

GASTROINTESTINAL SURGERY MADE EASY

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Gastrointestinal Surgery Made Easy

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To

My teachers

My parents

Mrs. Uma Bai and Dr. D. Siva Rao

My sister

Mrs. Tara and her husband Mr. S. Prabhakar

My beloved

wife Kalpana, daughters Bhavna and Kirthana

Preface

It has always been a great pleasure in sharing what one has learnt and experienced with the colleagues more so with the youngsters. The well read younger generation builds up the learning process in return. Though many new surgical techniques have been developed over a period of time by many surgeons, the basics remain the same. This book encompasses a wide range of common operations described in a stepwise fashion, for easy understanding. The true to real quality color photographs give clarity to the subject. It should be remembered that whether the surgery is performed by open method or by limited access and the technique is hand sewn or by using staplers, the surgeon requires to have a sound knowledge of the anatomy and the surgical procedures.

This handbook is designed to help the trainees, each step supported by a color photograph to obtain the practical insight of gastrointestinal operations, also the operative steps supported by a video format.

It is hoped that this handy volume will serve its purpose of supporting the surgeons who care to give their patients a safe voyage through their operations.

S Devaji Rao

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My very special thanks goes to my daughters, Bhavna for keen proof reading and Kirthana for rendering the computer aided illustrative work in a superb and dedicated manner.

Finally, my thanks and deep appreciation to my wife Kalpana for the tolerance to my preoccupation with the preparation of this manual during many evenings, weekends and the holidays.

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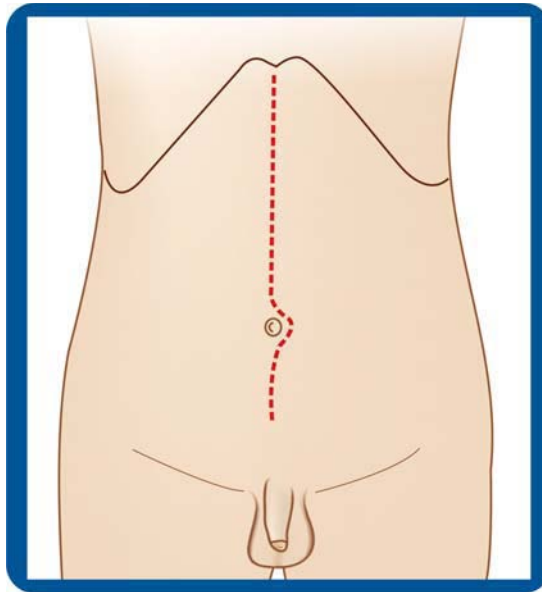
Chapter 1

Introduction

Surgery of the gastrointestinal tract dates back to centuries and essentially involves the partial or total removal of sacrificable organs when necessary (ectomies), and establishing bypass or diversion procedures (ostomies) of the hollow organs. The severity of the gastrointestinal operations vary from very minor to very major, with varying grades of complications, with an impact on morbidity and mortality.

The diversion or bypass procedures have to be near normal physiologically and the techniques vary from surgeon to surgeon. Hand sewn techniques are still preferred by many to stapled anastomoses for their versatility, low complication rates and economy. Stapled anastomosis is preferred by the modern surgeons, at least in select situations. However, *basic rules of sound surgical technique apply to stapled as well as to sutured anastomoses.*

*Abdominal
Incisions for
Gastrointestinal
Surgery*



Various abdominal incisions used for gastrointestinal surgery

Type of incision	Name of incision		Layers of abdominal wall incised to reach the abdominal cavity	Intra-abdominal structures accessible
Vertical	Midline	Upper	Skin, linea alba, peritoneum (All layers incised at the same line)	Stomach, duodenum, liver, gall-bladder, spleen
		Lower		Small bowel, appendix, large bowel, sigmoid colon and rectum
		Full		All organs where greater exposure is required
	Upper or lower paramedian (right or left - 2 cm lateral to the midline)		Skin, anterior rectus sheath, posterior rectus sheath, peritoneum (incised at the same line) - (rectus abdominis retracted or split).	Organs placed in the lateral aspect of the abdomen on the same side of the incision
Horizontal	Transverse abdominal		All layers divided including rectus abdominis muscles	Liver, pancreas
	Pfannenstiel (1 cm above pubic symphysis)			Pelvic organs, sigmoid colon and rectum
	Lanz			Appendix
Oblique	Right subcostal (Kocher's) or Hockey stick (2 cm below right costal margin)		All layers divided including rectus abdominis muscles	Liver, gallbladder
	Left subcostal			Spleen
	Roof top (bilateral subcostal)			Liver, pancreas
	Gridiron (McBurney's)			Appendix

