Indications
• Large bowel obstruction that is usually the result of carcinoma or, less commonly, diverticular disease • Proximal to anastomotic dehiscence • As a temporary diversion measure for distal fistulas and repair of sphincter mechanisms • Severe anal sepsis • Imperforate anus • Diversion in cases of anal incontinence, especially in elderly patients.[56]

Technique

Counselling the patient

The necessity of a stoma, its site and the alternatives to surgery should be discussed with the patient. The appearance and the function of the stoma should be explained. A general discussion about the appliance and frequency of changing is important. The effect of the stoma on clothing, sexual relations, sports, activities and work should also be discussed, as well as information about stoma care services . Such counselling should be carried out well in advance in elective operations. In emergency surgery, as much explanation as possible should be given.[56] .

Marking stoma site

This is one of the most important points to be considered in both elective and emergency surgery. The site will depend on the type of stoma, previous incisions, scars, the patient's build and clothing habits. The optimum stoma site must be accessible, visible and comfortable to the patient. The stoma site should be marked with the patient in the supine position. The position is then rechecked with the patient sitting, since any creases or folds of skin will be more prominent. The waistline can be identified in the standing or sitting position. A stoma site should fulfil the following criteria: • It should be at least 5 cm away from the planned incision line in the middle of, or at least within the surface markings of, the rectus abdominis muscle, i.e. it should traverse rectus abdominis in order to reduce the risk of prolapse, hernia and stoma retraction, as well as to improve adherence of the appliance to the skin • The stoma site should be away from creases, scars, the umbilicus and bony prominences, e.g. the iliac crest, and the costal margin. The proposed stoma site should be tested preoperatively, first by applying an empty bag and then, if apparently satisfactory, the site should be tested when the appliance is full of water and with the patient fully clothed. [56].

Commonly used sites for different stomas

• End and loop ileostomy in the right iliac fossa • Loop jejunostomy in the left upper quadrant • End colostomy in the left iliac fossa • Loop sigmoid colostomy in the left iliac fossa • Loop transverse colostomy in the right upper quadrant. [56] .

General considerations

Stoma surgery can be performed as part of laparotomy or minimally invasive surgery, or laparoscopically. The trephine in the abdominal wall, through which the stoma is brought to the skin surface, should be straight and wide enough to prevent bowel compression (two to three fingers in width: note that one should not measure by adult fingers for a child's stoma). In removing skin and subcutaneous tissue to form the trephine, the excessive excision of fat should be avoided, in order to minimize the chance of dead space around the stoma with its attendant risks of parastomal seromas and abscess formation. After muscle is exposed, a cruciate incision is made in the anterior rectus sheath, splitting the rectus abdominis muscle. The posterior rectus sheath is then divided using diathermy, making a cruciate incision in order to minimize bowel compression. [56] .

Colostomy

The ascending colon, descending colon and lower two-thirds of the rectum are retroperitoneal and tethered to the posterior abdominal wall, whereas the transverse and sigmoid sections of the colon have a mesentery which makes them quite mobile. The caecal pole may be completely retroperitoneal or have a short mesentery, giving it limited mobility. figures (6 – 7 – 8 – 9) This means that the ascending and descending colon will require mobilization if they are to be brought out as an end or loop colostomy.[57] .

End colostomy

As part of formal laparotomy After surgical resection of the diseased bowel and formation of the trephine in the abdominal wall, the colon is delivered through this stoma opening to the surface. After closure of the laparotomy and dressing of the wound, the proximal end of the colon is opened and a series of absorbable sutures taken between the skin and the full thickness of the colonic end ; the stoma appliance is then fitted. *Through a trephine without laparotomy.*This is commonly performed for end-sigmoid colostomy. After performing the trephine in the usual manner in the left iliac fossa, the sigmoid loop is brought out. figure (11) . The distal end ofthe loop is identified by either insufflating air into a Foley catheter inserted in the rectum or using the flexible sigmoidoscope to insufflate air or shine the light, which will identify the distal end of the loop. Using the surgical, linear, cutter

stapler, the distal end of the sigmoid loop is closed and then returned into the peritoneal cavity. The proximal end is constructed as an end colostomy, as described above.[57] .

Loop colostomy

As part of laparotomy either the transverse colon or the sigmoid loop is brought through a trephine. A small window is opened in the mesentery adjacent to the bowel, and a rubber tube is passed through that opening to facilitate its delivery through the trephine. Once the abdomen has been closed, the colostomy may be constructed immediately or a glass rod may be placed under the colostomy and the colostomy delayed .

Loop colostomy without performing laparotomy Loop transverse colostomy A transverse 5-cm incision is made in the right upper quadrant; the rectus sheath is then divided in the direction of the incision and the peritoneum is divided.
[57] .

A segment of transverse colon is identified by its taeniae and brought through the incision to the s u rface with the aid of a soft rubber sling passed t h rough the mesentery, as described above. A glass rod or plastic bridge is placed underneath the loop, replacing the rubber tube to prevent an early retraction of the loop colostomy . A 5-cm incision is made longitudinally in the taenia coli and the edges sutured to the skin circumferentially, as described before.

Loop sigmoid colostomy An oblique 5-cm incision is made in the left iliac fossa and a loop of the sigmoid colon is brought to the surface and fashioned, as described for loop transverse colostomy above.[57] .

Percutaneous endoscopic colostomy (PEC)

A percutaneous endoscopic colostomy is a modifi cation of the PEG (gastrostomy) using the same equipment and technique. A PEC is a simple, outpatient, endoscopic technique that allows access for antegrade colonic irrigation . [58] .

A PEC tube is inserted into the colon through which irrigation can be performed. This promotes evacuation of the colon into the toilet improving continence or constipation. The gastrostomy tube does need a sufficiently rigid inner flange to reduce the risk of early tube dislodgement (www.burdettinstitute.org.uk for a patient information leaflet). [59] .

POSTOPERATIVE CARE AND CONSIDERATIONS

Enterostomal Therapy

If the patient has not had the opportunity to be evaluated preoperatively by the ET nurse, consultation should be obtained as soon as the first postoperative day. The ET nurse is a resource for the floor nurses for stomal evaluation and care. For the patient, the ET nurse is the main source of education and adaptation to this new life change. Often a patient may not be discharged from the hospital until cleared by the ET nurse.

Irrigation Techniques

For some patients with a long-standing end colostomy and with stable bowel habits, an end sigmoid colostomy can be "trained" to defecate "on schedule" with routine irrigation. This reduces embarrassment and fears associated with unscheduled or public functioning of the colostomy. In addition to simply washing out the distal colon, irrigation stimulates the more proximal colon to peristalsis and empties the more proximal colon. When done on a regular basis, the results may be quite reliable. Irrigation is performed as a simple retrograde enema administered via a cone-tipped catheter held against the stoma. This reduces stomal trauma and leakage around the catheter. A number of commercial products are available to maintain cleanliness and facilitate emptying into a toilet. The enema is often administered with 500–1000 mL of warm tap water. Fluid is instilled slowly until a sense of fullness occurs. The stoma is allowed to drain and, for approximately the next half-hour, the colon will continue to evacuate. [60] .

COMPLICATIONS AND PITFALLS

End sigmoid colostomies are easier to manage, with fewer complications than other stomas , figure (11) . Complications are divided into early and late.

Early complications are frequently technical in nature and may require immediate intervention. Frequently, observation alone is adequate.

Late complications may be the result of early complications but more often are part of the natural history of colostomy. Surgical intervention is frequently required, but enterostomal therapists provide much of the care.

Risk factors are the same as for most of abdominal surgery: advanced age, obesity, poor wound healing secondary to diabetes, and poor nutrition. Disease

process is not an independent risk factor, but the creation of an emergency colostomy is associated with a higher complication rate .

By the time one is ready to mature the colostomy, the blood supply should have been unchanged for several minutes. Any demarcation or compromise from inadequate blood flow should be more than evident. Despite this, some type of colostomy necrosis occurs in 2–17% of cases .

The mucosa is more sensitive to arterial compromise, and this may become more apparent when the colon is opened. At this point, transillumination is a simple technique to establish adequacy. If the mucosa transmits light well, it will most likely continue to be fine. If blood flow was adequate prior to maturation or before passing the colon through the trephination, ischemia may be due to compromise at the fascial level. An effort can be made to enlarge the fascial opening slightly. If the patient or the colon is cold, arterial spasm may make the mucosa appear marginal. Holding the colostomy in a lap sponge soaked in warmed saline may improve its appearance. Small needle pricks may also demonstrate adequate arterial supply. More commonly, and far less concerning, the venous outflow of the colostomy may be compromised. This usually will not become apparent for many hours after completion of the case. [52] . [53] .

The colostomy appears dark and swollen, often with a purplish hue. Transillumination again is helpful. Despite a dark color, colon with adequate arterial inflow and compromised outflow will still transilluminate well. A colostomy with significant venous congestion may slough its mucosa and appear nearly necrotic but in the end may heal to a viable, well-functioning colostomy. If questions remain as to the colostomy's viability or if a return to the operating room is considered for revision, bedside endoscopy of the colostomy may be performed. This simple and most rapid technique is performed with a phlebotomist's test tube and a penlight. After removing the stopper top, a well-lubricated tube is passed through the colostomy. It may be passed through the fascia. [53] .

If the stoma is viable, shining the penlight down the tube should demonstrate healthy pink mucosa. A grossly ischemic or infarcted colostomy calls for a return to the operating room for revision. If the vascular compromise goes below the fascia, repeat laparotomy is in order. If the ischemia is limited to the distal most aspect of the bowel, it may be observed and allowed to demarcate. Eventually a skin-level revision should be performed if there is full thickness necrosis. This involves division

of the sutures, debridement of the compromised tissue, and rematuration of the stoma. [54] .

Circumferential ischemia left untreated may result in stricture of the colostomy. Clinically, colostomy retraction is less consequential than ileostomy retraction. A flat colostomy may be well tolerated by many patients. Still, a rise of 1⁄8 in. is preferred. Retraction of the colostomy is approached similarly to ischemia. If the colostomy retraction approaches the fascia, relaparotomy is called for. Retraction below the skin level will frequently require surgical attention at some point to avoid stricture and hygiene problems.

Prolapse of an end sigmoid colostomy is a late complication and is less frequent than with loop sigmoid or loop transverse colostomies . Surgical intervention is usually for psychological reasons or pouching difficulties. [55] .

Rarely, prolapse may result in obstruction or vascular compromise. Simple skin-level revision is adequate in uncomplicated cases. For patients with permanent colostomies, the most common complication is a paracolostomy hernia. Reports vary from 1% to over 60% . The most common complaint is of pain. Incarceration and strangulation are rare complications. Mucocutaneous separation may occur secondary to ischemia or retraction. In their absence, however, separation is due to improper technique or inadequate closure. Partial separation will be self-limited with time and wound contraction. Complete separation can easily be managed be debridement and revision. Occasionally but surprisingly rarely, contamination or infection of a hematoma or seroma results in an infection or abscess within the trephine. If the infection is limited to the subcutaneous tissue, simple drainage by dividing the maturation stitches will be adequate. A subcutaneous abscess with evidence of cellulitis requires systemic antibiotics. Signs and symptoms of sepsis should prompt a search for an interabdominal source. Recurrent infections indicate a fistula. This may be the result of a full-thickness everting stitch or an amputated diverticulum. Once established, colostomy fistulas require stomal revision. Mortality obviously can occur in association with colostomy creation. In one review of 126 patients with 130 end colostomies, there were 7 mortalities. In all cases, deaths were related to emergent operations or comorbid, nonsurgical disease. [55] .

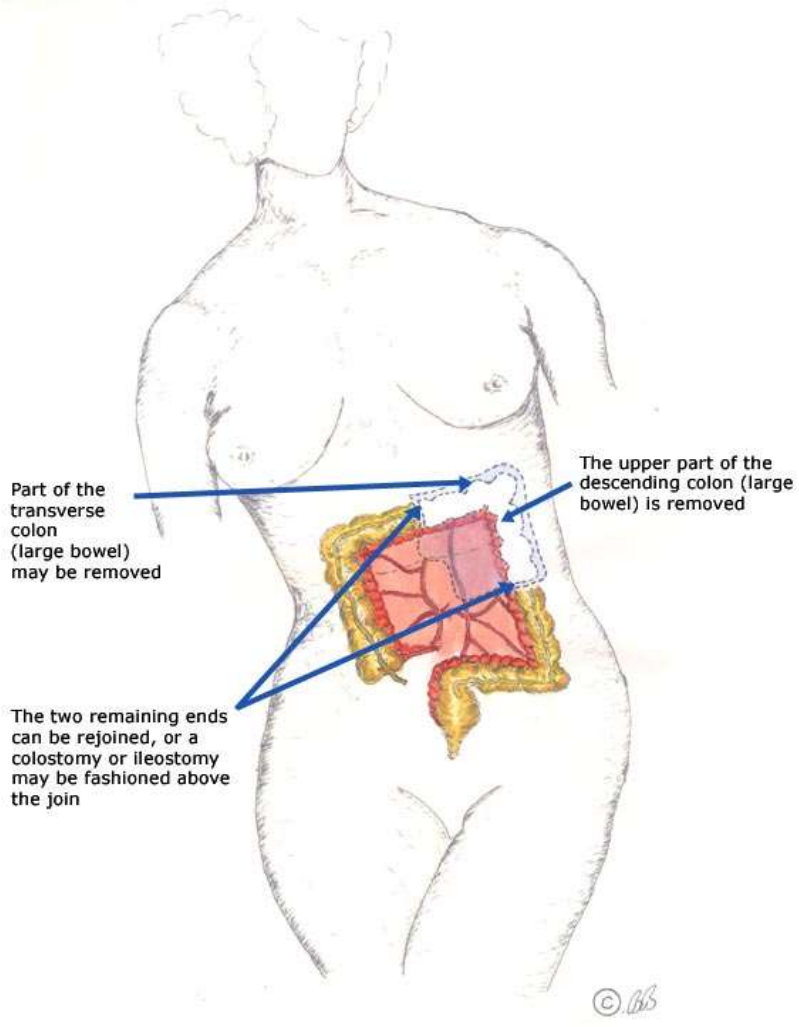

Figure (12) Transverse and descsnding colostomy (Google search figure 2013)

- Complications of colostomies include necrosis, stricture, and herniation. If the stoma becomes dusky, an anoscope is inserted. If necrosis does not extend below the fascia, it can be observed safely; otherwise, urgent revision is performed. Parastomal hernias are repaired only if they prevent application of a stomal appliance or cause small-bowel obstruction; these can be approached locally, although definitive treatment generally entails relocation of the stoma to a different site. Laparoscopic parastomal hernia repair has also been described.

A retrospective analysis of enteric stomas performed at Cook County Hospital was undertaken to evaluate stoma complications per stoma type and configuration and operating service. In addition, we attempted to identify factors predictive of increased enteric stoma complications. METHODS: From 1976 to 1995, data cards on 1,616 patients with stomas were compiled by Cook County Hospital enteric stomal therapists. Data card information included age, gender, weight, early and late stoma complications, emergency status, operating service, type and configuration of the stoma, and whether the patient was seen preoperatively by an enteric stomal therapist. Data were then analyzed using a logistic regression model to identify those variables that influenced the rate of complications. RESULTS: There were 553 (34 percent) patients with complications. Among the total complications, 448 (28 percent) occurred early (<1 month postoperative), and 105 (6 percent) occurred late (>1 month). [63] .

The most common early complications were skin irritation (12 percent), pain associated with poor stoma location (7 percent), and partial necrosis (5 percent). The most common late complications were skin irritation (6 percent), prolapse (2 percent), and stenosis (2 percent). The enteric stoma with the most complications was the loop ileostomy (75 percent). The enteric stoma with the least complications was the end transverse colostomy (6 percent). The general surgery service had the most complications (47 percent), followed by gynecology (44 percent), surgical oncology (37 percent), colorectal (32 percent), pediatric surgery (29 percent), and trauma (25 percent). Age, operating service, enteric stoma type and configuration, and preoperative enteric stomal therapist marking were found to be variables that influenced stoma complications.

Complications from enteric stoma construction are common. Preoperative enteric stoma site marking, especially in older patients, and avoiding the ileostomy, particularly in the loop configuration, can help minimize complications. [63] .

Prolapse represents one of the most common late complications involving stomas. Stoma prolapse is categorized as either fixed or sliding. The presentation of stoma prolapse ranges from asymptomatic to incarcerated and strangulated. Primarily, stoma prolapse is a challenge for ostomy care. Numerous factors, both patient-related and technical, have been linked to the development of stoma prolapse. The risk of stoma prolapse is best addressed by a well-constructed stoma. Various modifications to the procedure have been proposed to reduce the incidence of stoma prolapse. For asymptomatic or minimally symptomatic patients, the prolapse can be initially treated by modifying or changing the stoma appliance. A more significant or symptomatic stoma prolapse mandates surgical intervention. A prolapsed stoma may be approached via a local parastomal revision or laparotomy. For a temporary stoma, prolapse is best treated by its reversal. Re-siting of the stoma may become necessary if local revision is unsuccessful. Incarceration and strangulation are uncommon sequelae of stoma prolapse. An incarcerated but viable prolapsed stoma may be initially managed conservatively by reducing the intestinal edema. The appearance of gangrene requires emergent surgical intervention. [64] .

Colostomy Closure :

Closure of a loop colostomy is facilitated if the posterior wall of the colon has been transected. If it has been transected, a classical colocolostomy is required. The purpose of this operation is to close the colostomy and reestablish continuity of the colon without stricture at the site of the anastomosis. [65] .

Colostomy closure is not a trivial procedure, with a reported morbidity rate of 20 to 30% (bleeding, anastomotic leak, abscess) and a mortality rate of 3%. Tagging the rectal stump with long, nonabsorbable sutures and mobilizing the splenic flexure during the initial resection and placing preoperative ureteral stents can facilitate reanastomosis. Placement of adhesion barriers at the time of initial exploratory laparotomy may reduce adhesions enough to allow laparoscopic colostomy closure.

[61] .

Physiologic Changes. After this procedure, the patient may resume defecation per anum. In addition, the patient will receive more nutritive value from food because the additional colonic surface will allow greater absorption of water and nutrients from the intestinal contents.[65] .

Points of Caution

Care must be taken to prevent stenosis at the anastomotic site. If the diameter of the anastomosis is less than 2 cm, the anastomosis should be taken down and resected. A classic end-to-end anastomosis should be performed to ensure adequate diameter to the intestine. If the posterior wall of the colon has been preserved, care should be taken to close the colostomy prior to opening the peritoneal cavity. This will reduce intraperitoneal contamination from the stoma site. Copious irrigation of the wound should be made prior to primary closure. If gross contamination has occurred, delayed closure of the wound should be considered.

[65] .