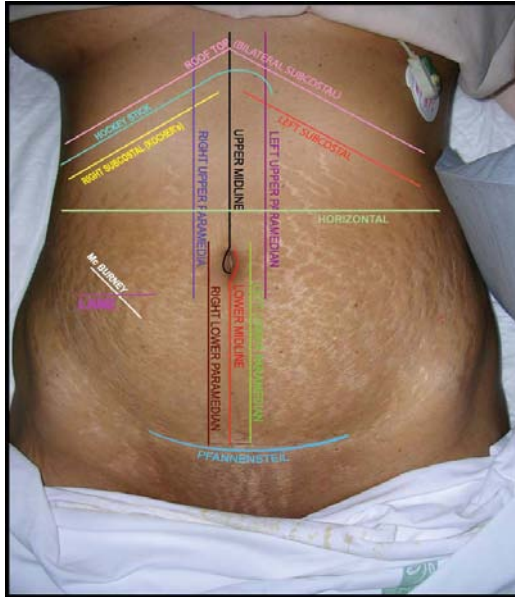
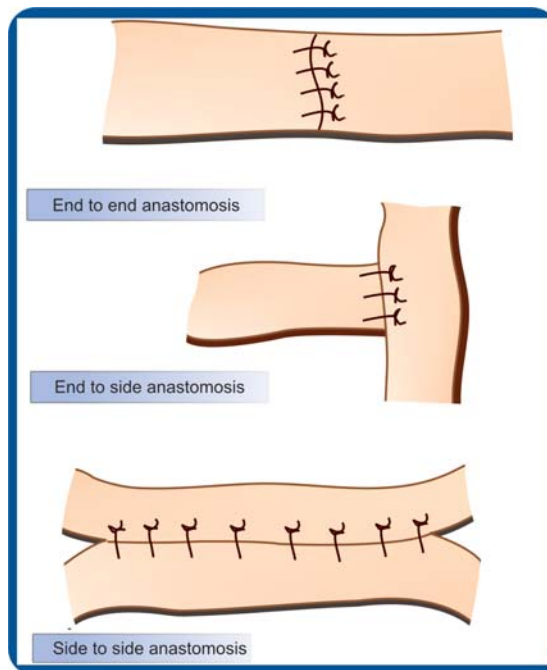