Technique

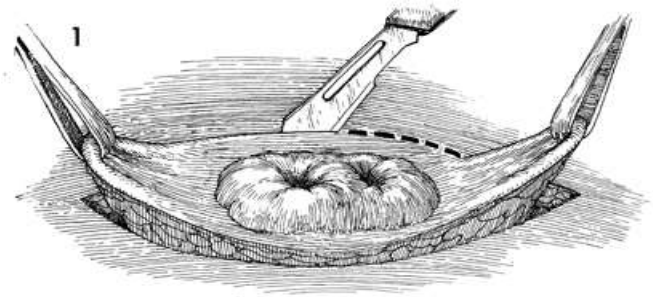

Figure (13) freeing colostomy edge [65]

The patient should have a thorough surgical bowel preparation prior to closure of the colostomy. This should consist of a clear liquid diet, a nonabsorbable antibiotic (such as

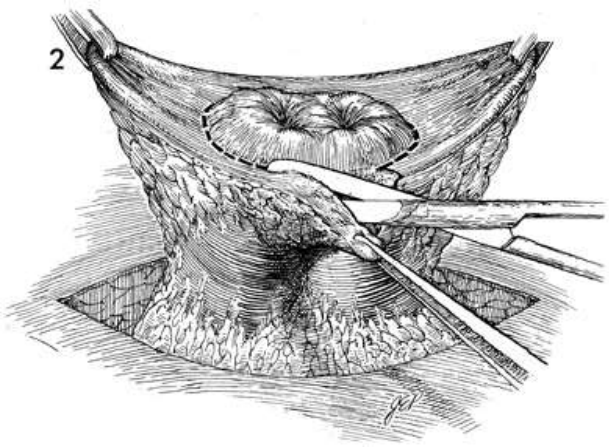

Figure (14) exposing two colostomy loops [65]

neomycin and Sulfathalidine), and a thorough mechanical cleansing of the bowel.

The patient is placed in the supine position, and adequate anesthesia is administered. The abdomen is surgically prepared, and an elliptical incision is made in the skin approximately 2 cm from the margin of the colostomy stoma. This incision is carried down to the rectus fascia, but no farther.

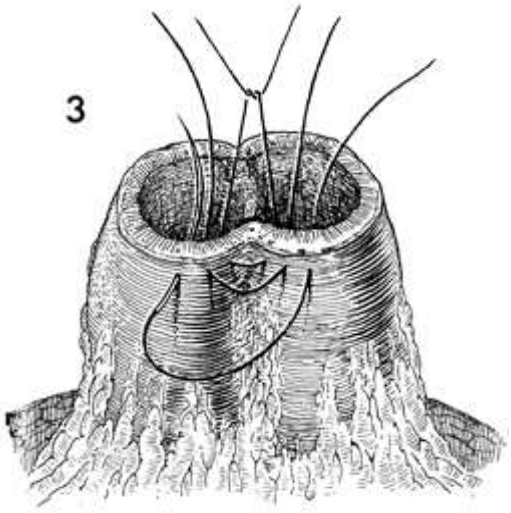

Figure (15) suturing post wall 1st [65]

The bowel has been prepped for a Gambee single-layer through-and-through anastomosis. Synthetic absorbable sutures are placed through the wall of the bowel, starting on the mucosa, exiting through the serosa, reentering the serosa on the opposite side, and exiting through the mucosa of the opposite side. Thus the knot will be tied in the lumen of the bowel. figure (15 – 16) .

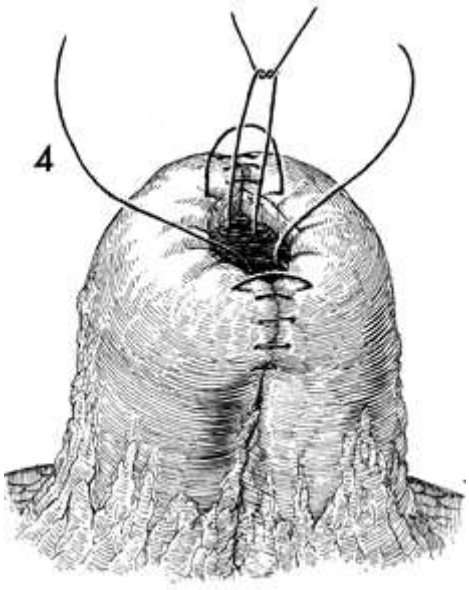

Figure (16) suturing anterior wall 2nd [65]

The Gambee anastomosis is near its completion with an inverting suture technique.

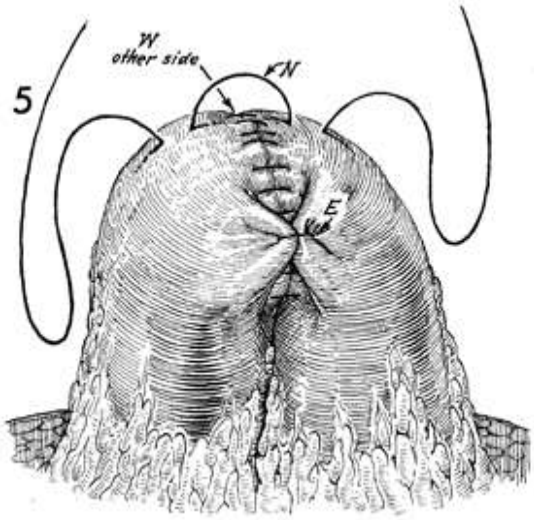

Figure (17) extra mucosal sutures [65]

When the Gambee anastomosis has been completed, several Lembert sutures are placed north (N), east (E), and west (W) to relieve tension on the suture line and improve wound healing. figure (17 – 18) .

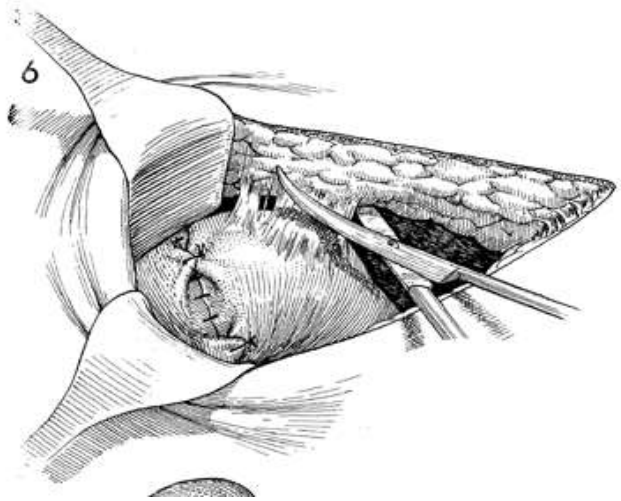

Figure (18) complete freeing of reanastomosed loops [65]

After the anastomosis is completed, the peritoneum is entered, and adhesions are dissected with Metzenbaum scissors.

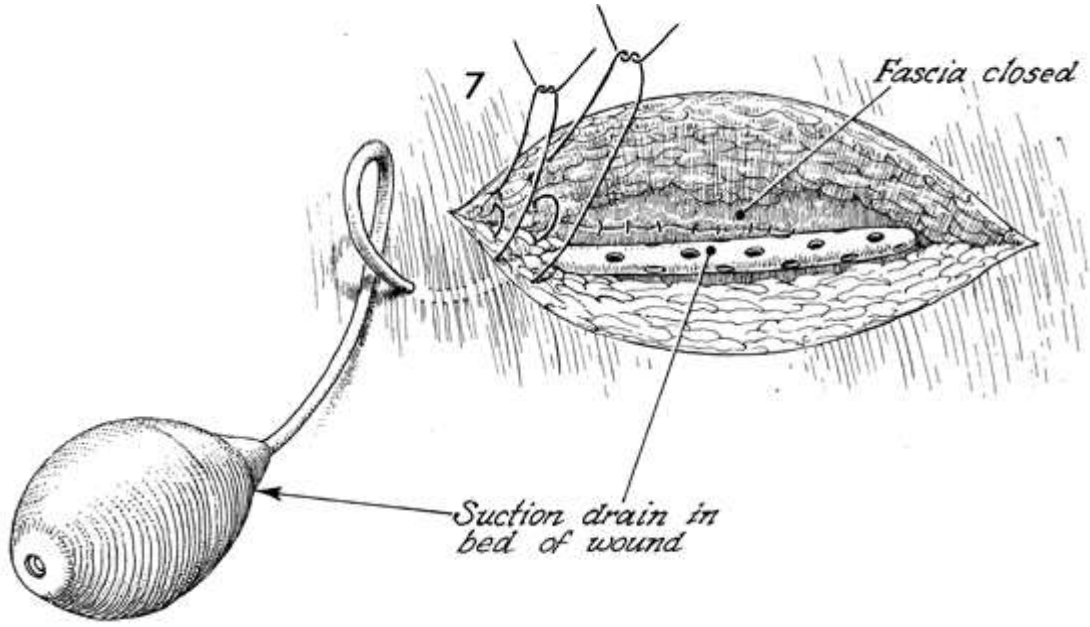

Figure (19) subcutaneous drain [65] .

The rectus fascia has been closed with synthetic delayed absorbable suture. A Hemovac suction drain is placed above the closure of the fascia and below the subcutaneous tissue. figure (19) .

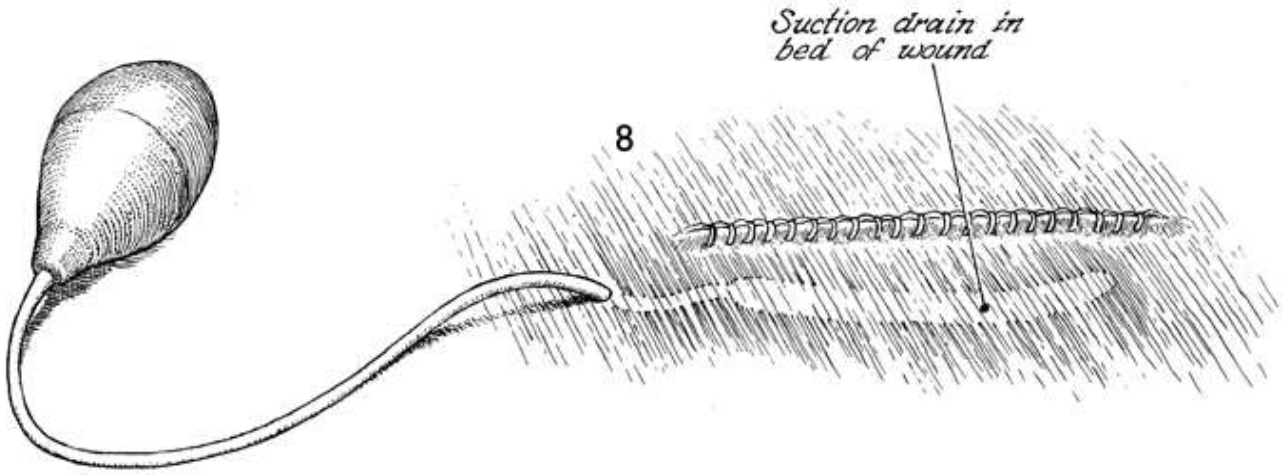

Figure (20) closure skin over suction drain. [65] .

The skin is closed with stainless steel clips. Note the suction drain ghosted under the closure. This is removed in 24-36 hours.[65] .

Cecostomy

Definition and History :

Cutaneous Cecostomy means a surgical opening of the cecum on the skin . Pillore performed the first right inguinal cecostomy in 1776 to provide decompression for an obstructing rectal carcinoma . [188]

Indications :

Pillore performed the first right inguinal cecostomy in 1776 to provide decompression for an obstructing rectal carcinoma. [66] . [67] . [68] . This technique was not popularized until the 1950s, when cecostomy was advocated for several clinical conditions: (1) distal colonic obstruction, (2) proximal diversion to protect a distal anastomosis, (3) cecal volvulus, (4) decompression of toxic megacolon, and (5) intestinal pseudo-obstruction . [69] . [70] . . It should be recalled that cecostomy allowed for satisfactory colonic decompression with minimal anesthetic requirements at a time when large bowel obstruction carried a mortality of 12–56% . [71_ 74] .

Two other factors that increased the frequency with which this diversion procedure was performed were the reliance on three-stage resections for complicated diverticular disease and obstructing neoplasms and the perceived need to protect distal colonic anastomoses. The use of cecostomy as an initial decompressive procedure for distal colonic obstruction has been very successful for decompression of the colon and subsequent preparation of the colon for definitive surgery . [75] . However, in most series the mortality rate following decompressive cecostomy was alarmingly high (21.5%) . [68 _ 75]. This situation is more a reflection on differences in perioperative care of the patient with large bowel obstruction rather than a specific disadvantage of cecostomy. [66] .

At the time of cecostomy placement, as many as 10% of patients in these series had cecal perforations that would have been unnoticed if a blind transverse loop colostomy had been chosen as the diversion procedure . [75] . Conversely,

complementary cecostomy placement performed to protect a difficult distal colonic anastomosis has been associated with few complications. However, it is disconcerting that leakage, with subsequent mortality, occurred as frequently (2%) at the cecostomy site and at the distal anastomosis. Such leakage is a factor that discourages wide application of this form of proximal diversion . [67] .

The treatment of nongangrenous cecal volvulus has included cecal resection, cecopexy, detorsion alone, and cecostomy with or without cecopexy . [76 _ 80] . A preference for nonresectional therapy with viable bowel has been noted, and the lowest recurrence rate appears to be associated with cecopexy and cecostomy tube placement . [76] .

In such cases cecostomy is most readily achieved through the appendicular stump unless the stump was previously resected. Overall, an approach involving cecostomy and cecopexy is highly successful and is associated with lower operative mobility and mortality than resectional therapy . [80] .

The use of surgical cecostomy for intestinal pseudo-obstruction had been associated with operative mortality ranging from 25–44%, even with adequate decompression . [81 _ 83] . Mortality increases significantly with delay in diagnosis and associated full-thickness necrosis of the bowel wall, usually in the face of significant associated medical illnesses . [85 , 86] . However, the morbidity rates associated with endoscopic decompression are minimal compared to those of surgical cecostomy.
[66] .

SURGICAL TECHNIQUE AND ACCESS :

TUBE PLACEMENT

Throughout the years a number of techniques and tubes have been advocated for cecostomy. The two most frequently recommended techniques are exteriorization and blind tube cecostomy . [75 , 89 _ 91] .Typically the tube placement procedure is performed through a right-lower-quadrant incision, although Hughes [92] has advocated a formal laparotomy with placement of the cecostomy through a separate stab incision. The procedure can be performed with the patient under local infiltrative anesthesia, although general anesthesia and regional blocks have been used, depending on the patient's medical condition. [66] .

A transverse (McBurney) incision is made in the right lower quadrant to allow access to the peritoneal cavity . On entry to the peritoneal cavity, the distended cecum should be readily identifiable. The cecum is carefully and gently inspected for perforations or serosal tears, which can occur in as many as 3% of patients with cecal distention greater than 10 cm . [68] .

If the surgeon encounters a collapsed cecum, bloody peritoneal fluid, or purulent exudate, the procedure should be terminated in favor of a formal laparotomy, which allows for clearer identification of the pathological condition and definitive treatment. After the cecum has been identified, the cecotomy can be performed by exteriorization or the blind tube technique . [66] .

When exteriorization is used, the cecal pouch is allowed to protrude from the abdominal cavity to skin level. A row of seromuscular sutures is placed prior to opening the cecum to prevent spillage of cecal contents into the peritoneal cavity. A cecotomy is made, and the cecum is sewn to the skin circumferentially with seromuscular sutures , completing the cecotomy. When tube cecotomy is chosen, the cecum is initially sutured to the peritoneum circumferentially to prevent peritoneal soiling. Two concentric purse-string sutures of 2-0 silk are then placed in the cecum . A small colotomy is made in the center of the inside purse string, with suction readily available to aspirate the effluent. An important technical point is to place the suction tip at the opening of the colostomy rather than to insert it into the cecum, because collapse of the cecum through suction may prevent adequate removal of the more distal contents. [66].

Once the effluent has been controlled, a 22 or 24F soft rubber catheter is inserted through the cecotomy and both purse strings are tied securely. A variety of catheters can be employed, including a de Pezzer catheter, Foley catheter, endotracheal tube, or even a soft rubber chest tube . [75_ 94] . A water-filled balloon catheter has the advantage of being more readily interchangeable, if a change should become necessary, than the de Pezzer catheter. In addition, the water balloon catheter offers a security advantage over a non–balloon-type catheter in that the balloon tends to retard accidental dislodgment. After the tube has been secured, the fascial skin layers are closed loosely around the catheter and a light dressing is applied . In recent years, percutaneous cecostomy guided by computed tomography (CT) has been described . [95 _ 96] .

For this technique, the patient is rolled to the left lateral decubitus position. Only local infiltrative anesthesia is required at the site of tube insertion. A small incision is made, and, under CT guidance, a needle is placed through the retroperitoneum into the cecal lumen. The track can then be gently dilated via the Seldinger technique to allow catheter placement for decompression. Although most reports have involved a relatively small group of patients, the technique has resulted in successful rapid decompression of the cecum. Such decompression usually is achieved with the use of a 12F catheter. In addition to the significant advantage of requiring only a local anesthetic, there have been no reported cases of major morbidity or procedure-related mortality with this approach . [94 , 96 , 97] .Subsequently, Morrison et al. [99] have described a transperitoneal approach that excludes the need for CT guidance. This technique requires only fluoroscopy, thereby making the procedure readily available at most institutions. In addition, there are limitations associated with the retroperitoneal approach via CT guidance: (1) what appears to be an extraperitoneal cecum actually may be intraperitoneal because of a thin veil of peritoneal reflection that encircles the cecum and (2) the posterior approach via CT guidance presents difficulties when the cecum is tremendously dilated or when it has twisted anteriomedially on its mesentery .
[81 , 99] .

When the transperitoneal approach is used, the dilated cecum is located fluoroscopically and an area central to the cecum is identified. A 2-in. square of skin and abdominal wall is anesthetized with a local infiltrative anesthetic agent. A specially designed 18-gauge introducer needle loaded with a plastic T fastener is carefully inserted into the cecal lumen. The T fastener is launched from the introducer and used to secure the cecum against the anterior abdominal wall. This step is repeated at each of the four corners of the selected site for tube insertion. After the cecum has been attached to the abdominal wall, the transcutaneous needle track to the cecal lumen is progressively dilated via the Seldinger technique to allow a 24–34F tube to be placed at the initial setting. This technique has been advocated primarily for patients with cecal volvulus or those with distal colonic obstruction. In a small group of patients, the technique has been very successful with no procedure-related morbidity or mortality reported . [98] .