Figure 2.1: Various incisions for gastrointestinal surgery

Varieties of Intestinal Anastomosis



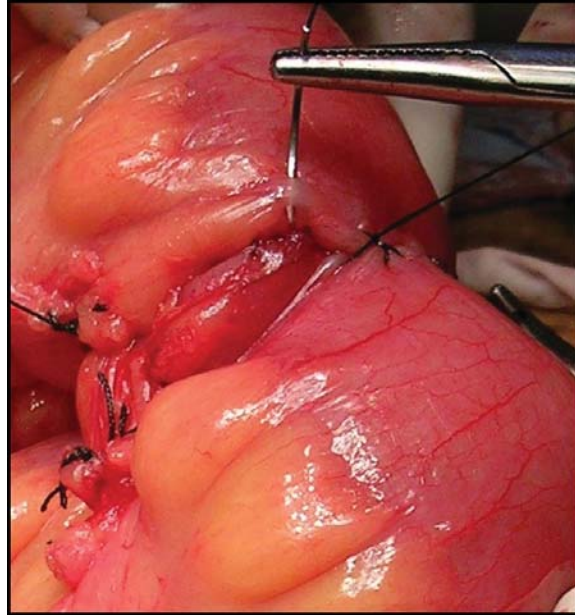


Figure 3.1: End to end anastomosis



Figure 3.2: End to side anastomosis

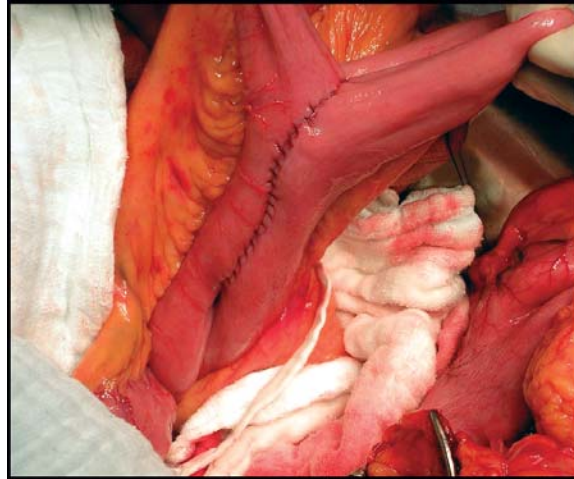
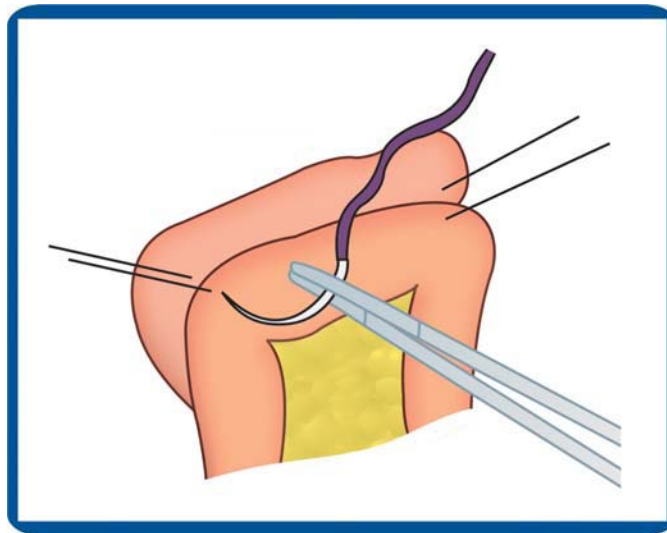


Figure 3.3: Side to side anastomosis

*Hand Sewn
Techniques in
Gastrointestinal
Surgery*



The choice between hand sutured or stapled anastomosis principally is decided by the surgeon's choice. The incidence of dehiscence does not considerably differ between the two methods, provided the surgeon ensures adequate vascularity to the anastomosis. The anastomosis should be without any tension.

The bowel anastomosis is performed by two techniques. They are:

- Single layer (in anastomosis involving the esophagus, colon and rectum)
- Double layer (in anastomosis involving stomach, duodenum, jejunum and ileum).

METHOD OF PERFORMING SINGLE LAYER ANASTOMOSIS

Step 1: Approximation of bowel ends: The bowel ends (oesophagus with stomach or jejunum/colon with rectum) are brought together with the help of already applied non-crushing intestinal clamps.

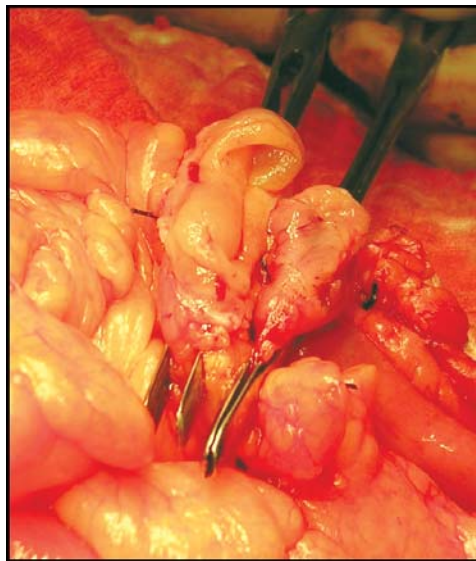


Figure 4.1: Approximation of bowel ends

Step 2: Application of posterior sutures: Interrupted non-absorbable sutures on atraumatic needles are applied full thickness and each one is held with straight artery forceps separately. They are all tied one by one and cut.

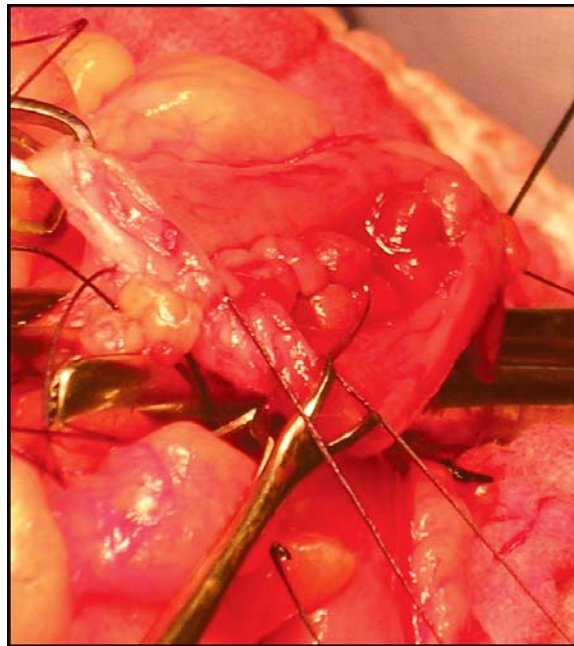


Figure 4.2: Application of posterior sutures

Step 3: Application of anterior sutures: Interrupted horizontal non-absorbable sutures on atraumatic needles are applied full thickness and tied and cut immediately after placement.

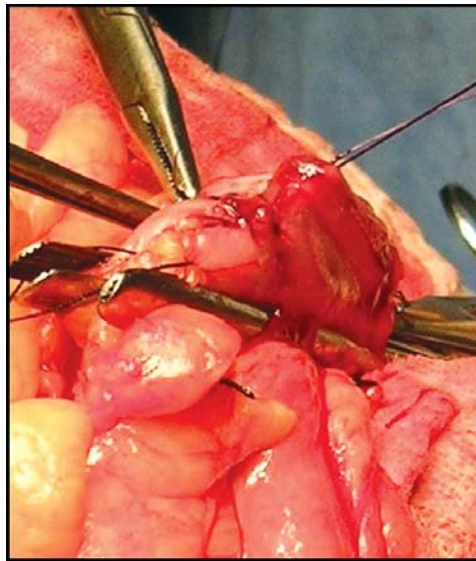


Figure 4.3: Application of anterior sutures

METHOD OF PERFORMING TWO LAYER ANASTOMOSIS

Step 1: Approximation of bowel ends: Ends of the bowel for anastomosis are brought together with the help of already applied non-crushing intestinal clamps. The bowel ends are held firmly with Babcock's forceps.

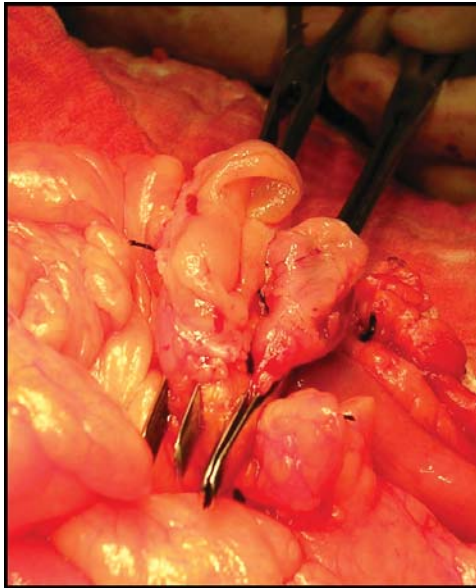


Figure 4.4: Approximation of bowel ends

Step 2: Suturing the outer posterior layer: A continuous suturing is done with 2/0 non-absorbable sutures (silk) to the required length, with tying of knots at the corners.

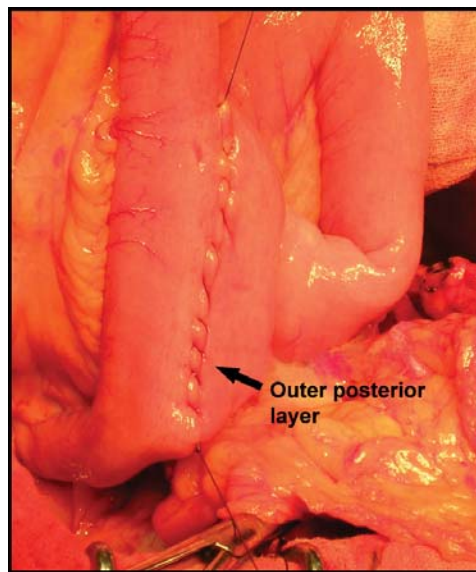


Figure 4.5: Suturing the outer posterior layer

Step 3: Suturing the inner posterior layer: A continuous suturing is done with 2/0 or 3/0 absorbable sutures (Vicryl) from corner to corner.