Care :

For the first 12–24 hr after placement of a cecostomy tube, the tube should be gently irrigated with 30 mL of normal saline every 2 hr. Use of larger volumes may

disrupt the seal between the cecum and the abdominal wall, increasing the chance of peritoneal contamination. During ensuing days, the irrigation solution can be increased steadily to 500–1000 mL . As the volume is increased, turning the patient in different positions can allow adequate preparation even as far distally as the descending colon. Between irrigation intervals, the tube must be carefully inspected to ensure that no obstruction has occurred as a result of accumulation of stool or kinking. If unrecognized obstruction occurs, the cecum may burst .[75]

Ileostomy

Definition and History :

Cutaneous Ileostomy means a surgical opening of the ileum on the skin .
The ileostomy is a much newer technology, which mainly came from the realisation that surgery could be an effective treatment in severe ulcerative colitis and Crohn's disease. This surgery requires removal of part or the entire colon, which is called a colectomie. In 1940 surgeons were still uncertain about the feasibility of a colectomie because of technical difficulties of the operation and the problems of post-operative care. Around 1950, however, anaesthesia (general anaesthetic) and postoperative care improved, and a colectomie in combination with an ileostomy manifests itself.
[189]

Anatomy of the Small Intestine

The small intestine is divided into three regions . The **duodenum** (doo-o¯-DE¯-num), the shortest region, is retroperitoneal. It starts at the pyloric sphincter of the stomach and extends about 25 cm (10 in.) until it merges with the jejunum. *Duodenum* means "12"; it is so named because it is about as long as the width of 12 fingers. The **jejunum** (je-JOOnum) is about 1 m (3 ft) long and extends to the ileum. *Jejunum* means "empty," which is how it is found at death. The final and longest region of the small intestine, the **ileum** (IL-e¯-um _ twisted), measures about 2 m (6 ft) and joins the large intestine at a smooth muscle sphincter called the **ileocecal sphincter** (il_-e¯-o¯-SE¯ -kal). [100] .

Histology of the Small Intestine

The wall of the small intestine is composed of the same four layers that make up most of the GI tract: mucosa, submucosa, muscularis, and serosa. The **mucosa** is composed of a layer of epithelium, lamina propria, and muscularis mucosae. The epithelial layer of the small intestinal mucosa consists of simple columnar epithelium that contains many types of cells . **Absorptive cells** of the epithelium digest and absorb nutrients in small intestinal chyme. Also present in the epithelium are **goblet cells,** which secrete mucus. The small intestinal mucosa contains many deep

crevices lined with glandular epithelium. Cells lining the crevices form the **intestinal glands (crypts of Lieberkühn)** and secrete intestinal juice (to be discussed shortly). Besides absorptive cells and goblet cells, the intestinal glands also contain paneth cells and enteroendocrine cells. **Paneth cells** secrete lysozyme, a bactericidal enzyme, and are capable of phagocytosis. Paneth cells may have a role in regulating the microbial population in the small intestine. [100] .

Physiology :

Three types of enteroendocrine cells are found in the intestinal glands of the small intestine: **S cells, CCK cells,** and **K cells,** which secrete the hormones **secretin** (se-KRE¯ -tin), **cholecystokinin** (ko¯-le¯ -sis_-to ¯-KI¯ N-in) or **CCK,** and **glucosedependent insulinotropic peptide** or **GIP,** respectively. The lamina propria of the small intestinal mucosa contains areolar connective tissue and has an abundance of mucosa-associated lymphoid tissue (MALT). **Solitary lymphatic nodules** are most numerous in the distal part of the ileum Groups of lymphatic nodules referred to as **aggregated lymphatic follicles (Peyer's patches)** are also present in the ileum. The muscularis mucosae of the small intestinal mucosa consists of smooth muscle. [100]

The **submucosa** of the duodenum contains **duodenal (Brunner's) glands** , which secrete an alkaline mucus that helps neutralize gastric acid in the chyme. Sometimes the lymphatic tissue of the lamina propria extends through the muscularis mucosae into the submucosa.

The **muscularis** of the small intestine consists of two layers of smooth muscle. The outer, thinner layer contains longitudinal fibers; the inner, thicker layer contains circular fibers.

Except for a major portion of the duodenum, the **serosa** (or visceral peritoneum) completely surrounds the small intestine.

Even though the wall of the small intestine is composed of the same four basic layers as the rest of the GI tract, special structural features of the small intestine facilitate the process of digestion and absorption. These structural features include

circular folds, villi, and microvilli. **Circular folds** or *plicae circulares* are folds of the mucosa and submucosa . These permanent ridges, which are about 10 mm (0.4 in.) long, begin near the proximal portion of the duodenum and end at about the midportion of the ileum. Some extend all the way around the circumference of the intestine; others extend only part of the way around. [100] .

Circular folds enhance absorption by increasing surface area and causing the chyme to spiral, rather than move in a straight line, as it passes through the small intestine. Also present in the small intestine are **villi** (_ tufts of hair), which are fingerlike projections of the mucosa that are 0.5–1 mm long . The large number of villi (2 0–40 per square millimeter) vastly increases the surface area of the epithelium available for digestion and absorption and gives the intestinal mucosa a velvety appearance. Each villus (singular form) is covered by epithelium and has a core of lamina propria; embedded in the connective tissue of the lamina propria are an arteriole, a venule, a blood capillary network, and a **lacteal** (LAK-te¯ -al _ milky), which is a lymphatic capillary. Nutrients absorbed by the epithelial cells covering the villus pass through the wall of a capillary or a lacteal to enter blood or lymph, respectively. Besides circular folds and villi, the small intestine also has **microvilli** (mı¯-kro¯-VIL-ı¯; *micro-* _ small), which are projections of the apical (free) membrane of the absorptive cells. Each microvillus is a 1 _m-long cylindrical, membrane-covered projection that contains a bundle of 20–30 actin filaments. When viewed through a light microscope, the microvilli are too small to be seen individually; instead they form a fuzzy line, called the **brush border,** extending into the lumen of the small intestine . There are an estimated 200 million microvilli per square millimeter of small intestine. Because the microvilli greatly increase the surface area of the plasma membrane, larger amounts of digested nutrients can diffuse into absorptive cells in a given period. The brush border also contains several brush-border enzymes that have digestive functions . [100] .

INDICATIONS

End ileostomy remains a viable alternative to ileal pouch–anal anastomosis for patients undergoing proctocolectomy for ulcerative colitis. It is often preferable in

cases of concomitant rectal cancer, in patients with compromised sphincter function, in cases of indeterminate colitis with a high clinical suspicion of Crohn's disease [104] , or in patients whose medical comorbidities preclude a more extensive procedure. Alternatively, the patient simply may not wish to be exposed to the pouch-specific complications (e.g., pouchitis) or multiple surgical procedures that may be required with ileal pouch–anal anastomosis. [105] . Similarly, end ileostomy is an alternative to pelvic pouch surgery in patients with familial adenomatous polyposis. [101] .

Total proctocolectomy with end ileostomy remains the procedure of choice for patients with Crohn's colitis whose rectum is unsuitable for anastomosis and in many patients with multiple large bowel carcinomas, particularly if there is a synchronous rectal cancer. An end ileostomy is required in a wide variety of circumstances in which urgent ileal and/or colonic resection is required and an anastomosis is deemed unsafe. A common scenario would be subtotal colectomy for toxic megacolon or refractory colitis (e.g., Crohn's colitis, ulcerative colitis, pseudomembranous or other infectious colitis) or ileocolic resection for mesenteric ischemia. Disease-specific factors (e.g., perforation, ischemia, or residual diseased bowel) and patient specific factors (e.g., malnutrition, hemodynamic instability) must be carefully assessed in determining whether an end ileostomy is the preferred or safest option. Reconstruction may be best performed at a later date under more favorable circumstances. [101] .

The end ileostomy remains an important option in the definitive management of many diseases encountered in the colon and rectum despite the availability of restorative options that have diminished its role. A properly constructed end ileostomy continues to afford countless patients an outstanding quality of life [102 , 103] , often at lower risk than its more complex reconstructive counterparts. [101] .

Loop ileostomy

This is always *temporary* and has become popular as a means of:

• protecting low anterior resection, ileorectal anastomosis, ileoanal pouch (in ulcerative colitis and familial polyposis), and colo-colic anastomosis in unprepared bowel or in a septic patient • diversion of enteric contents from a distal enteric fistula • decompression of distal ileum and colon • definitive therapy for megacolon. [117] .

Several points bear emphasis in this situation:
1. Many such stomas will turn out to be permanent and must therefore be carefully constructed.
2. The distal bowel should be exteriorized by creation of an endloop
stoma [106] or mucous fistula or otherwise positioned to facilitate easy identification and closure at a later date, when possible without the need for a major laparotomy. This relatively simple maneuver may ultimately determine whether the patient will be able to undergo subsequent stoma closure, since some patients who would otherwise be unable or unwilling to undergo a major intraperitoneal procedure will be suitable for a skin level stoma closure.
3. Unnecessary dissection, removal, or division of bowel may compromise later reconstructive efforts. [101] .

PREOPERATIVE PREPARATION

Appropriate preoperative counseling and preparation by both the surgeon and an enterostomal therapist are crucial components of the preparation for surgery. A thorough discussion of surgical alternatives and life with a stoma can greatly enhance the patient's and family's adjustment to an end ileostomy. Preoperative discussions with the enterostomal therapist and willing ostomates can be invaluable in allaying anxiety about a wide variety of pragmatic quality-of-life issues and potentially prevent the social isolation that some patients will experience, particularly in the early postoperative period. [101] .

SITE SELECTION

There is probably no more important technical issue affecting quality of life after ileostomy than proper site selection and construction. A face plate should be placed on the proposed site with the patient in both the supine and sitting positions to demonstrate skin creases that would interfere with a good seal. For similar reasons, the faceplate should not impinge upon bony prominences and be kept away from surgical scars or damaged skin. The patient's usual choice of clothing and belt line also need to be considered. Although the right lower quadrant is typically selected as the site for an end ileostomy, this is not always the best choice. A previous right-lower quadrant stoma or right paramedian incision may not allow a sufficiently flat surface for a secure appliance.

Obese patients often benefit from a stoma in the upper abdomen, where they can more readily see the stoma and care for it. Further, many such patients have considerably less subcutaneous fat in the upper abdomen, facilitating creation of a tension-free stoma. The site may be indicated with an indelible pen and then more aggressively marked with a needle or the tip of a scalpel blade after induction of anesthesia but prior to preparation of the abdomen. If there will be a delay between stoma marking and surgery, an indelible tattoo may be left for subsequent identification . [101] .

OPERATIVE TECHNIQUE

A midline incision is generally preferred. Paramedian incisions may interfere with future stoma sites should the patient require reoperative surgery owing to stoma complications or, for example, recurrent Crohn's disease. After the diseased bowel is resected, the ileum is transected with a linear cutting stapler . Unless the terminal ileum requires resection, it is our practice to divide the ileum just proximal to the ileocecal valve. The antimesenteric fatty fold routinely found on the terminal ileum is dissected off and reflected toward the cecum . The entire ileum may thereby be preserved, which may be of particular importance if the patient later undergoes an ileal pouch–anal anastomosis. Experience with pelvic pouch surgery has demonstrated that the historical admonitions mandating resection of 5–10 cm of ileum after division of the ileocolic vessels is generally unfounded. As such, It is preferred to divide the ileocolic vessels at the level of the mesenteric window that exists almost universally on either side of these vessels . [101] .

The small branches remaining in the mesentery are divided up to the level of the divided ileum . The retroileal fold may then be divided, if needed, to provide for more length. It is crucial that careful mesenteric division and mobilization be performed to facilitate construction of a properly everted ileostomy. The preoperatively marked stoma site is grasped with a Kocher clamp. Using the cutting cautery or scalpel, a disk of skin approximately 2 cm in diameter is excised . Pulling up on the skin with the Kocher clamp makes it simpler to make the circular incision. A second Kocher clamp is placed on the midline fascia to keep all layers of the abdominal wall in alignment. A longitudinal incision is made through Scarpa's fascia and the remaining subcutaneous tissue bluntly retracted to expose the anterior rectus sheath. A longitudinal incision is then made in the anterior sheath, with small horizontal crosshatches, thereby creating a cruciate incision . Upward pressure with the nondominant hand inside the abdomen provides for better exposure. The rectus muscle is gently separated with a Kelly clamp and the retractors repositioned,

exposing the posterior rectus sheath. With continued upward traction from a laparotomy pad over the intra-abdominal hand, the posterior sheath is incised . The resulting defect should be approximately two finger breadths in diameter . [101]

A large Kelly clamp may be placed through the stoma site and lifted upward, providing for excellent visualization of the stoma aperture should bleeding be encountered. A Babcock clamp is placed through the hole and the ileum is gently delivered for subsequent maturation, taking care to ensure that the bowel and its mesentery have not been twisted . The mesentery should be angled in a cephalad direction. Absorbable sutures may then be placed to affix the mesentery to the anterior abdominal wall from the level of the stoma to the falciform ligament, although this step is probably unnecessary . The midline incision, including the skin, is then closed and a towel placed over it for protection. With the stoma site quarantined by surrounding towels or drapes, the staple line is excised. Four absorbable sutures of 3.0 or 4.0 are then placed 90 degrees apart to create an everted stoma . The suture is first passed through the full thickness of the cut edge of the bowel, then placed seromuscularly approximately 3–4 cm below the cut edge, and then through the subcuticular layer of the skin . The suture should not be placed through the epidermis, since this can create mucosal islands or dense scar that may ultimately impair pouching of the stoma . These four sutures are clamped, rather than tied, to facilitate placement of additional four sutures: one between each of the corner sutures . These need not include a seromuscular bite and may be tied as they are placed, utilizing the four corner sutures to evert the stoma and take the tension off the sutures as they are tied. The four corner sutures are then tied and a postoperative appliance is affixed . [101] .

End ileostomy

An end ileostomy can be constructed via a trephine in the abdominal wall, by a formal laparotomy or laparoscopically. A 5–10 cm length of healthy ileum with a good blood supply is used to construct the stoma. In general, the ileum should be divided as close to the ileocaecal valve as possible – usually 2 cm in the case of ulcerative colitis, but in C ro h n ’s disease this will depend on the degree of the involvement of the distal ileum. Pro p e r visualization of the mesenteric blood vessel a rcade is re q u i red to ensure adequate blood supply to the terminal ileum. The ileum is then divided between two clamps or by using a cutter stapler to avoid spillage of the bowel contents. After completion of the primary surgical procedure, the stoma trephine is made and the terminal ileal end pulled through it. To form a good spout, a 5–10 cm length of ileum is drawn through, which after eversion of the mucosa should give a spout of 3–5 cm. The stoma is everted by taking a series (six to eight) of

absorbable sutures between skin, serosa 3 cm from the stoma edge and the full thickness at the mucosal edge of the stoma When these sutures are tightened, the stoma should be everted, resulting in a spout approximately 3 cm in length. Care should be taken not to suture small bowel mesentery. [57] .

Loop ileostomy

A few technical points are worth emphasizing:

• The trephine must be large enough to admit two fingers • We no longer use a rigid rod under the loop of ileum postoperatively because it may cause ileal damage and skin excoriation, and it is painful at removal • The ileal loop is delivered through the t rephine by placing a soft rubber tube under the mesenteric border of the ileal loop. The loop ileostomy is constructed in a similar way to the end ileostomy, after closure and coverage of the laparotomy wound. A transverse enterotomy is done at the antimesenteric border of the ileum; the distal end is sutured to the skin before eversion of the proximal end . Eversion and suturing of the ileostomy are done in the same way as in end ileostomy, creating a spout 2–3 cm above the skin surface.
[57] .

Care and Prevention of COMPLICATIONS

Many stoma complications can be prevented by careful technique and attention to detail. Nonetheless, even a well-constructed end ileostomy may be associated with a technical complication, or a problem may arise related to the patient's intrinsic disease (e.g., Crohn's disease.) [101] .

- Ileostomy creation and care was revolutionized with the description of the eversion technique by Brooke in 1952. Eversion eliminates the serositis reaction commonly observed from the proteolytic ileal effluent. Another advance has occurred with the widespread employment of trained nurse enterostomal therapists to educate and care for patients with ostomies.

- Physiology. The small intestine adapts to ileostomy formation within 10 days postoperatively, with ileostomy output typically reaching a plateau between 200 and 700 mL/day. Because the effluent is highly caustic, it is crucial to maintain a stoma appliance that protects the surrounding skin and seals to the base of the ileostomy.
- Stoma construction of either a loop ileostomy or end-ileostomy should include eversion of the functioning end to create a 2.5-cm spigot configuration. Stoma creation lateral to the rectus abdominis increases the risk of peristomal herniation. Precise apposition of mucosa and skin prevents serositis and obstruction. Preoperative marking of the planned stoma prevents improper placement near bony prominences, belt/pant lines, abdominal creases, and scars. [107] .

- Ileostomy care requires special attention to avoid dehydration and obstruction. The patient is encouraged to drink plenty of fluids and to use antidiarrheal agents as needed to decrease output volume. Patients should be warned to avoid fibrous foods, such as whole vegetables and citrus fruits, because these may form a bolus of indigestible solid matter that can obstruct the stoma. Irrigating the ostomy with 50 mL of warm saline from a Foley catheter inserted beneath the fascia, in combination with intravenous fluids and nasogastric decompression, may relieve obstruction and dehydration. Alternatively, water-soluble contrast enema may be diagnostic as well as therapeutic. [107] .

- Reversal of a loop ileostomy is relatively straightforward and rarely requires laparotomy. A double-stapled technique with a GIA stapler is utilized if enough intestinal length can be obtained; otherwise, the enterostomy is closed with sutures in two layers. [107] .

A retrospective review of 610 consecutive patients with intestinal stomas constructed at Cook County Hospital, Chicago, was carried out to analyze early local complications with respect to stoma type and to compare complication rates by

surgical specialty. A total of 197 complications were recognized in 158 patients for a corrected complication rate of 25.9%. Peristomal skin irritation (42.1%) was the most frequently recognized early complication in this study. Ileostomy was associated with the highest morbidity (40%) of any type of stoma. Emergency stoma formation seems to be associated with the highest complication rates, probably because of suboptimal stoma placement. The morbidity of stoma formation seems to be related to the amount of formal training in gastrointestinal tract surgery. Technical guidelines for stoma construction are presented to help minimize these complication. [109] .

Ilieostomy Closure :

A temporary loop ileostomy or loop colostomy is often constructed to protect a distal anastomosis [110] , as an anastomotic leakage is a serious post-operative complication following colorectal surgery . [111] . A loop ileostomy may be easier for patients to manage and cause fewer complications than a loop transverse colostomy . [112] . Ostomates normally return to hospital within three to six months following their initial procedure for closure of their temporary stoma . [10] . An early ileostomy closure reduces stoma-related complications and improves quality of life . [113]. Prior to their stoma reversal, ostomates are generally admitted to the ward on the day before surgery. Typically in patients who have undergone a restorative proctocolectomy, a pouchogram may be performed to verify the integrity of the pouch and the pouch–anal anastomosis prior to the ileostomy closure. Loop stomas often negate the need for laparotomy as a circumferential incision can be made around the stoma to mobilise the loop of bowel. Once the stoma has been taken down the anastomosis can either be hand sewn [114] or stapled [115].