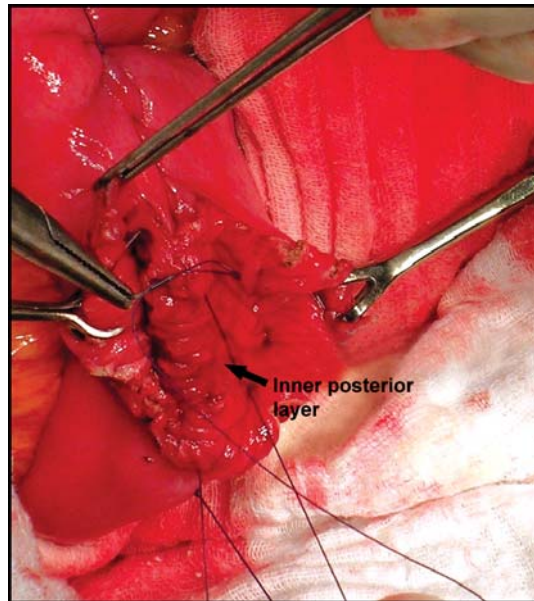


Figure 4.6: Suturing the inner posterior layer

Step 4: Suturing the inner anterior layer: The end of the suturing is further continued along the inner anterior layer to reach the starting point, where it is tied and cut. The knot stays inside the lumen. The bowel edges are inverted by Connell technique (inside out sutures).

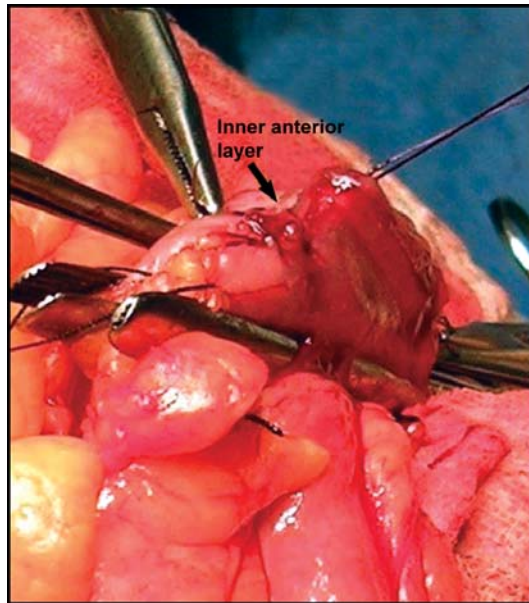


Figure 4.7: Suturing the inner anterior layer

Step 5: Suturing the outer anterior layer: One end of the sutures which was tied at the corners during seromuscular layer (outer posterior layer) is continued in the outer anterior layer and tied at the starting point and cut.

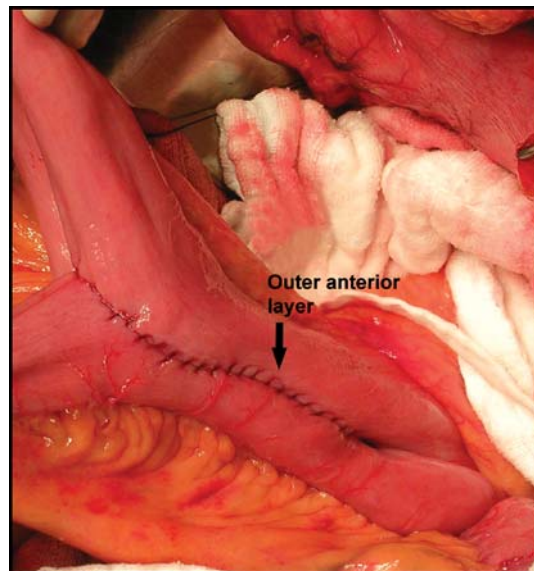
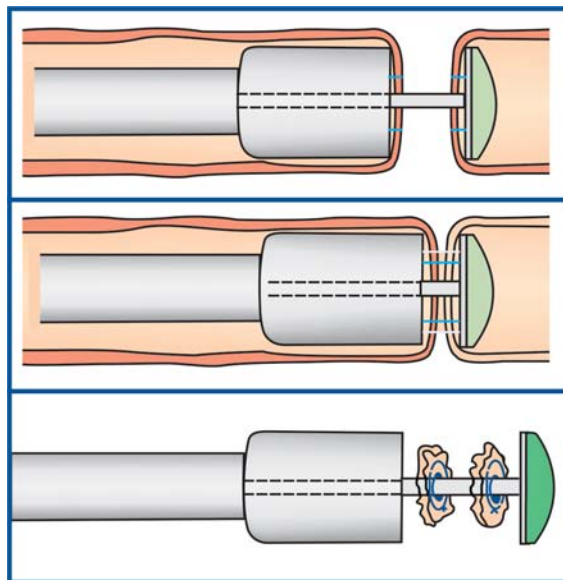


Figure 4.8: Suturing the outer anterior layer

Staplers and Stapling Techniques in Gastrointestinal Surgery



PURPOSE

The staplers are now available to carry out most types of gastrointestinal anastomosis.

VARIETIES

Disposable and angled instruments are available for use in particular circumstances, and the metal staples come in different lengths to accommodate the different tissue thicknesses.

Sizes

- i. The curved circular stapler (Figure 5.1) used in the end to end anastomosis (EEA stapler) is available in four sizes and with universal color coded anvils, 21 mm (light green), 25 mm (white), 29 mm (blue) and 33 mm (dark green).
- ii. The linear staplers (Figure 5.2) are available with reloadable cartridges made of titanium in sizes of 30 mm, 60 mm and 90 mm.
- iii. The linear cutters (Figure 5.3) are also available with safety lock-outs and with reload units made of titanium in sizes of 55 mm (blue cartridge); 55 mm thick tissue reload unit (green cartridge); 75 mm (blue cartridge) and 75 mm thick tissue reload unit (green cartridge).



Figure 5.1: Curved circular stapler



Figure 5.2: Linear stapler



Figure 5.3: Linear cutter

Selection of Size of Stapler

The size of the stapler should be chosen with thought given to the thickness of tissue involved. Most of the large and small bowel, is stapled with 3.5 to 4.5 mm staples that close to a height of 1.2 mm and are marked blue in color by the manufacturers. For the thicker tissue, such as the gastric wall, there are 4.8 - 5.5 mm staples which close to a height of 1.6 - 1.7 mm and come with green color code. Use of too small a stapler, on thicker tissue or conversely, use of too large a stapler on thinner tissue leads to the risk of leakage, as the suture closure is adjustable, whereas the staple closure is standardized.

METHOD OF APPLICATION

For end to end anastomosis (e.g., colorectal, esophago-jejunal) the stapling gun is introduced into the intestinal lumen upwards (through the anus in colorectal anastomosis and through the jejunum in esophago-jejunal anastomosis or through the stomach in esophago-gastric anastomosis), brought out through the cut end of the distal bowel (Figure 5.4). The largest anvil should be chosen that will fit comfortably into the proximal lumen (Figure 5.5). Proximal and distal guts are snugged tightly around the central rod using purse-string sutures (Figure 5.6), (distal gut, the rectum may be stapled with linear stapler instead of a purse string suturing) and the anvil is then approximated to the cartridge by closing the instrument (Figure 5.7). When the gun is fired, a circular double row of stainless-steel staples is inserted, and at the same time a complete 5 mm rim of each bowel end (the doughnuts) is resected (Figure 5.8A and B). The gun is now opened 2 - 3 cm to allow the stapled flange of the bowel walls to recede outwards from its grasp. Next, it is rotated to tear any residual strands of mucosa that were not completely divided by the trephine, and then gently withdrawn, leaving a nicely inverted end-to-end stapled anastomosis. The machine is then withdrawn, the doughnuts are checked and the anastomosis is complete.

The withdrawal of the instrument is generally achieved without any significant trauma to the anastomosed bowel.