On return to the ward the patient will need to have their observations maintained regularly as previously discussed until suitably recovered. Nurses must also be assiduous in checking the closure site regularly for signs of excessive bleeding and report any disproportionate swelling around the site. Intravenous fl uids

will normally be required post-operatively to combat dehydration, until the surgeon feels it is appropriate to commence oral fl uids and subsequent diet, which in some cases may be immediately postoperatively . [112] . Overall complication rates from ileostomy closure have been reported to range between 10% and 30% . [116]. Therefore nurses should be aware of the potential problems that may occur following the closure of a loop ileostomy:

• small bowel obstruction • wound infection • abdominal sepsis. [109] .

Duodenostomy and Jujenostomy

Chyme passes from the stomach to the duodenum via the pyloric sphincter to prevent regurgitation [174] . The duodenum is shaped like the letter C and is about 25 cm long [175] , curving around the head of the pancreas. Chyme enters the duodenum approximately 30 minutes after eating a meal. About 6–10 ml of chyme enter the duodenum every minute, emptying the stomach usually four to fi ve hours after a meal [176] .

The common bile duct and the pancreatic duct empty into the mid section of the duodenum, through the sphincter of Oddi, at the ampulla of Vater [177] .

These secretions help to neutralise the acidic gastric contents making them more alkaline [178] . The enzyme-rich secretions aid digestion of carbohydrates, fats and proteins. In the duodenum the absorption of calcium, magnesium, iron, protein, fats and starch occurs [179] .[180] .

The jejunum is the upper two-fifths (2.5 m) of the small intestine [181] . The lower three-fifths (3.6 m) is the ileum [182] , although there is no sharp demarcation between the two sections of small intestine [183] . The jejunum begins at the duodenojejunal (DJ) fl exure and gradually changes into ileum, ending at the ileocaecal junction. The jejunum allows further digestion of proteins, fats and carbohydrates. The main function of the small intestine is to absorb nutrients via the many folds in the intestinal mucosa that increase the surface area about three times. The folds also force the chyme to move around the bowel lumen, mixing with intestinal juices and slowing down its passage to increase absorption [184] .

It can be seen that following an extensive small bowel resection (where less than one metre remains) it may not be possible to reabsorb suffi cient nutrients to maintain life. The structure of the small bowel is ideally suited for absorption as there

are five million small villi that project into the bowel lumen . The villi are about one millimetre in height and each villus has about 1000 microvilli, named the brush border, increasing the surface area more than 20 fold . The brush border produces some intestinal juice (peptidase) that breaks down protein. Each epithelial cell (enterocyte) in the small intestine has about 600 microvilli . Villi require rapid replacement and have a very high rate of mitosis. The villi may be replaced every 36 hours and worn-out cells are shed and excreted in the faeces (Hinchliff 1981). The mucosa of the small intestine secretes about two litres daily of a slightly alkaline substance (pH 7.5–8.0). The villi rapidly reabsorb the secretions and use them as a transporter for the absorption of nutrients from the chyme .[180] .

Patients with a high faecal output may lose bowel secretions in addition to nutrients. In starvation the enterocytes shrink and the villi can decrease in size by up to half; this reduces the absorptive capability of the small intestine. This generally reverses when enteric feeding recommences. Damage to enterocytes also occurs in coeliac disease, Crohn's disease or due to radiation, for example . When the body absorbs glucose and sodium from the ileum the luminal water is also drawn across the epithelium . This is particularly important if rehydration therapy is required, for example by patients with a short bowel or diarrhoea. Rehydration therapy is more effective if it contains sodium and glucose in the water, as glucose is required for sodium uptake. The villi in the small intestine absorb almost all of the proteins, carbohydrates and fats. Proteins and carbohydrates as amino acids and simple sugars respectively are absorbed via the capillaries to the portal vein and liver. Fats as fatty acids and glycerol pass into the lymph within the villi and are drained into the lymphatic capillaries . The proximal ileum absorbs vitamins, monosaccharides and disaccharide. [180] .

The terminal ileum absorbs sodium, potassium, chloride, bicarbonate, bile salts and vitamin B12 . Considerable volumes of water are absorbed throughout the ileum. Within about three to six hours the chyme will reach the ileocaecal valve . CCK is thought to regulate the release of chyme and is secreted by endocrine cells in the

intestinal mucosa when chyme is present, altering peristalsis . The ileum empties about 1.5 litres daily into the colon , having absorbed fi ve to six litres in the jejunum and about two litres in the ileum. The various sites through which absorption of nutrients occurs can be important if that part of the bowel is resected during surgery and may therefore affect absorption of various dietary nutrients. [180] .

There are a few very rare stomas, the jejunostomy or duodenostomy, that are made from the higher gastrointestinal tract. These ostomates pass high faecal outputs often in excess of one litre daily from their stoma. There is also a small group of ostomates that have a high output from their ileostomy or colostomy, passing up to several litres daily . Management of high faecal outputs can be diffi cult, the appliance fills quickly and the storage capacity of many appliances may be inadequate. Some manufacturers make a larger size bag in their range that can be useful in this situation . However, there is also a limited choice of high-output bags, available only in two pieces. The appliances are large for extra storage and instead of the outlet being like an ileostomy appliance, the opening is round and about one centimetre in diameter. This allows the connection of a catheter night drainage bag or a specialized drainage bag. Extra drainage is particularly useful overnight to reduce the frequency of appliance emptying. Many ostomates feel the need to apply extra adhesive around the stoma fl ange to help improve adherence or wear a stoma belt to help with the weight of the pouch when full. [164] .

Jejunostomy

A rarely formed stoma is the jejunostomy. A jejunostomy will be formed in situations such as a bowel infarct or following an extensive resection of small bowel. A jejunostomy is formed from the jejunum and will have a high faecal output, usually

over one litre daily. Thus the frequency of emptying the loose or liquid faeces is high . Some ostomates will attach further drainage facilities to overcome this issue. Ideally the jejunostomy will look like an ileostomy, with a spout, but as the stoma is often formed in an emergency situation this is not always possible and stoma management may be diffi cult. The appliance used for a jejunostomy can be an ileostomy appliance but there are also a limited number of specially designed appliances on the market. The high output appliances are slightly larger than the general ileostomy appliance and have a connector on the bottom that can be attached to a drainage bag. The appliance is generally changed on alternate days, but this may vary. If there is under 100 cm of small bowel before the jejunostomy then parenteral nutrition will be required . Any type of jejunostomy will generally require the ostomate to reduce oral hypotonic fl uids and to take rehydration solution. Medications are also generally used to slow the gut and to reduce secretions, in addition, to try and reduce the faecal output . A feeding jejunostomy should not be confused with a faecal jejunostomy and is not discussed. [185] .

Posterior Sagittal Anorectoplasty (PSARP)

Definition and History :

PSARP is a surgical operation that make an opening of the rectum to its anatomical anal site in cases of imperforate anus .

Founding Director Alberto Peña, MD, revolutionized the treatment of pediatric colorectal patients in 1980 when he introduced a surgical procedure called the posterior sagittal anorectoplasty (PSARP), or pull-through procedure. The pull-through surgery technique provides greater surgical accuracy in repositioning the anus, minimizes damage to surrounding anatomical structures, reduces post-surgical pain and improves outcomes.

[190]

Anatomy :

The *rectum* is a highly specialized organ that is fixed within a cone of muscles comprising the pelvic floor; it is richly supplied by both mesenteric and hypogastric (internal iliac) blood flow and by autonomic innervation that helps to control defecation. [118] .

Anorectal Physiology :

The Defecation Reflex

Mass peristaltic movements push fecal material from the sigmoid colon into the rectum. The resulting distension of the rectal wall stimulates stretch receptors, which initiates a **defecation reflex** that empties the rectum. The defecation reflex occurs as follows: In response to distension of the rectal wall, the receptors send sensory nerve impulses to the sacral spinal cord. Motor impulses from the cord travel along parasympathetic nerves back to the descending colon, sigmoid colon, rectum, and anus. The resulting contraction of the longitudinal rectal muscles shortens the rectum, thereby increasing the pressure within it. This pressure, along with voluntary

contractions of the diaphragm and abdominal muscles, plus parasympathetic stimulation, opens the internal anal sphincter. The external anal sphincter is voluntarily controlled. If it is voluntarily relaxed, defecation occurs and the feces are expelled through the anus; if it is voluntarily constricted, defecation can be postponed. Voluntary contractions of the diaphragm and abdominal muscles aid defecation by increasing the pressure within the abdomen, which pushes the walls of the sigmoid colon and rectum inward. If defecation does not occur, the feces back up into the sigmoid colon until the next wave of mass peristalsis stimulates the stretch receptors, again creating the urge to defecate. [119] .

In infants, the defecation reflex causes automatic emptying of the rectum because voluntary control of the external anal sphincter has not yet developed.

The amount of bowel movements that a person has over a given period of time depends on various factors such as diet, health, and stress. The normal range of bowel activity varies from two or three bowel movements per day to three or four bowel movements per week.

Diarrhea (dı¯-a-RE¯-a; *dia*- _ through; *rrhea* _ flow) is an increase in the frequency, volume, and fluid content of the feces caused by increased motility of and decreased absorption by the intestines. When chyme passes too quickly through the small intestine and feces pass too quickly through the large intestine, there is not enough time for absorption. Frequent diarrhea can result in dehydration and electrolyte imbalances. Excessive motility may be caused by lactose intolerance, stress, and microbes that irritate the gastrointestinal mucosa.

Constipation (kon-sti-PA¯ -shun; *con*- _ together; *stip*- _ to press) refers to infrequent or difficult defecation caused by decreased motility of the intestines. Because the feces remain in the colon for prolonged periods, excessive water absorption occurs, and the feces become dry and hard. Constipation may be caused by poor habits (delaying defecation), spasms of the colon, insufficient fiber in the diet, inadequate fluid intake, lack of exercise, emotional stress, and certain drugs. A common treatment is a mild laxative, such as milk of magnesia, which induces defecation. However, many physicians maintain that laxatives are habit-forming, and that adding fiber to the diet, increasing the amount of exercise, and increasing fluid intake are safer ways of controlling this common problem. [119] .

Normal Anorectal Function

- The rectum functions as a capacitance organ, with a reservoir of 650 to 1,200 mL compared to an average daily stool output of 250 to 750 mL.
- The anal sphincter mechanism allows defecation and maintains continence. The internal sphincter (involuntary) accounts for 80% of resting pressure, whereas the external sphincter (voluntary) accounts for 20% of resting pressure and 100% of squeeze pressure. The internal anal sphincter relaxes periodically to sample rectal contents but is contracted at rest. The puborectalis muscle is contracted at rest and relaxes only during defecation. It also maintains the anorectal angle. The external anal sphincter contracts in response to stimulation and relaxes during defecation.
- Defecation has four components: (1) mass movement of feces into the rectal vault; (2) rectal-anal inhibitory reflex, by which distal rectal distention causes involuntary relaxation of the internal sphincter; (3) voluntary relaxation of the external sphincter mechanism and puborectalis muscle; and (4) increased intra-abdominal pressure.
- Continence requires normal capacitance, normal sensation at the anorectal transition zone, puborectalis function for solid stool, external sphincter function for fine control, and internal sphincter function for resting pressure.
- [120] .

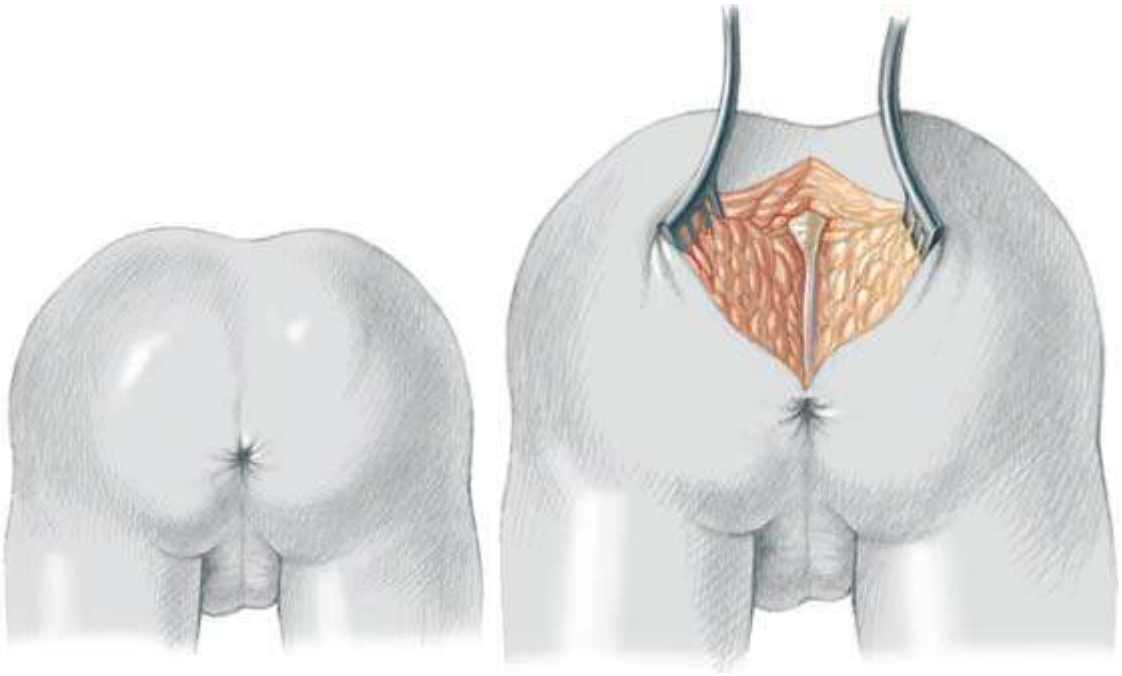

Figure (21) PSARP positin **Figure (22) self retaining to expose rectum (P. Puri · M. E. Höllwarth , springer surgery atlas series page 293 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

Indications of PSARP :

Anorectal malformations, represent a wide spectrum of defects. Surgical techniques useful to repair the most common types of anorectal malformations seen by a general pediatric surgeon are presented following an order of complexity from the simplest to the most complex. Malformations considered “low” have traditionally been approached perineally, without a protective colostomy, whereas malformations that are considered “high” were treated by colostomy in the newborn period, subsequent definitive repair of the malformation, and eventual closure of the colostomy. Surgical management has been evolving towards fewer operations and minimally invasive procedures. Anorectal malformations have been included in this trend. Colostomy is still a widely accepted procedure for children born with rather high and complex malformations. The circumstances in which this procedure is performed vary from one institution to another and from one country to another. Some surgeons feel confident approaching newborns without a protective colostomy. This is feasible and safe, provided the surgeon has experience in the management of these defects. Some surgeons do not feel confident with this approach and prefer a safer path in which they open a protective colostomy, particularly when the baby is premature or has severe associated anomalies The colostomy that is recommend in the management of anorectal malformations is a descending colostomy. [121] .

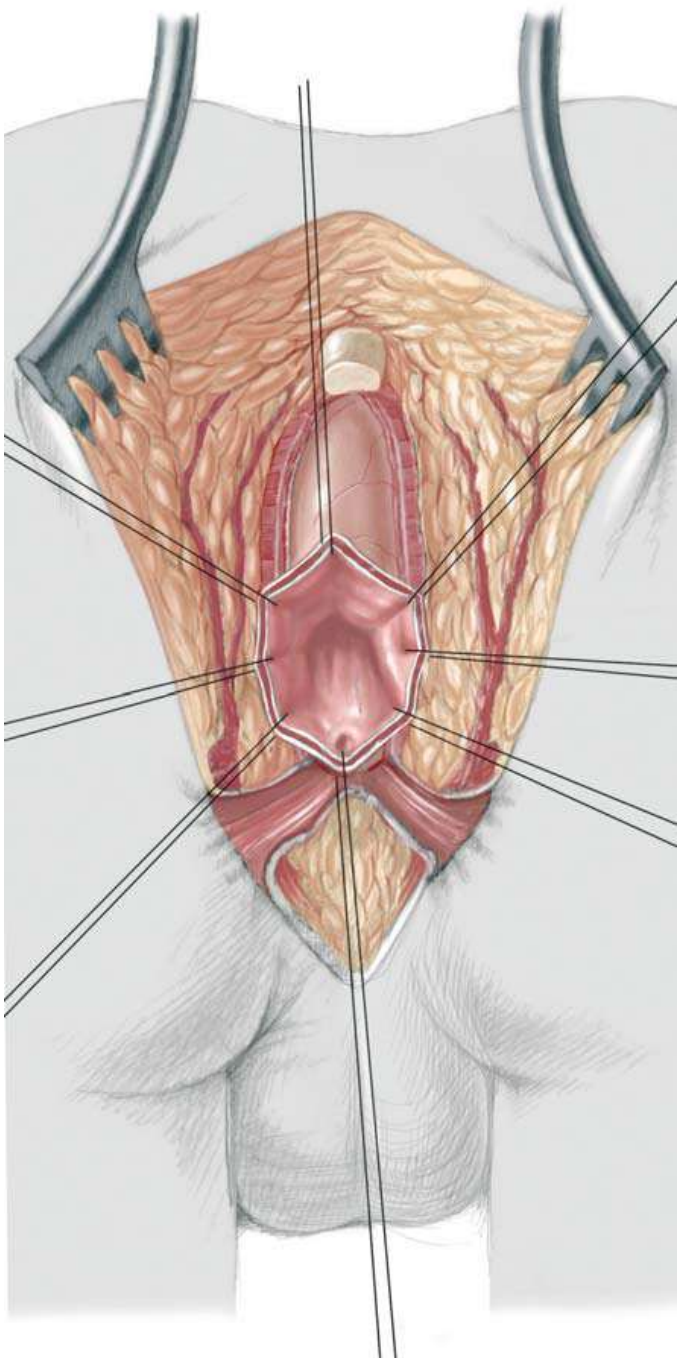

Figure (23) stay sutures to get rectum stoma to skin (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 295 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

Surgical access and techniques of PSARP :

The surgeon must understand that all colostomies performed in a mobile portion of the colon have a tendency to prolapse. The mobile portion, in the type of colostomy that we propose, is the distal stoma (mucous fistula) and therefore the surgeon must either to fix this distal sigmoid colon to the anterior abdominal wall or make the mucous fistula very small (4 mm in diameter) since it will be used only for colonic irrigations or distal colostogram imaging procedures. The incision is created in the left lower quadrant, long enough as to be sure that both the stomas are sufficiently separated as to be able to accommodate the stoma bag over the proximal stoma. The mucosa fistula should not be included under the stoma bag. When creating the colostomy in the newborn, the surgeons should look for the descending colon and select the first portion of mobile sigmoid to open the colostomy. That part of the colon is usually very distended and full of meconium. [121] .

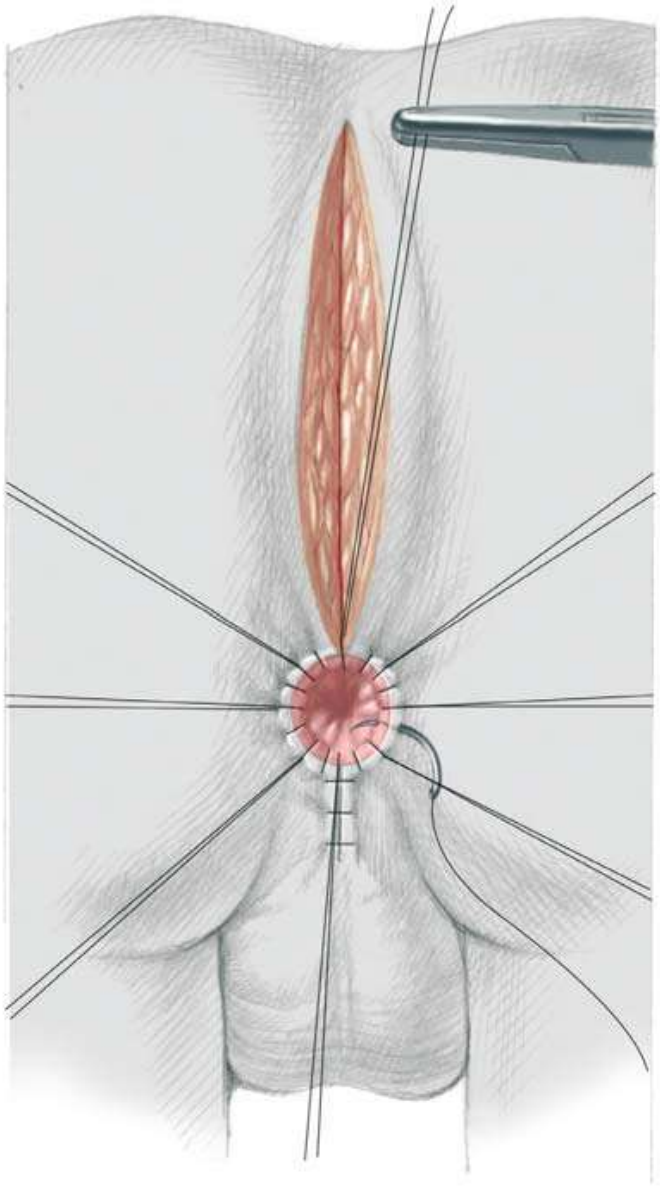

Figure (24) end appearance of rectal stoma (**P. Puri · M. E. Höllwarth , springer surgery atlas series page 301 , puplished by Springer-Verlag Berlin Heidelberg 2006 Printed in Germany)**

The surgeon can place a purse-string suture, make an orifice in the centre, and pass a catheter to irrigate the sigmoid until all the meconium has been removed. This simple maneuver facilitates the manipulation of the colon and helps to create a better colostomy. Loop colostomies are contraindicated in children with anorectal malformations. They have a tendency to prolapse, and with them stool can pass into

the distal stoma, which may provoke faecal impaction in the distal rectum and also contaminate the urinary tract with faeces. [121] .

Male defects:

Perineal Fistula.

This malformation represents the simplest of the spectrum. In this defect, the rectum opens immediately anterior to the centre of the sphincter, yet, the anterior rectal wall is intimately attached to the posterior urethra. The anal orifice is frequently strictured. figure (24) . These patients will have bowel control with and without an operation. Some surgeons decide not to operate on these patients. In such a case, the anus should be dilated to allow the easy passing of stool, and the orifice should be sequentially dilating up to no. 12 Hegar in a newborn baby.It is preferred to operate on these babies to achieve a better cosmetic effect. It is also believed that the operation must be done as soon as the diagnosis is made. These operations are performed without a colostomy in the newborn baby. The baby is placed in prone position with the pelvis elevated. It is *mandatory* to place a catheter in the urethra of the patient. [121] .

The most common intra-operative complication is a urethral injury. The incision usually extends mid-sagittally approximately two cm posterior to the anal orifice, dividing the entire sphincter mechanism.Multiple very fine nonabsorbable sutures are placed in the anal orifice in order to exert traction to facilitate the dissection of the rectum. The posterior incision divides the entire sphincter until the posterior rectal wall that has a characteristic whitish appearance is identified. The surgeon continues dissecting in this plane, first the lateral walls of the rectum and eventually the anterior rectal wall. While dissecting the anterior rectal wall, the surgeon must put special emphasis in trying to avoid urethral injury since there is no plane of separation between rectum and urethra. Once the rectum has been mobilized enough as to be moved back to be placed within the limits of the sphincter. The limits of the sphincter are determined with an electrical stimulator. The perineal body is then reconstructed with long-term fine absorbable sutures and the rectum is anchored to the posterior edge of the muscle complex. An anoplasty is performed within the limits of the

sphincter with 16 circumferential 6/0 long-term absorbable sutures. The baby does not have any diet limitations and receives intravenous antibiotics for 24–48 h. Dilatations are performed twice per day beginning 2 weeks after surgery. The parents learn to advance one size (1 mm) every week until they reach the size adequate for the patient's age, which is no. 12 for a newborn baby, no. 13 for a 4-month-old, no. 14 for an 8-month-old, no. 15 for a 1-year-old, and no. 16 for older patients. [122] .

Rectourethral Fistula.

This group of patients include two specific categories: (a) rectourethral bulbar fistula , and (b) rectoprostatic fistula . These two variants represent the majority of male patients with anorectal malformations.We believe that it is important to recognize the difference between these types because of the prognostic and therapeutic implications. Rectourethral bulbar fistula patients, in our experience have an 80% chance of having bowel control by the age of 3,whereas the rectoprostatic fistula patients only have a 60% chance. Patients with a rectoprostatic fistula have a higher incidence of associated defects (60%) compared to patients with rectourethral bulbar fistula for whom the incidence is 30%. The rectoprostatic patients require a more demanding perirectal dissection to mobilize the rectum that is located higher in the pelvis. These operations are performed at our institution when the babies are 4 weeks old. If the neonatal approach with no colostomy is to be attempted, perhaps the kind of patient for this management would be the one who has a rectal pouch located below the coccyx. In that way, the surgeon knows for sure that, when he or she opens posterior sagittally, the rectum is going to be found. The dissection of this distal rectum must be meticulous as it is intimately attached to the urethra. If the surgeon does not have a specific and reliable image that shows the rectum is located below the coccyx, he or she should *never* approach a patient posterior sagittally without a colostomy and without a distal colostogram. [123] .

The distal colostogram is by far the most valuable study in defining the anorectal anatomy. That study is done in patients with anorectal malformations and can only be done when the patient already has a colostomy. It have seen catastrophic complications during the performance of posterior sagittal operations in male patients, that did not have a distal colostogram. It is preferred to perform a cystoscopy in all patients,which helps the surgeon confirm the location of the fistula. A Foley catheter is inserted and the patient is placed in prone position with the pelvis

elevated. The incision is a posterior sagittal one, in between both buttocks, running from the middle portion of the sacrum down to the anal dimple, which is electrically determined. The incision goes through skin, subcutaneous tissue, parasagittal fibres,muscle complex and levator muscle. When the surgeon is dealing with a rectourethral bulbar fistula , he expects to see a bulging rectum as soon as he opens the levator muscle. In cases of the rectoprostatic fistula, the rectum is much smaller, it may not bulge through the incision, and the surgeon expects to find the rectum immediately below the coccyx. The surgeon should not look for the rectum in the lower part of the incision in patients with rectoprosatic fistula. Looking for a rectum without evidence that the rectum is there is the main source of complications in this approach. [123] .

The surgeon will find the urethra, vas deferens, prostate, and seminal vesicles and will damage the nerves important for urinary control and sexual potency. The posterior rectal wall is easily identified by its characteristic whitish appearance. The surgeon must keep in mind that there is a fascia that covers the rectum posterior and laterally that must be removed. The dissection of the rectum must be performed staying as close as possible to the rectal wall without injuring the rectal wall itself. The posterior rectal wall is opened in the midline, in between two 5/0 silk stitches. The incision is continued distally, staying in the midline while applying stitches in the edges of the rectum. The traction on these stitches will allow the surgeon to see the lumen of the rectum.When the incision continues, extending distally in the midline, it ends directly into the rectourethral fistula that is identified usually as a 1–2 mm orifice. Multiple 6/0 silk sutures are placed in a semi-circumferential fashion surrounding the fistula site above and lateral to the fistula. These multiple sutures serve the purpose of exerting uniform traction on the rectal mucosa to facilitate the separation of the rectum from the urinary tract. [123] .

The fascia that covers the rectum is removed, creating the lateral planes of the rectum. The mucosa of the anterior rectal wall distal to the multiple 6/0 silk sutures is divided about 1 mm deep. The dissection continues between the rectum and urinary tract in a submucosal plane for approximately 5–10 mm and then gradually becomes a full-thickness dissection, looking at the lateral planes until the rectum is completely separated from the urinary tract. The separation of the urethra from the rectum is the most delicate part of the operation.Most of the serious complications occur during this part of the procedure. The fistula site is closed with

three or four 6/0 long-term absorbable sutures. The surgeon should then evaluate the size of the rectum and compare it to the available space to decide if the rectum has to be tapered to be accommodated within the limits of the sphincters. Look at figures (21 – 22 – 23) . In the past, we performed many of these tapering procedures and we believe that is because patients came later in life, had inadequate colostomies, and therefore suffered from severe megarectum. Currently, babies are referred to us earlier, surgeons are opening better, totally diverting colostomies, and we therefore do not see megarectums as often. Consequently, tapering is rarely necessary. [123] .

When a tapering procedure is required, we recommend to remove an adequate portion of the posterior rectal wall, closing this wall into two layers of interrupted long-term absorbable sutures. Tapering on the anterior wall is absolutely contraindicated as it would leave a rectal suture line against the urethral fistula repair and a recurrent fistula may develop. The limits of the sphincter are then electrically determined and marked with temporary silk sutures. The perineal body is reconstructed when the incision extends anterior to the centre of the sphincter. The anterior limits of the sphincter must be reconstructed. The posterior edge of the levator muscle is electrically determined, and the rectum is placed in front of the levator. The posterior edges of the levator muscle are sutured together with interrupted 5/0 long-term absorbable sutures. The distal continuation of the levator muscle is arbitrarily called the muscle complex. The posterior edge of this muscle structure is sutured together in the midline with interrupted 5/0 long-term absorbable sutures. These sutures also take a bite of the posterior rectal wall in order to anchor the rectum in a good position to avoid retraction and/or prolapse. The rest of the incision is closed meticulously reapproximating all the layers of the wound. An anoplasty is performed with 16 circumferential stitches of 6/0 long-term absorbable sutures, trimming off that part of the rectum that has been damaged or does not have adequate blood supply. [123] .

Recto-Vesical Neck Fistula.

This malformation is the highest of all defects seen in male patients. Fortunately, only 10% of male patients suffer from this particular defect.Associated

defects occur in 90% of these patients.Usually, the sacrum is hypodeveloped. This particular group of malformations is the only one that, in order to be repaired, requires not only a posterior sagittal approach, but also an abdominal one, either by laparotomy or laparoscopy. The advent of minimally invasive procedures has been extended to anorectal malformations and we believe that it has specific indications in those patients that formerly required a laparotomy. We still do not believe that the laparoscopic repair of a rectourethral fistula is less invasive than the posterior sagittal approach alone. However, in a case of rectobladder neck fistula, the rectum can be separated from the urinary tract laparoscopically avoiding a laparotomy. These patients, unfortunately, do not have a good functional prognosis. In our experience, only 15% of them have voluntary bowel movements by the age of 3. These patients require a posterior sagittal approach to create the space through which the rectum will be pulled down. [124] .

During the laparotomy or laparoscopy, the surgeon must separate the rectum from the urinary tract.Fortunately, in these very high malformations, the common wall between the rectum and the urinary tract is very short. In other words, the rectum connects to the bladder neck in a “T” fashion. When we operate on these patients, we perform what we call a total body preparation. The purpose is to have access to the perineum and to the abdomen, when necessary. The operation is started via a posterior sagittal approach.All the sphincter mechanisms are divided in the midline. No attempt should be made to find the rectum through this approach. A rubber tube is placed in the presacral space behind the urethra and located, following the tract the rectum will subsequently occupy.The perineal body, the posterior edge of the levator muscle as well as the muscle complex are reconstructed around the rubber tube that represent the rectum. The patient is then turned onto a supine position and a laparotomy is performed. The bladder is pulled anteriorly and the rectosigmoid is found. In these very high defects, the rectobladderneck fistula is usually located within 1 to 2 cm below the peritoneal reflection and, therefore, the pelvic dissection necessary to mobilize it is minimal. Ureters and vas deferens run very close to the rectum to approach the trigone of the bladder. This should be kept in mind to avoid any damage. The dissection of the rectosigmoid must be performed while staying in direct contact with the bowel wall itself. The rectum opens into the bladderneck in a T fashion. This means that there is no common wall above the fistula as described in lower malformations. The fistula is divided and the bladder end is sutured with interrupted long-term absorbable sutures. The rubber tube is easily found in the presacral space. The decision is made to taper the rectum when necessary and then to anchor the rectum to the rubber tube. The legs are lifted up and the rubber tube is

pulled down, pulling together the rectum that will be placed in the desired location. The anoplasty is performed as previously described and the abdomen is closed. [124].

Imperforate Anus Without Fistula.

This particular malformation is unique.When we say imperforated anus without fistula, we do not have to refer to the height of the defect because in all cases the rectum is located approximately 1–2 cm above the perineal skin, at the level of bulbar urethra. This malformation only happens in 5% of all cases and half of these have Down's syndrome. The patients with these defects have good prognosis, good sacrum and good sphincters. Ninety percent of our patients with this defect without Down's syndrome have bowel control and 80% of our Down's syndrome patients have bowel control. The technique to repair this malformation is not necessarily simpler than the one for rectourethral bulbar fistula since the rectum is intimately attached to the posterior urethra. The surgeon has to open the posterior rectal wall and still has to create a plane of dissection between the anterior rectal wall and the urethra, a manoeuvre that requires a meticulous dissection. [124] .

Female Defects:

Female defects are represented by a similar spectrum. However, over the last 22 years, we have been learning a great deal about these defects, particularly with regard to cloacas.We have learned, for instance, that the so-called rectovaginal fistula is an almost nonexistent defect.Most of the patients that were referred to us after having an operation to repair a "rectovaginal fistula", actually never suffered from that particular defect. Most of them suffered originally from a cloaca that was misdiagnosed; the surgeon repaired the rectal component of the defect and left the patient with a persistent urogenital sinus. In other more unfortunate cases, the babies were born with rectovestibular fistulas, the surgeons mislabelled and misdiagnosed it as a rectovaginal fistula and performed an abdominal perineal procedure for a malformation that could otherwise have been repaired posterior sagittally with good results, leaving the patient totally incontinent for faeces. [125] .

Rectoperineal Fistula.

This defect is equivalent to the recto-perineal fistula in males already described. Bowel control exists in 100% of our patients and less than 10% of them have associated defects. The patients are faecally continent with and without an operation. Constipation is a constant sequela and should be treated energetically. This is true also for the male patients with perineal fistulas. We have learned that the lower the defect the more there is a chance of constipation. We have also learned that constipation is a self-perpetuating and self-aggravating condition that eventually produces severe megacolon, chronic faecal impaction and overflow pseudo-incontinence, and must vigilantly be avoided. At our institution, the operation to repair this defect is performed at birth.We offer this operation to our patients mainly to avoid cosmetic, psychological and potential obstetric sequelae in the future. We perform this operation before the baby leaves the hospital during the newborn period. [125] .

The patient is placed in prone position with the pelvis elevated. Multiple 6/0 silk stitches are placed around the fistula site. The incision is about 1.5–2 cm long and divides the entire sphincter mechanism in the posterior midline.We dissect the rectum as previously described in the case of perineal fistulas in male patients. The perineal body is reconstructed as shown and the rectum is anchored to the posterior edge of the muscle complex.An anoplasty is performed. These patients can eat on the same day of the surgery and since they are only passing non-colonized meconium, we give antibiotics for 48 h. [125] .

Rectovestibular Fistula.

This defect is perhaps the most important anorectal malformation in females. This is because it is by far the most common defect seen in the females. It is also a malformation that has an excellent functional prognosis when managed correctly.Also, paradoxically and unfortunately, girls with these defects are the ones that we have seen suffer from more complications after a failed attempt to repair. For many years, it has been very controversial whether this malformation should be treated with a previous protective colostomy or should be operated primarily at birth. Again, we believe that this depends very much on the experience of the surgeon. When a baby is born with this malformation at our institution and the baby is otherwise healthy, we repair this malformation during the newborn period.

If the baby is premature or has associated defects, it is always safer to open a protective colostomy. [125] .

The surgeon must keep in mind that dehiscence and infection in patients with anorectal malformations not only represent a few more days in the hospital and an ugly scar but also represents the possibility of changing the prognosis for bowel control. Patients with a vestibular fistula have an excellent prognosis. Bowel control exists in 93% of our patients; 70% of them have constipation that is incurable but manageable and it should be treated aggressively. The most important anatomical feature that should be recognized by the surgeon is that the rectum and vagina share a long common wall that must be separated, creating a plane of dissection where it does not exist, in order to mobilize the rectum and put it in the right place. We believe that most of the complications that we have seen from treatment of this malformation originate from the lack of separation of these two structures, or the defective separation of these two structures These patients are also placed in prone position with the pelvis elevated. The incision runs usually from the coccyx down to the fistula site. Again, multiple 6/0 sutures are placed in a circumferential manner in the fistula opening. Traction always facilitates the dissections of these delicate structures. The entire sphincter mechanism is divided posteriorly until we identify the posterior rectal wall, and then the plane of dissection is established removing the fascia that covers the rectum. The dissection then continues laterally. The surgeon must put a special emphasis on a very meticulous separation of the rectum from the vagina. The purpose of this dissection is to make two walls out of one. He or she should try at all costs to avoid making perforations in the rectal wall or the vaginal wall. Once the rectum has been completely separated from the vagina, the surgeon determines the limits of the sphincter electrically and reconstructs the perineal body, bringing together the anterior limits of the sphincter. The rectum is then placed within the limits of the sphincter as well as the muscle complex.We can see only the lower part of the levator because the incision is rather limited in this operation. The rectum is anchored to the posterior edge of the muscle complex and the anoplasty is performed like we discussed in the previous cases. When the patient is a newborn, we keep the baby 2 or 3 days with nothing by mouth post-operatively, while receiving intravenous antibiotics. [125] .