Figure 5.4

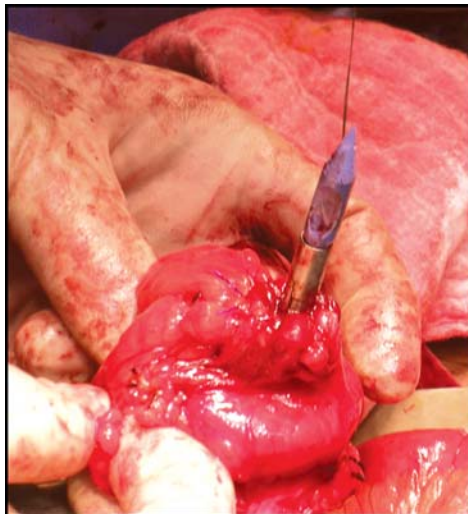


Figure 5.5

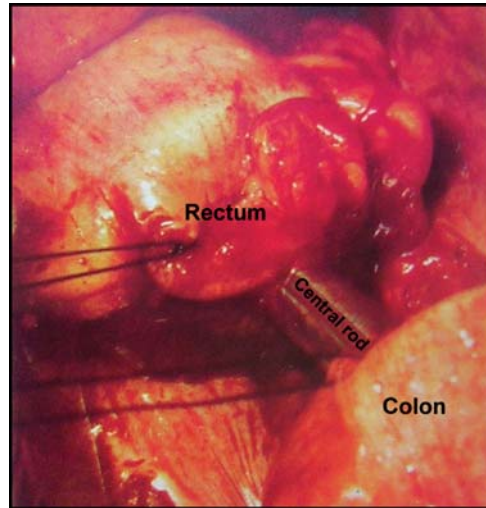


Figure 5.6

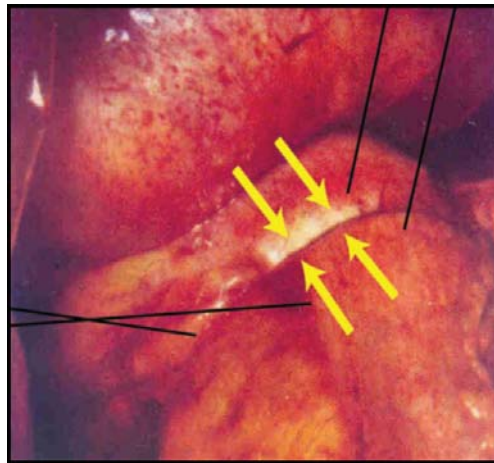


Figure 5.7

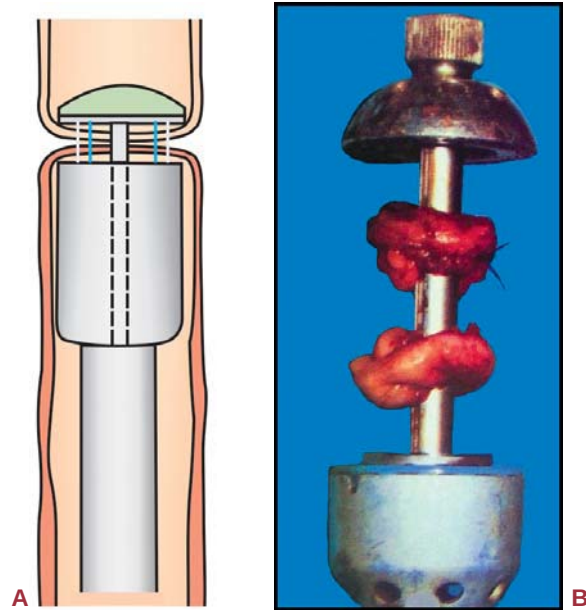


Figure 5.8A and B

Extrication is difficult in cases where there is failure to divide all the mucosa. The best solution for this embarrassing situation is to make 3 - 4 cm longitudinal cuts on the anterior aspect of the bowel 2 - 3 cm above the anastomosis to bare the head of the gun, which can then be simply unscrewed and removed, allowing the rest of the instrument to be withdrawn per anum or the jejunum. The opening in the bowel is closed with one or two layers of fine silk sutures.

Checking the State of Anastomosis

When the anastomosis is done low down in the pelvic cavity, the integrity of the anastomosis can be checked in many ways:

- By checking the doughnuts, whether they are complete and intact. This should be done after the removal of the purse string suture, as non-removal may give a false impression of its being intact. *An incomplete disc very strongly suggests that the anastomosis is defective, while a complete disc makes it highly likely, but not absolutely certain, that a sound anastomosis has been achieved.*
- By filling up the pelvis with warm saline to submerge the anastomotic site and injecting air through a fine catheter in the rectum, while the bowel is compressed with fingers above the anastomosis. The air leaks as bubbles if there is a defective anastomosis.
- By filling the rectum with colored solution such as povidone-iodine through a catheter from below. Escape of this solution indicates a defective anastomosis.