Occasionally, we see patients that come later in life without a colostomy; in those cases, we clean the bowel meticulously the day before surgery with a balanced electrolyte solution, insert a central line in the operating room and keep the patients 10 days with nothing by mouth, while receiving parenteral nutrition. Following this routine, we have never had a case of a wound infection. Clinical results are different for each type of the malformations. A recent review of the authors' series showed that 100% of patients with rectal atresia and perineal fistula had voluntary bowel movements, those with vestibular fistula 93.8%, bulbar urethral fistula 87.5%, imperforate anus without fistula 85%, cloaca 83.3%, rectourethral prostatic fistula 76.5%, and bladderneck fistula 28.6%. Soiling in patients who enjoy voluntary bowel movements usually represents a manifestation of faecal impaction and when the constipation is treated properly, the soiling usually disappears. Patients who enjoy voluntary bowel movements and never soil are considered "totally continent". Constipation is a common sequela seen after the repair of an anorectal malformation. Interestingly, patients with lower defects, and therefore with better prognosis for bowel control, suffer a higher incidence of constipation and vice versa. [125] .

Constipation correlates directly with the degree of rectosigmoid dilation at the time of colostomy closure. Therefore, every effort should be made to try to keep the rectosigmoid empty and decompressed from day 1 in these patients. Urinary control can be expected in the overwhelming majority of male patients after repair of imperforate anus provided a good surgical technique was performed. Urinary incontinence is a concern only in male patients with absent sacrum or in some female patients with cloaca. In this last defect, when the common channel is shorter than 3 cm, approximately 20% of patients require intermittent catheterization to empty the bladder. The remaining 80% enjoy urinary control. When the common channel is longer than 3 cm it was observed that 68% of the patients require intermittent catheterization to empty the bladder. Fortunately, after the repair of a cloaca, patients have a good bladderneck; they have the capacityto empty the bladder. Thus, when the bladder becomes completely full, the patients start suffering from overflow urinary incontinence. Intermittent catheterization keeps these patients completely dry. [125] .

General Complications of Stomata

Complications of stomas

Incidence

The complication rate for ileostomies is higher than for colostomy (55% and 39%, respectively). The incidence of complications after urostomy is similar to that for ileostomy. The incidence of complications is higher in stomas constructed following radiotherapy or for Crohn's disease than those for ulcerative colitis, in children compared with adults, and in stomas constructed as an e m e rgency rather than as an elective surgical procedure . [126] .

Early complications of stomas

Ischaemia

This is an early complication occurring in approximately 2–3% of cases. The usual cause is excessive tension on the stoma, resulting in a dark dusky appearance .
A tight stoma opening and tight appliance may result in venous congestion and oedema, with a purple or even black stoma within the first 24–48 hours postoperatively. Other causes are mesenteric haematoma and inadvertent ligation of stomal blood supply. If left to progress, necrosis will develop and the stoma will disintegrate. It is often recognized perioperatively soon after drawing out the stoma .

Management

Ischaemia can be treated conservatively if the general condition of the patient is satisfactory and there is no evidence of an interrupted blood supply due to either inadvertent ligation of blood vessels perioperatively or an expanding haematoma. The extent of ischaemia can be assessed endoscopically or by use of a clear test-tube (or blood bottle) and pen-torch. If the patient's general condition deteriorates with frank evidence of ischaemia, laparotomy with re-fashioning of the stoma should be considered. Careful reassessment of the abdominal stoma orifice may reveal it to be too tight and this can be rectified easily. In the case of urostomies, treatment consists of anastomosing a further segment of bowel to the remaining viable part of the conduit or even the formation of an entirely new conduit and stoma. It is very important to differntiate between local ischaemia of the stoma and hypoperfusion of the stoma as part of haemodynamic instability after major surgery in septic patients. [126] .

Sepsis

This is a potentially serious early complication. It is common in urological procedures for colitis and Crohn's disease and after emerg encysurgery. It may be caused by ischaemia of the stoma or repeated trauma from a rod (bridge) inserted under the loop stoma. Ischaemia may result in retraction of the stoma with subsequent faecal contamination within the abdominal wall or peritoneal cavity. Abdominal wall sepsis, particularly in obese patients, immunocompromised patients and patients with diabetes, may result in synergistic gangre.

Management

In cases of secondary peritonitis, management is early laparotomy, resection of non-viable bowel, mobilization of the bowel and fashioning of a new stoma without tension and with a viable blood supply. In cases of fasciitis, management is early laparotomy, resection of non-viable bowel and débridement of the abdominal wall and re-siting of a viable stoma. [126] .

Bleeding

Early bleeding is not an unusual complication; it occurs in up to 10% of cases and is usually self-limiting and the result of perioperative trauma. It can be caused by inadequate local haemostasis or venous congestion resulting from a tight stoma opening.

Management

If the bleeding is minor and the patient haemodynamically stable, observation is all that is required because it usually stops spontaneously. On the other hand, if the bleeding is excessive, local exploration of the stoma is mandatory with suture ligation of the bleeding vessel. [126]

Prolonged ileus

This is failure of normal bowel peristalsis. Prolonged postoperative ileus can be caused by intraperitoneal or retroperitoneal haemorrhage , sepsis, bowel ischaemia, electrolyte imbalance, regional anaesthesia or medications. The patient will look and feel unwell, with abdominal distension and either vomiting or high nasogastric aspirate. This may lead to dehydration, oliguria, hyponatraemia and hyperkalaemia.

Management

Management involves nasogastric decompression, fluid replacement and correction of electrolyte imbalance. Consider restitution of steroids if the patient was on steroid therapy within a month of the operation. Radiological investigations, in the form of oral contrast studies or abdominal computed tomography with oral contrast, may be required to exclude intestinal obstruction and the presence of intraabdominal collections. If the patient does not settle within 7–10 days or becomes septic or increasingly unwell, further laparotomy is indicated. [126] .

Retraction

Early retraction is not an uncommon complication; it can be caused by difficulty in mobilizing the bowel to reach the surface of the wound, owing to either short bowel or, more commonly, short mesentery, which puts the bowel under undue tension . It also occurs as a result of poor fixation of the bowel or ileal conduit to the fascial layer. In the case of urostomies, this results in an increased risk of cutaneous complications such as encrustation, ulceration and stenosis.

Management

The same lines of management as for cases of ischaemia and infection would be followed. Stomal revision is often required. [126] .

Late complications of stomas

Skin excoriation

This is a more common problem with ileostomies and urostomies than with colostomies. The ileostomy efflux is liquid and contains proteolytic enzymes. The contact of efflux with the skin causes irritation, maceration, excoriation and digestion. For this reason, an ileostomy is constructed as a spout 3–5 cm beyond the skin of the abdominal wall, so that the motions pass directly into the connecting appliance.

Management

Re-fashioning of the stoma may be required if modification of the appliance fails. This can be done as a local procedure without the need for full laparotomy or formal procedure may be required. [126] .

Prolapse

Ileostomy

This not uncommon complication can be found alone or in association with a parastomal hernia. Chronic prolapse can cause irritation, bleeding, and even stomal necrosis

Colostomy

Prolapse is more common in loop colostomies, especially loop transverse colostomy . It is thought to develop in patients with obstruction because of the discrepancy between the size of the colon and the defect in the abdominal wall. It is not common to have a parastomal hernia in association with colonic prolapse . usual aetiology is inadequate fascial fixation; it occurs in up to 10% of cases. Should the stoma become so prolapsed that it causes difficulty with appliance attachment or trauma, any excessive protuberance may be trimmed off s u rgically and the resulting deficit oversewn.

Management

Ileostomy prolapse Management involves careful local revision with fixation of the serosa to the rectus muscle. The junction between the skin and the mucosa is carefully divided without mobilizing the emerging ileum. The everted limb is straightened. An appropriate length of ileum is excised, usually leaving 5–6 cm projecting above the skin, and a new spout is fashioned. Recurrent prolapsed is best treated by stapling the stoma spout with a non-cutting device. *Colostomy prolapse* Manual reduction may be considered in acute prolapse. This can be very difficult if the prolapsed colon is oedematous. The options include conservative treatment, amputation or re-siting of the colostomy. If it is a temporary stoma, stoma closure should be considered. [126] .

Stenosis

The causes of stenosis are ischaemia, trauma, peristomal sepsis, retraction, narrow abdominal trephine or narrowing after repair of a parastomal hernia. It may also occur in recurrent disease, particularly Crohn's disease Ileostomy stenosis was a common complication before Brooke's ileostomy became common practice.

Management

Dilatation may be considered, using Hagar's dilators if the stoma is not very tight; however, if it is tight and painful, examination under anaesthesia and manual

dilatation may be required. This is not usually successful in the long term and re-fashioning of the stoma is generally required, which can be done by a local procedure or formal laparotomy. [126] .

Fistula

Paraileostomy fistulas occur in 10% of the patients with ileostomy in the UK . Fistulas can result from either recurrent Crohn's disease or chronic infection caused by the use of non-absorbable sutures. Fistulas complicating recurrent Crohn's disease are multiple and associated with recurrent infection. The stoma is deformed or stenotic and there is a history of intermittent obstruction. Non-Crohn's disease fistulas are usually single with a straight track and the stoma looks normal and healthy with no distortion. Fistulas may lead to either recurrent leaks or skin excoriation.

Management

Surgery is usually required to correct the local infection and re-fashion the stoma. The exclusion of Crohn's disease is important to assess the extent of the procedure required. This is usually done via a laparotomy. The new spout can be fashioned through the old trephine if suitably sited or through a new trephine, depending on the condition of the local tissues. [126] .

Parastomal hernia

This complication occurs in at least 2–3% of cases and can be difficult to manage . A hernia can be associated with prolapse of the stoma. It occurs as a result of poor anchorage of the stoma to the underlying fascia, with the most common site being at the mesenteric attachment. Parastomal hernias can cause dislodgement of ileostomy appliances; the small bowel may also be damaged during ileostomy closure or re-fashioning because of adherent loops within the hernia sac. The most common complication of parastomal hernia and the indication for surgery is obstruction. Strangulation and bowel infarction within the sac are less common .

Management

If the hernia is asymptomatic, it is better to leave well alone; if symptomatic, with a history of intermittent obstruction or continuous leakage from the appliance, or if it is associated with severe prolapse, surg e ry should be considered. Local repair is usually considered first and it can be achieved either by re - suture of the defect or placement of a non-absorbable mesh support around the stoma to repair the defect; however, both these pro c e d u res have a re c u rrence rate of more than 50%. Re-

siting is the optimum method of management, by taking down the ileostomy, repairing the defect and constructing a new trephine on the opposite side of the abdomen . [127] .

Persistent infection

Persistent infection occurs in up to 10% of patients. Ulceration, polypoid granulomas and sinuses in patients with Crohn's disease usually indicate recurrent Crohn's disease. Ulcers and persistent local infection may be caused by trauma from a badly fitting stoma appliance, pyoderma gangrenosum or selfinduced trauma. Non-absorbable suture s can cause chronic infection with sinus formation. Local infection, if treated inappropriately, can result in ulcerations and sinus or fistula formation, which perpetuates the infection.

Management

Management involves active treatment of any local infection, with great care on applying appliances to avoid trauma, treatment of active Crohn's disease and proper drainage of any local abscess. Appropriate management of a sinus or fistula is mandatory in order to control and prevent persistent local infection . [127] .

Mechanical obstruction

Mechanical obstruction occurs as a result of stenosis, stricture, prolapse, hernia, tumours or polyps. As with any laparotomy, mechanical obstruction may be the result of adhesions. Entrapment of bowel through the lateral gutter of the abdominal cavity, in the peritoneum or through the pelvic–peritoneal closure line should be considered as a possible cause of obstruction . The presenting symptoms vary according to the degree and site of the obstruction and the cause. Vomiting, cessation of stoma output (nonfunctioning stoma) and abdominal distension are features of complete obstruction; they should be dealt with aggressively in order to avoid progression of a simple obstruction to gangrenous bowel, which necessitates resection of a valuable segment of bowel, particularly in the case of Crohn's disease. [127] .

Bleeding

Bleeding may result from ulceration, trauma from a badly fitting stoma appliance or selfinflicted injury, recurrent inflammatory bowel disease, polyps

particularly in patients with familial adenomatous polyposis and in inflammatory bowel diseases, or parastomal varices. Parastomal variceal bleeding can occur in patients with inflammatory bowel disease and sclerosing cholangitis with cirrhosis of the liver; it indicates progressive liver disease in patients with portal hypertension. Variceal bleeding is usually profuse, recurrent and of sudden onset, but an excessive oozing can result from local trauma. Parastomal varices are a consequence of the formation of a shunt between the mesenteric veins and veins of the abdominal wall. This portosystemic connection is often termed 'caput medusae' when it appears around the umbilicus .

Management

In contrast to bleeding from parastomal varices, bleeding from other causes is usually not profus e ; it can be controlled by treating the underlying cause and local measures such as simple compression or ligation of bleeding points. The patient should be admitted to hospital. The initial treatment of parastomal variceal bleeding consists of local compression around the stoma. The simplest and safest procedure to control the bleeding is by disconnecting the portosystemic collaterals. The mucocutaneous junction between the stoma and the skin is detached and the mucosal edge of the stoma oversewn, underrunning the vessels in the abdominal wall. This procedure is satisfactory in controlling the bleeding in the short term. Injection sclerotherapy is often unsatisfactory as an initial treatment and r a rely provides long-term control . As variceal bleeding is usually recurrent and not prevented by local procedures, portosystemic decompression is frequently required, and the technique of transjugular intrahepatic portosystemic shunting (TIPS) is increasingly employed. Splenorenal or portocaval shunts or even liver transplantation have also been advised. [127] .

Ileostomy flux

Ileostomy flux means profuse ileostomy diarrhoea. It can be caused by local or systemic infection, intra-abdominal infection, gastroenteritis, bacterial overgrowth, bowel obstruction, ileostomy stenosis or recurrent Crohn's disease, but in many patients no cause can be found. This is a common and very serious complication and, if active measures have not been taken at the appropriate time, patients become severely dehydrated with hyponatraemia, hypokalaemia and profound electrolyte imbalance. Patients who are on or have been on steroid therapy in the previous year are at great risk of developing an addisonian crisis, if the dose of

steroid has not been increased or re - started when the ileostomy output increases Patients with flux usually present with symptoms and signs of dehydration, with hyponatraemia, hypokalaemia, hypocalcaemia, hypomagnesaemia and deficiency of trace elements such as zinc, selenium and others.

Management

All patients in whom ileostomy output becomes high or who lose more than 1.5 litres of fluid daily require admission to the hospital immediately; active treatment is started and consists of the following:

• A thorough examination to identify any possible precipitating cause and starting treatment of the underlying pathology if found

• Replacement of ileostomy losses by giving intravenous fluid and electrolytes and withholding oral intake because this may exacerbate fluid and electrolyte losses

• Close monitoring of the fluid and electrolyte haemostasis because losses may continue. Maintenance requirements plus replacement of losses should be continued until the patient is stabilized and the ileostomy output decreases

• Patients on steroids should have their steroid dose adjusted and patients who have been on steroids in the previous year should be given hydrocortisone (100 mg) intravenously 6-hourly for 24 hours

• Oral fluid intake is recommenced when the ileostomy output has decreased, preferably in the form of a glucose–electrolyte solution

• Antidiarrhoeal drugs, such as codeine or loperamide, can be used to decrease stoma output. In patients with recurrent flux, somatostatin analogues may be used

• The pH of the output should also be checked. Underlying causes amenable to surgical treatment are dealt with after complete resuscitation if they present as an emergency, such as intra-abdominal infection; otherwise, surgery is deferred until complete recovery. [127] .

Cancer

In patients who have had stoma surgery for bowel or urinary tract malignancy, a carcinoma appearing around the stoma may result fro m metastasis, seeding of the tumour at operation or residual tumour . In these cases the tumour will usually be evident within months of the initial surgery. Some patients however, may develop primary carcinoma of the stoma or surrounding skin many years after stoma surgery for non-malignant disease. It has been suggested that such cases occur as a result of the chronic peristomal inflammation seen in some stoma patients or perhaps secondary to bowel metaplasia occurring around the stoma. Carcinoma requires surgical resection. [127] .

Dermatitis artefacta

Self-inflicted trauma to the stoma and surrounding skin is a rare event, but one that should be considered in instances in which the lesion is atypical in its distribution or duration. These lesions are characteristically chronic and are commonly found in patients who have been plagued by unexplained stomal complications in the past . Chronic inflammation is the most common finding on biopsy, although the possibility of squamous cell carcinoma at the lesion edge must be borne in mind (Marjolin's ulcer). Strict observation and supervision will usually allow the lesion to heal satisfactorily and these patients are at increased risk of returning with further problems . [127] .

STOMA CARE

Wound care

The mucocutaneous junction of the stoma and skin needs to heal after surgery. The dissolvable sutures are usually adequate to secure the wound edges, but if the wound breaks down action may be required. The midline surgical incision is usually superfi cially healed within ten days when the clips/stitches are removed. However, care should be taken to protect the wound from contamination from the stoma output for several weeks or longer. [128] .

Post-operative stoma care teaching

A practical guide to stoma teaching promotes the patient's independence. The patient should be instructed so that they are aware what is normal for their stoma, in relation to appearance, size, output and function. It is important to also be aware of potential complications and the appropriate action to take if they occur. The basic teaching schedule for new ostomates will need to be individualised. For example, a patient with poor balance should change their appliance sitting or lying down . [129] . The nurse should demonstrate an appropriate appliance change and the patient should take over increasingly until they are confi dent and able to continue changing alone: the time to independence varies between patients. Nurses should wear gloves when participating in an appliance change but patients do not [130]. When dealing with the ostomate there should be no signs of distaste or rejection to help the patient to cope with their stoma . [131].

Teaching plan

The basic components of a teaching plan are as follows.

• Explain the procedure to the patient.
• Ensure privacy.
• Collect all the necessary equipment:
_ new appliance;
_ measuring guide (and pen);
_ scissors;
_ cleaning/drying cloths (or kitchen roll);

_ warm tap water (no soap);
_ disposal bag.
• Empty drainable appliances – to reduce risk of spillage.
• Gently remove the soiled appliance, use one hand to support the skin.
Join together the edges of the used appliance fl ange, to avoid leakage of any contents and place in the disposal bag.
• Clean the peristomal skin thoroughly but gently – tiny spots of bleeding may be seen from the stoma surface if touched.
• *Note*: the stoma may move as part of peristalsis.
• Dry the skin well.
• Inspect the skin and stoma for any changes.
• Measure the stoma with the guide – the size will reduce for the fi rst eight weeks after formation.
• Cut the appliance to the same shape as and 2–3 mm larger than the stoma – to give a small margin for error in appliance placement.
• Remove the backing from the pouch.
• Apply the fl ange to the skin around the stoma.
• Secure the adhesive to the skin by pressing fi rmly: start directly around the stoma and work outwards.
• If a two-piece appliance is used attach the bag, then hold the appliance on to the abdomen for 30 to 60 seconds to aid adhesion.
• Ensure that the fastening is closed (if appropriate).
• Seal the rubbish bag and dispose of it.
• Wash hands.
• Avoid bending the abdomen for ten minutes after application to help adhesion. [130] .[132] . [133] .

Post-operative care

Patients with an ileoanal pouch performed either in two or three stages initially post-operatively require stoma care. This involves regular observation of the stoma colour, output and temperature. Patients need to be reminded that if the rectal stump is left in situ that they may feel the need to empty their bowels rectally. This is quite normal as the rectal mucosa will still produce mucus and may also contain old blood-stained fluid or fresh if there is still active rectal disease. If the pouch has been formed at the same time some patients can pass old blood, mucus and may even pass small amounts of faeces or wind if it bypasses the loop ileostomy. Patients need to be reassured that this is normal. It is also helpful to provide advice on follow-up procedures so that they can prepare for the last stage when the ileostomy is

closed and the pouch is active. Follow-up usually takes place six to eight weeks after RPC when the doctors feel that the ileoanal anastomosis is fully healed. If there is doubt an examination under anaesthetic may be performed prior to closing the ileostomy. When the ileostomy is closed the pouch will usually start to work in a couple of days. The patient may experience faecal urgency and frequency and this is again normal. The pouch needs to adapt to hold the faeces and gently expand into its new role. Patients can encourage this by extending the time when they get the urge to use the toilet to the time they empty the pouch. [134] .

The increasing 'holding' time can start at just a few minutes and be increased within reasonable measures and within personal pain tolerance. The sphincter muscles that were defunctioned by the ileostomy will need to regain strength and may occasionally leak at night when the patient relaxes. This is normal and reassurance can be provided that these nocturnal episodes will get less frequent or stop over time. Some patients use pads at night for peace of mind. Small panty liners or sanitary pads can be used by both sexes as these are discrete and seepage is usually minimal. Pouch frequency can be as often as every couple of hours during the day so barrier creams and good quality anal hygiene should be introduced as soon as the ileostomy is reversed and the pouch is active. Followup in the community can be provided by the GP, practice nurse and/or pouch or stoma specialist nurse. [134] .

Post-operative psychological adjustment

There has been work undertaken on the coping mechanisms adopted by ostomates. White (1998) felt that to enhance the psychological adaptation to stoma-forming surgery, early learning of stoma skills was required. Gaining these skills promotes independence and is usually achieved prior to discharge home from the hospital. However, with the shorter hospital stays careful planning may be needed to achieve this, which may include pre-operative teaching. It is unlikely that much adaptation to the stoma will have occurred in the hospital. However, by three months it is usual for many ostomates to have returned to their previous employment or activities. This can also be a stressful time for the new ostomate who will now be feeling stronger and the full impact of their situation may become evident. It is important for health care professionals to be aware of this and follow-up at this time can be benefi cial. It must be remembered that adjustment to a stoma is an ongoing process. The health care professional is ideally placed to ensure that adaptation occurs as smoothly as possible and to try to prevent the ostomate from worrying

about stoma-related issues. Depression is also a potential problem after stoma-forming surgery and may be identified and addressed at a clinic visit. Pringle & Swan (2001) found that, in their study of patients with a stoma for colorectal cancer, depression was reported by more than a quarter one week after discharge home but this had reduced to ten per cent at one year. Thus it is essential for the health care professional to be aware of the risk of depression on discharge and that it can be a long-term problem. [135] .

Resuming social activities and hobbies

After returning home and following a period of recovery, it is important for the ostomate to recommence activities, such as hobbies and sports. For most patients the activities and employment undertaken prior to surgery can be resumed. Pringle and Swan (2001) found that one week after discharge home virtually no social activities were undertaken. However at one year only a third of their patients with a stoma formation for cancer had completely resumed their social lives. The high percentage of ostomates who did not return to their previous lifestyle after their stoma was formed mainly chose not to go out as much after their surgery. Anecdotally many patients do alter their life after surgery, which is not always necessary or benefi cial. It may be useful for the ostomate to join one of the support groups . These groups can provide a network of other ostomates to discuss coping mechanisms and many groups also arrange social activities . Sport and hobbies can be recommenced gradually following surgery. [135] .

Age related issues

The age of the ostomate can have an impact on the care required from the health care professional. The issues related to infants [136], children, adults [136] and the elderly population are explored. This can include, for the elderly, issues related to poor eyesight [138] or manual dexterity. Practical advice is provided, such as the use of two-piece appliances for ostomates with dexterity problems. [139] .

Babies

The majority of stomas formed on babies are performed as an emergency on neonates, with a temporary colostomy being the most commonly formed stoma [140].

This is a distressing time for both the baby and their parents [136] . Ideally the parents should be well informed and supported. However the babies are often transferred to a specialist hospital adding further stress. As babies usually wear a nappy it might be more appropriate to also use this to contain their stomal output rather than an appliance. Barrier cream around the stoma might be required, if using a nappy, particularly if the faeces are loose and corrosive to the peristomal skin. [139] .

Children and teenagers

Caring for the child with a stoma can be challenging. Siting is important taking into account any physical disabilities such as callipers. Involving the child can help them to accept their stoma [140]. It can also be diffi cult for parents to cope with the concept of their child having a stoma. However, often young children are able to perform their own stoma care so parents need to be encouraged to let children have a degree of independence. School can be problematic due to the concerns of the child, parents and teachers [141]. It may be necessary for the parents to meet with the teacher to discuss the situation. Being a teenager is a difficult time for many without the additional stresses of a stoma. No one wants to be different to their peers, particularly in relation to issues such as their bowels.[139] .

Often the teenager will have a stoma for ulcerative colitis or a trauma and in many cases this will be temporary. The changes that puberty brings make body image of great importance and may make coping with a stoma more difficult. Each ostomate will need to be individually assessed and involving the parents is vital. Teenagers may have many questions or may prefer to ignore it and avoid talking about their concerns. Careful communication is required by the multidisciplinary team to encourage discussion and some acceptance of their stoma. [139] .

Adults

All ostomates are different and need to be considered individually [137]. Ideally adult ostomates will become independent with their stoma care needs and be able to return to their roles in society after surgery and recuperation.

Learning disabilities

The degree that a person with learning disabilities will be able to cope with their stoma will depend upon the extent of their disability. If patients are capable of living on their own or with minimal assistance they should be able to become independent

with their stoma care needs. However, the training may take longer and other training approaches may be required. People need to be individually assessed to ascertain their potential independence. It may be necessary to include carers in planning and undertaking the care [142] .

Older ostomate

The elderly ostomate may encounter additional problems, such as rheumatoid arthritis, that may reduce their manual dexterity. Poor eyesight [138] or short-term memory loss, for example, may also make the care of the stoma difficult. There are ways in which these issues can be addressed. Those colostomates with arthritis might find that the newer two-piece appliances are simpler to use. In severe cases a community nurse can apply the flange if hand co-ordination is poor, and the colostomate can simply apply the bag when required. The older ileostomate might find a newer type of appliance with an integral clip and a Velcro type fastening easier to use. The older urostomate might find that some taps or openings are easier to use than others. An assessment should also be made to ensure that the appliances are pre-cut as scissors can be difficult to use for those with arthritis. Poor vision can be addressed in a number of ways. If the ostomate can live independently with their current vision then they should also be ablesuccessfully learnt how to care independently for their stoma. For those with memory problems it might be useful to put reminders in the toilet about their stoma. [139] .

Printed instructions for their stoma care and/ or forms to tick to remind the ileostomate to empty the appliance can be useful. A quality of life study was undertaken on older ostomates by Notter *et al.* (2003) and found that initial dietary problems were overcome by trial and error but this left some with inadequate diets. Diets need to be assessed to ensure a good balance. The study also found a wide variation between levels of activities, with some ostomates reporting doing any type of sport, including white water rafting, while others felt unable to do any exercise at all. Approximately 14% felt that they even needed to give up gardening.[139] .

Drugs

There are a number of drugs that are useful for the ostomates, such as laxatives [143] and bowel thickening agents. Some nurses are now able to prescribe,

however many of the drugs used in stoma care are not on the list for nurse prescribers. The ones that will be discussed are related to:
• laxatives
• bulking agents
• pain management. [139]

Laxatives

Laxatives are suitable for the colostomate and the urostomate. However, other methods such as dietary changes should be tried as the first option.
The following will be discussed:
• stimulants
• osmotics
• suppositories
• enemas
• softeners

Stimulants

Stimulant laxatives, such as senna [143] , increase intestinal motility but often cause abdominal cramps and should be avoided if there is an intestinal obstruction. Stimulant laxatives often take 8–12 hours to be effective and therefore should be taken prior to bed for a morning action. There can be a number of side effects associated with stimulant laxatives such as diarrhoea and hypokalaemia. It is thought that the consistent use of stimulants may lead to a 'lazy' bowel, although there is no conclusive evidence to support this. Dantron should only be used in the terminally ill due to the increased cancer risk. Stimulants in general should not be used for those with infl ammatory bowel disease.[139] .

Psychological issues

Facing stoma-forming surgery can be daunting and worrying. Fear about the surgery and/or the stoma can manifest itself in a variety of psychological responses:
• anger
• depression
• denial
• repression
• low self-esteem
• socio-emotional problems
• psychosexual problems.
[144], [145] .

Anxiety may be a product of helplessness, accentuated by a hospital admission. Anxiety may be due to misconceptions about stomas, lack of information or worries about body image. It is felt that strengthening patients' self-effi cacy can accelerate their adaptation to their stoma [146] .

However this is made more difficult if there are associated stoma complications. In the short term most ostomates experience negative feelings and each ostomate will react differently. Feelings can change over time [147] and with support from the multidisciplinary team. Some ostomates may require further support in the form of counselling. The ostomate may experience loss and grief over a variety of actual or potential losses. These can include:

- body parts
- fertility
- relationships.

[148] .

The nurse can utilise listening skills and convey a caring attitude to promote trust and collaboration with the ostomate (Sirota 2006b). Interpersonal skills are essential to enable the ostomate to feel comfortable to discuss any areas of concern that they might have. [149] .

STOMA APPLIANCES and CARE

Stoma accessories

There are various stoma accessories available for the patients and the nurse specialist to help in the management of ostomies. A wide range of skin barrier preparations is available, including:

• Wipe-on films, e.g. Saltair lotion, Periprep
wipes (Salts, Birmingham, UK); Clinishield wipes (CliniMed, Bucks, UK); Protective Wipes (Coloplast, Cambs, UK)

• Plastic or hydrocolloid films (wafers), e.g. Coloplast protective sheets (Coloplast, Cambs); Askina (Braun, Sheffield, UK)

• Hydrocolloid washers, e.g. G-Xtra seals (Dansac, Cambridge); Cohesive seals (Salts, Birmingham)

• Pastes and powders, e.g. Stomahesive paste, Orahesive, Orabase (ConvaTec, Uxbridge, UK); Dansac Soft Paste (Dansac Ltd, Histon, UK); Soft paste (Pelican, Cardiff, UK). [150] .

These preparations are applied to peristomal skin as a protective layer to help prevent skin damage. Skin contours, creases and scars can be filled using pastes or hydrocolloid wafers and washers to render the surface level before applying a bag. Patients often use stoma wafers and skin barriers because they feel that they have developed an allergy to their product. However, allergy to ostomy products is rare.18 Barrier preparations may also be used by patients who feel the need for added security, such as those who are very active or working closely with other people. Some such patients use innovations of their own to improve security, e.g. one of our male patients uses an adapted, reinforced corset to allow him to go rock climbing, confident that he will not suffer leaks. Other examples of the use of these products are given in the next section. [150] .

Figure (25) stoma bags (google figures 2013)

As the surgeons strive to improve their surgical techniques, the stoma specialist ensures successful management of the ostomy with the patient's approval of an appropriate wellfitting pouch. The choice of stoma appliance is made with advice from the specialist nurse, who considers the stoma site, the clinical need, and the patient's preference, lifestyle and ability. Patients today have a large and varied range of pouches, skin care products, deodorants, adhesives and even methods of obtaining stock to choose from. However, for the patient with a new ostomy, adapting to life with a stoma may be confusing with the amount of choice available. [151] .

Early appliances date back to the 1700s when Daquesceau15 performed a colostomy, which was managed with a small drawstring leather bag as a collecting device. Patients at the time used available household products such as lint, Gamgee dressings and cotton material to collect their effluent, with the use of heavy belts and buckles to hold them in place. The black rubber bag was a significant breakth rough in the 1940s; patients were able to wash and change these weekly. Leather harnesses , strong adhesives and silicone glue were used to hold the bag in place. Patients were instructed to ' rest' quietly while the silicone set . An assortment of bags was given in varying lengths for social activities and 'intimate moments'. Despite the appearance of these devices, some patients continue to use them today, along with the Schacht's bag , which became available in the 1960s. Schacht's bag is a clear plastic pouch secured with a non-adhesive harness. Patients who favour the older designs often report that the new products are expensive and not as effective . [151] .

Plastic appliances improved the patient's quality of life, because the appliances were disposable and lightweight. Pouch development improved with the introduction of karaya to protect the peristomal skin, which encourages early epithelialization of any wounds or ulceration. Colostomy appliances are now available that a re toilet-flushable to reduce the embarrassment of disposing of the contents. Some people with a colostomy also have the advantage of being able to irrigate the bowel intermittently and wearing only a plug in between. The plug looks a little like a tampon. It can be kept in situ for up to 12 hours. Today's flange adhesives have been developed from hydrocolloids patented in the 1960s for wound dressings. Developments to improve the flexibility, adhesiveness and water-handling pro p e rties during the 1970s have encouraged the use of hydrocolloids in most modern bags. Today 's pouches consist of several layers of plastic film that are odour- proof, low noise, of softer feel and have a waterproof backing with the added security of hydrocolloid sticking to body contours . [151] .

Odour treatment options

Some ostomates find the smell of their faeces, from either their ileostomy or colostomy, unacceptable. It is important to remember that odour should only occur when either changing or emptying the pouch. There are many options to reduce odour, including diet manipulation and generic air fresheners, but there are possible solutions on drug tariff. There is a range of drops or powders that can be put directly into the new appliance before use to eradicate the odour. There are also sprays that are specially formulated to eliminate odour rather than mask it, although their effi cacy may be limited [152] . Sprays are best used just prior to emptying or changing rather than afterwards, as the faecal odour may cling to clothes. [151] .

Protective powder

A protective powder can be used on broken skin that is reddened, sore or irritated, to promote healing. Protective powder should be used sparingly and any excess needs to be removed to be effective, as excessive powder can reduce the adhesion of the fl ange [153] . The correct amount of powder is achieved by gently 'dusting' the excess powder from the skin. The cause of the red skin should be investigated so that the powder is not used as a long-term solution. For a limited number of ostomates there is a slight discomfort when the powder is applied; this soon passes.
[151] .

Flatus filters

Filters are integral in modern faecal stoma appliances to release flatus [154]. However, the filters can become ineffectual if made wet, so covering the filter when bathing or swimming is advised [155] . Filter covers are generally small stickers supplied in each box of appliances. Covers can also be useful if the ostomate needs to keep some flatus in their pouch to help prevent pancaking. Filters need to be effective for the two different types of faecal odour; sulphorous and complex organic odours containing indoles and skatoles that are found in faeces. Each appliance manufacturer uses a different type of construction for their treated carbon filter so if a patient finds one filter ineffective trying a different appliance may be useful.
[151] .

Hernia support garments

Parastomal hernias can be treated non-surgically with a hernia support garment. Unisex support garments can range from elasticated underwear to support belts and can provide light to firm support. There are mixed opinions as to whether there should be a hole in the belt to pass the stoma appliance through or not; general consensus is in favour of no opening. Undergarments are made by different companies in various forms to try and suit different tastes and requirements. However, many ostomates do not use support garments. [151] .

There are three main types of stoma appliance:
1 . A closed pouch is suitable for transverse or sigmoid colostomy when the contents are solid faeces. This appliance is usually changed once or twice a day. An integrated charcoal filter is fitted to allow flatus to escape and to absorb odour.
2. A drainable pouch is suitable for an ileostomy or for a colostomy in the ascending colon, which produces effluent of a porridge-like consistency. The pouch is changed every 48–72 hours and, in between, effluent can be emptied through a drainable end that is held secure with a clip or a tie. It is important that these are fixed properly to ensure safe closure and no leakage. Many drainable pouches now have an integrated charcoal filter, which allows flatus through while absorbing odour.
3. A urostomy pouch has a tap mechanism for drainage, often with a tactile or coloured spot to indicate whether the tap is open or closed. This pouch is suitable for urine and high enterocutaneous fistulas. Most types incorporate a non-return valve to prevent urine splashing back on to the stoma. A facility to attach a night drainage system is available. The pouch is usually changed every 48 hours [156] .

These pouches can also be divided into three groups: one piece, two piece and convexed (or convex inserts). figure (25) . One-piece pouches have a sticky flange usually made of hydrocolloid, which sticks directly on to the skin. The two-piece system has a separate flange that is applied to the skin and can remain in place for about 3–5 days. Pouches are attached to it by a clip or plastic attachment, which provides a secure seal. Two-piece systems can be difficult for patients with poor eyesight, tremor or poor manual dexterity; however, the new generation of two-piece pouches is easier to use. Convexed pouches have an integrated convexity on the skin surface, which improves the peristomal seal by increasing the depth of the faceplate in order to conform to the peristomal skin contours. The pouch can be v e ry effective in patients who are experiencing leakage problems caused by retraction of the stoma or high-output effluent. However, caution is needed in patients with a history of pyoderma gangrenosum, caput medusae (peristomal varices), pressure ulcers, mucocutaneous separation, Crohn's disease ulcers or malignant ulcers, because further peristomal skin damage can occur. It is probable that a convex pouch may trigger pyoderma gangrenosum in some patients . Two-piece and convexed pouches can have additional support from the optional use of waist belts; however, caution is needed to ensure that the patient does not wear the belt too tightly because added skin trauma can occur at the belt loop sites . In the immediate postoperative period, a clear plastic pouch is usually used to allow observation of the stoma . A number of patients with poor eyesight or poor manual dexterity prefer to continue using this . [156] .

Figure(26)
stoma Caps
(googlefigures2013)

History of stoma care products

Stoma surgery dates back as far as 400 bc and has a plotted history through to Leonardo da Vinci and his drawings made from dead bodies. Historically there were no stoma appliances available to the ostomate. A variety of devices were used to collect faeces, offering poor skin care and very little odour control. These included tins, cloths and leather bags during the seventeenth century [157] . In 1944 the Koenig–Rutzen bag was introduced; this black rubber bag adhered to the skin with a latex solution. The bag incorporated a screw at the bottom that was used to empty the device [158] . Most rubber bags required renewal after four to six months or longer [159] . These bags solved many problems but were far from ideal. The black bags were large and the adhesives used with them led to severe skin irritation in many cases. The appliances were washed, dried, powdered and reused but however thorough the wash, the faecal smell would permeate the appliance and they soon become malodorous. A later option was a disposable bag that was held in place by a ring and belt. This was not snug fitting and led to leakage, odour and excoriated skin. In the 1960s there were several revolutionary developments for ostomates with the use of karaya gum and hydrocolloid skin wafers. Karaya is produced from trees [160] and can be used to protect the peristomal skin. Karaya comes in a variety of confi gurations: powder, a ring/washer or as an integral part of the stoma appliance. The use of karaya greatly reduced excoriated skin. Although karaya-based products are still available it is not a part of modern appliances. [161] .

A further advancement for ostomates was the use of hydrocolloid. Initially hydrocolloid wafers were used to reduce the incidence of excoriated skin and to provide security [162] .

The hydrocolloid adhesive is made from carboxymethylcellulose, polyisobutylene, pectin and gelatin [157] . Hydrocolloid flanges hold moisture and are more skin friendly than the older acrylic adhesives [163] . Variations of hydrocolloid are currently used, some in a more flexible and comfortable version. Laminated plastic pouches also superseded the polythene pouches in the 1960s. These were more odour-proof, less noisy, more environmentally friendly and felt more comfortable for the patient. [164] .

Modern pouches

The aims of the modern appliance are to be leak-proof, odour-proof, easy to apply and remove, secure and skin friendly [165] . Appliances have evolved to offer ostomates more choice, comfort and discretion. This is important for the new ostomate to help them to adapt [166] . There are many variations of stoma products, attempting to suit different ostomates, as it has long been recognised that one bag will not suit all [159]. Stoma appliances are designed to contain faeces or urine within them whilst not allowing odour to permeate through the appliance. Appliances are available in one and two pieces and with clear or opaque coverings. Clear appliances are used after surgery so that nurses and ostomates can observe the stoma without removing the appliance. Some ostomates choose to continue wearing clear appliances. Generally, however, in the United Kingdom (UK) most ostomates choose opaque appliances to disguise the faecal content, but clear urostomy appliances. Many manufacturers produce paediatric, small, medium and large size appliances to suit the different ostomates' needs. Stoma appliances are available with cut to fit flanges. This is essential in the fi rst eight weeks after surgery, when the stoma is changing shape and size. Companies also offer pre-cut sizes once the stoma size settles; however, these are only circular in shape and many stomas are not. It is imperative to ensure that the aperture size in the appliance fl ange is correct for the stoma. If the aperture is too large sore skin can occur, whereas if it is too small there may be leaks or constriction of the stoma. Pre-cut appliances are very beneficial for ostomates with manual dexterity or visual problems; however, it should be noted that delivery companies will hand cut unusual shaped apertures if that suits the ostomate. The ostomate when using a two-piece appliance can leave the adhesive in place for up to five days [167] , although it is

generally advisable to change every two to four days. The pouch can then be changed as required. [164] .

Colostomy appliances

Colostomy appliances are closed bags and used to collect soft to formed stool . There is also flatus passed and modern appliances include a filter to release the air but not the odour [168] . The stool consistency depends upon the position of the colostomy in the colon, e.g. a transverse colostomy tends to produce a looser stool and may require use of a drainable bag. Colostomy appliances are replaced when dirty which can be up to three times daily. One study found the majority of colostomates change their appliance twice daily [169].

The frequency of appliance change depends on the faecal consistency and the output volume. However, when there is nothing in the appliance it does not require changing. [164] .

Ileostomy appliances

Ileostomy appliances are drainable and collect loose to porridge-like faeces . However, ileostomies fashioned in the upper ileum produce more liquid faeces. The drainable pouches historically fastened with either a hard plastic clip or a soft tie. However, clip-less fastenings such as Velcro have largely superseded this in the UK. Ileostomy appliances are replaced daily to every four days and appliances are emptied about four to six times daily when a third to half full. Most manufacturers make ostomy products in both one- and two-piece appliances. One-piece appliances tend to be thinner, more flexible and more discreet, while two-piece appliances offer the ostomates the opportunity to keep the flange in situ and change the bag, useful to protect the skin from damage due to repeated appliance changes [170] . Twopiece appliances historically join using plastic clicking ring type connectors. Many manufacturers now also produce two-piece appliances that join together with adhesive [171] . One-piece colostomy appliances are generally suitable for colostomates with a faecal output that requires appliance changes of two or fewer daily. However, it may be more time-efficient, more skin-friendly and more costeffi cient to use a two-piece appliance if the colostomy is active two or more times daily. If the colostomy output is loose then a drainable appliance may be more suitable. One-piece ileostomy appliances are popular in the UK. In other countries two-piece

appliances can be more cost-effective and thus have greater usage where patients self-fund or have limited insurance cover. Two-piece appliances may be useful if the ileostomate wishes to change the bag daily or to wear a smaller appliance during the day and a larger one at night, for example. Two-piece urostomy appliances are popular, allowing the angle of the appliance to be changed if necessary; for example at night when the night drainage bag is attached. Some urostomates also find that mucus can build up in the appliance lining and prefer to change the bag daily and leave the flange in situ. [164] .

Adhesive coupling system

Two-piece appliances have been developed to be less bulky. There are now appliances that come in two adhesive parts. This offers the ostomate all the benefits of the two-piece system but with a thin and discreet profile. [164] .

Toilet flushable colostomy appliances

Each year over 36.5 million used stoma pouches are disposed of, many to landfill sites [158] . It is not just the environmental aspect that needs to be considered but also the psychological effect of pouch disposal on the individual. There are colostomy appliances available that can be flushed down the toilet and biodegrade as they go through the sewage system. Flushable appliances are useful when the ostomate is away from home and disposal of used colostomy appliances could prove difficult but they can also be used at any time. Despite worries about these appliances blocking the toilet, there have been no proven cases of this occurring
[172] .

Due to the impact on the environment stoma appliance manufacturers should be considering the disposal of all appliances as a real issue.[164] .

Stoma caps

For the colostomate there are small caps that are designed to cover the colostomy but have little more than a pad inside, so the absorption capacity is minimal. Look at figure (26) . Caps can be used in a variety of situations:

- after irrigation (with no expected output for one to two days);
- for sexual activities (for a short period of time);
- for sport and hobbies (for a limited period).[164] .

Appliances for high-output stomas

There are a few very rare stomas, the jejunostomy or duodenostomy, that are made from the higher gastrointestinal tract. These ostomates pass high faecal outputs often in excess of one litre daily from their stoma. There is also a small group of ostomates that have a high output from their ileostomy or colostomy, passing up to several litres daily [173] .

Management of high faecal outputs can be difficult, the appliance fills quickly and the storage capacity of many appliances may be inadequate. Some manufacturers make a larger size bag in their range that can be useful in this situation . However, there is also a limited choice of high-output bags, available only in two pieces. The appliances are large for extra storage and instead of the outlet being like an ileostomy appliance, the opening is round and about one centimetre in diameter. This allows the connection of a catheter night drainage bag or a specialised drainage bag. Extra drainage is particularly useful overnight to reduce the frequency of appliance emptying. Many ostomates feel the need to apply extra adhesive around the stoma flange to help improve adherence or wear a stoma belt to help with the weight of the pouch when full. Another method of caring for a high output stoma with a very liquid output is to use a urostomy pouch. This has the benefit of being able to be connected directly into a night drainage system. However, should the output become thicker, the non-return valve can block and the pouch will not function properly or the outlet may be too small to drain the faeces. Using a urostomy appliance can be a good short-term solution for ostomates with post-operative high outputs that resolve soon after surgery. [164] .

Stoma plug

The Conseal plug is available as a one- or two-piece system and allows the colostomate to be free from wearing a colostomy pouch. The plug itself looks like a mushroom with the stalk part being placed in the colon to stop faeces from leaving the colostomy for up to 12 hours. Plugs do need to be used in conjunction with an appliance or colostomy irrigation, to allow passage of faeces from the colostomy. It may take time for the colostomate to learn how to use the plug and a number of weeks for them to be able to wear it for extended periods of time. [164] .

Summary

We wrote dedication , contents , introduction for literature , the review is subdivided in to parts , every part is talking about a stoma , for every stoma we talk about anatomy , histology , physiology , indications , surgical access & techniques , post operative complications , care and managements , closure if it is transient stoma type . We made chapter for general stoma complications & their managements . Also , we added chapter for stoma care and chapter for stoma appliances . We wrote refrances for every paragraph including auther name , book title , page number , year of publishing , number of edition if found , & the name of publisher . This is wrote under every paragraph or part and numbered at the end of the literature for researchers .

Quality of life is becoming an increasingly important outcome for both surgeons and patients. As patients become better informed, they demand more information about both the surgical procedure and their long-term outlook. It therefore behooves the surgeon to consider quality of life and to measure it objectively with instruments that are sensitive, reliable, accurate, and valid. The development of instruments to measure quality of life is also important, so that modifications of techniques and new procedures can be evaluated adequately.

Despite the limitations of studies assessing quality of life, it appears that quality of life is good in most patients with an ileostomy or a colostomy. Although some restrictions may be encountered, most patients are able to lead a normal life

Although the creation of a colostomy is not particularly difficult, its nuances

should not be overlooked. A well-functioning colostomy is taken for granted at its creation. A poorly created colostomy can truly be a lifeending catastrophe. "Temporary" colostomies will frequently turn out to be permanent. If all the principles of surgical anastomoses—such as blood supply and freedom from tension—are observed, stoma creation will remain nearly intuitive.

Cecostomy was originally employed as a means of colonic decompression for distal obstruction requiring minimal surgical insult. In most cases, the procedure can be performed with the patient under local anesthesia to achieve prompt decompression of the colon. In fact, the fluoroscope-guided percutaneous technique may be the most efficient, least morbid approach to achieving cecostomy tube placement. Although—as perioperative medical management has improved and reliance on staged procedures diminished—the need for cecostomy as a diverting procedure has decreased significantly in recent years, it is still useful for the surgeon to be familiar with the technique.

Perfect, simple, and safe stomal continence has yet to be achieved. Ileostomy continence has come closest to this ideal through modifications of Kock's technique of reservoir ileostomy. The price of excellent continence with this method has been a significant rate of complication and reoperation. Acceptable colostomy continence has been achieved through the use

of stomal irrigation. Despite its simplicity and safety, this technique is not perfectly reliable. Although considerable progress has been made over the past 30 years, the ideal substitute for the anal sphincter remains elusive. Temporary ostomies can be created from small or large bowel in a variety of manners and serve a valuable role in persons undergoing surgery for acute infectious events, malignancy, or trauma. Take-down of these stomas mandates careful preoperative assessment and individualized preparation. While loop stomas can be closed with relative ease and acceptable morbidity, end ostomy take-down is more complicated, with relatively greater risk for associated complications.

Most patients with ileostomy and or pouch dysfunction have an underlying cause that is relatively easy to diagnose and treat. In most instances the cause relates to the underlying disease or the type of surgical procedure performed. Successful management, often without surgery, is possible in the majority of cases.

Ostomy prolapse is a common complication after colostomy or ileostomy construction. Presentation may range from asymptomatic protrusion to incarceration with vascular compromise. A variety of surgical options are available for the management of this condition. The physician caring for the ostomy patient with prolapse must be aware of all options.

The surgeon who creates stomas must adhere to the basic surgical principles of stoma construction. Prolapse is one of the stoma-associated complications that is directly related to the surgical technique. Prevention, therefore, is preferable to treatment of this often avoidable complication. It is our recommendation that creation of intestinal stomas be performed or directly supervised by the senior member of the operating team, as this is often the part of the operation that will remain with the patient for months to years and will have a major impact on his or her quality of life.

Conclusion

This literature condensates surgical informations about cutaneous gastro

-intestinal tract stomata (gastrostomy , oesophagostomy , colostomy , ileostomy

, cecostomy , posterior sagittal ano rectoplasty – psarp -- , deudenostomy and

jujenostomy) And to make this title close to surgeons minds . This work is

done and extracted from several text books and some scientific websites .

There are many issues that have to be considered when caring for the ostomate, whether the stoma is newly formed or after many years. Some people never seem to adjust to their stoma whilst others cope well. Some factors that can help the ostomate are the support of their family and the multidisciplinary team.

Ideally ostomates should be able to undertake a 'normal life' unless they have a poor prognosis. Many ostomates of both sexes have successfully parented after their stoma was formed. They are also able to continue their job, sports and holidays. This should be encouraged.

the construction of a diverting stoma should be considered a major part of the overall operative procedure. It should be performed by a surgeon who is not only technically skilled but also understands the potential complications associated with an ileostomy or a colostomy. In the majority of cases, loop stomas do seem to effectively divert the fecal stream. Almost half of all temporary loop stomas become permanent, a fact that underscores the importance of placing them in an optimal location on the abdominal wall and paying strict attention to technical detail. Finally, loop ileostomy should be considered a potentially superior alternative to transverse loop colostomy following various colorectal surgical procedures.

الفتحة التفميمية المتحكمة بشكل جيد و آمن وبسيط قد تم التوصل إليها مؤخرا وبالأخص تفميم اللفائفي من خلال كوك تكنيك لتفميم اللفائفي بإضافة خزان له . إن ثمن هذا التحكم يظهر من خلال يعض المضاعفات و إعادة التفميم من وقت لآخر . أما الفتحة التفميمية للقولون المتحكمة فيمكن الوصول لها من خلال الري المستمر من وقت لآخر من خلال الفتحة التفميمية .

هذا يسري على تفميم المستقيم ولا يسري على تفميم المعدة و المريء .

ومع وجود تقدم ملحوظ في هذا المجال في السنوات الثلاثين الأخيرة فإن التحكم المثالي لعضلة المستقيم تظل غير متحققة .

كذلك سقوط وتدلي الفتحة التفميمية وما ورائها هي من المضاعفات المنتشرة و الكثيرة والتي تحتاج إلى تدخل جراحي سريع لإيقاف المضاعفات .

الرسالة تشير إلى الإجراءات الجراحية في تفميم المريء و المعدة والمستقيم والقولون واللفائفي والصائم و الإثنا عشر , وأخذت في الإعتبار المضاعفات المحتملة و كيفية مواجهتها و كذلك طرق العناية الحديثة والمستلزمات الواجبة لذلك . أخذنا في الإعتبار النظرة التشريحية والنسيجية والفسيولوجية على حد سواء .

إن جودة ممارسة الحياة لمريض التفميم الجراحي تزداد أهمية لكل من الجراح و المريض على حد سواء , ويتسنى ذلك من خلال إمداد وتثقيف مرضى التفميم الجراحي بالمعلومات اللازمة عن العمليات التي خضعوا لها و الفترات الطويلة من عمرهم اللتي سوف يقضونها أسرى لهذا التفميم الجراحي . كل ذلك يعتمد على مدى التقدم العملي والثقافي للجراح في أداءه تجاه تلك التفميمات الجراحية.

وبالنظر في حدود الدراسات المجراة على التفميم الجراحي و التي تحدد وتوضح مدى جودة الحياة لمرضى التفميم يظهر جليا وبشكل لافت تحسن وتكيف ورضى تفميم القولون واللفائفي أكثر من غيرهم من المفممين جراحيا ومع ذلك توجد بعض الإستثناءات اللتي يجب التنويه لها وعلى كل فإن معظم المفممين جراحيا قادرون على خوض حياة طبيعية .

وبالرغم من أن أداء التفميم القولوني ليس صعبا نسبيا إلا أن مشاكله لا يجب أن يتم تجاهلها حيث أن الأداء الجيد للتفميم القولوني يعتمد على جودة أداءه أثناء الجراحة . إن القولون المفمم بشكل سيء قد يؤدي إلى مشاكل قد تودي بالحياة والفتحات المؤقتة بالتتالي تتحول لفتحات دائمة . و لو أن كل القواعد و المعايير الجراحية تم أخذها في الحسبان فإن التفميم الجراحي سيظل يؤدي أداءات مرضية و جيدة .

تفميم الأعور ظل و سيلة لتخفيف الضغط عن القولون في حالات الإنسداد القولوني . وفي معظم الحالات , فإن الإجراء الجراحي يمكن أن يتم إجراءه تحت تأثير مخدر موضعي للوصول إلى الغاية المنشودة من خفض الضغط القولوني . و في الحقيقة فإن تفميم الأعور من خلال ثقب الجلد الموجه بالفلورسكوب هو الأكثر فاعلية وجودة حتى الآن . وهو الأقل في المضاعفات الجراحية . ومع تطور الأداء الطبي فإن التفميم للأعور يقل أهمية مع الوقت .

Arabic Summary

الملخص العربي

هذه الرسالة تتحدث عن الفتحات التفميمية للجهاز الهضمي على الجلد , تحدثنا عن فتحات تفميم المعدة و المريء و كذلك فتحات تفميم القولون و الأعور واللفائفي والصائم و الإثنا عشر و كذلك المستقيم , ثمانية فتحات تفميمية , ستة منها مشهورة , واثنان نادران جدا وهما تفميم الإثنا عشر و الصائم . قسمنا الرسالة إلى أجزاء , كل جزء تناول فتحة تفميمية من حيث التشريح و النسيج و الوظيفة كذلك أسباب التفميم و طرق إجرائها جراحيا و مشاكل ما بعد الجراحة و معالجتها كذلك العناية بها و أيضا طرق إغلاقها إذا كانت فتحة تفميمية مؤقتة . تحدثنا في جزء من الرسالة عن المضاعفات العامة للفتحات التفميمية و معالجتها كذلك تحدثنا في جزء آخر عن العناية ما بعد الجراحة بالفتحة التفميمية و في جزء آخر عن المستلزمات الخاصة بالفتحات التفميمية من كريمات وأكياس و لدائن . ثم جمعنا كل مصادر الرسالة في جزء واحد في آخر الرسالة بحيث عزونا كل فقرة تم اقتباسها من المراجع العلمية باسم المؤلف و عنوان الكتاب و رقم الصفحة و تاريخ الطبعة و رقم الطبعة إن وجد , كذلك ذكرنا اسم الناشر ليسهل على الباحثين الرجوع لمصادر الرسالة و الإستفادة العلمية قدر الإمكان . آمل أن تجعل الرسالة هذا العنوان قريبا من أذهان الجراحين .

إن جودة ممارسة الحياة لمريض التفميم الجراحي تزداد أهمية لكل من الجراح و المريض على حد سواء , ويتسنى ذلك من خلال إمداد وتثقيف مرضى التفميم الجراحي بالمعلومات اللازمة عن العمليات التي خضعوا لها و الفترات الطويلة من عمرهم اللتي سوف يقضونها أسرى لهذا التفميم الجراحي . كل ذلك يعتمد على مدى التقدم العملي والثقافي للجراح في أداءه تجاه تلك التفميمات الجراحية .

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الفوهات الجراحية الجلدية للجهاز الهضمي

تكثيف للمعلومة الجراحية

الرسالة المقدمة من

الطبيب / محمد ربيع طنطاوي

بكالوريوس الطب والجراحة (كلية الطب جامعة بني سويف)

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