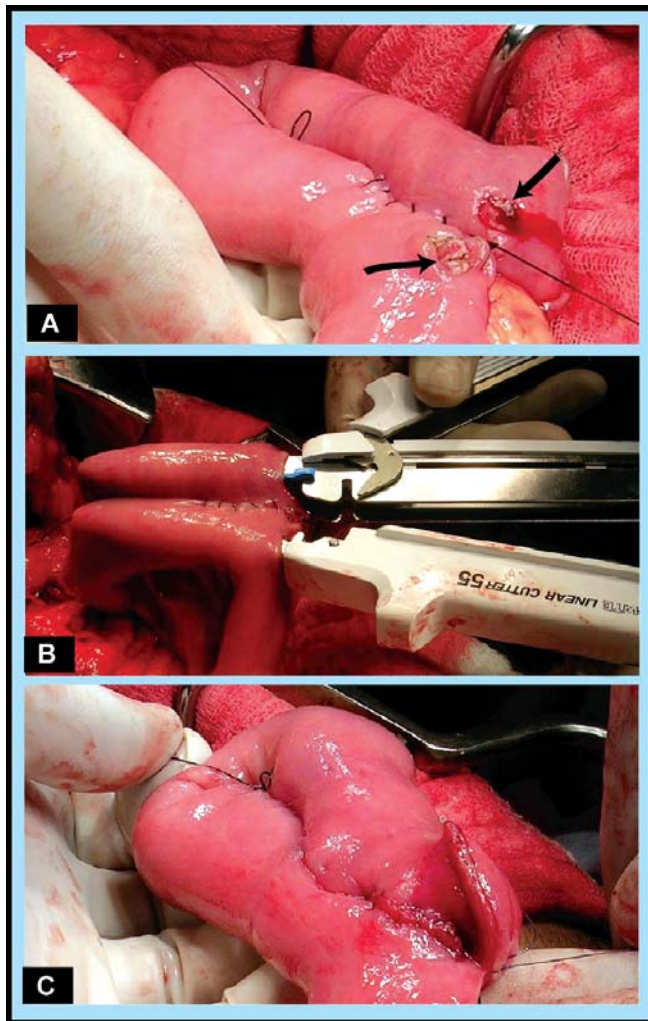
Whenever, the anastomosis is found to be defective, the defect should be repaired with silk sutures. It may be worthwhile to do a proximal diversion, if the repair is not satisfactory.

For end to side anastomosis, the circular staplers can be used with a slightly different technique. The gun is introduced through an enterotomy in the bowel for end

anastomosis and a purse string applied. A small incision is made in the side anastomosis bowel, through which the spindle end can be pushed until the cartridge comes into contact with the wall. It is not necessary to apply a purse-string suture on the side anastomosis bowel. The anvil and the cartridge are apposed, and the machine actuated. The gun is withdrawn, and the enterotomy is closed with a linear stapler.

For side to side anastomosis, a different instrument, linear cutter is used. They insert four parallel, linear rows of staples and at the same time cut between the two middle rows. The instrument separates into two parts, and can be used to unite two tubes, producing a stoma between them. The two parts of gut are brought together which are to be anastomosed. A hole is made in each tube so that the separated jaws of the stapler can be inserted and laid parallel to each other (Figures 5.9A to C). The two halves are locked together after ensuring that no extraneous tissue is inadvertently trapped. The stapler is actuated, the two halves are separated and withdrawn. From within the hole, the ends of the staple lines are identified and picked up with tissue forceps. The forceps is separated to create a linear defect. The defect is closed either with sutures, or conveniently a linear stapler of suitable length is applied.

For occluding the lumen of a bowel, yet another set of instruments (Figure 5.10) has been designed to



Figures 5.9A to C

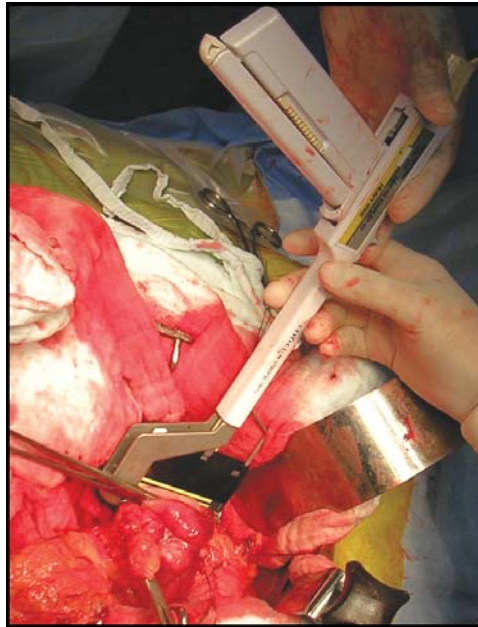


Figure 5.10

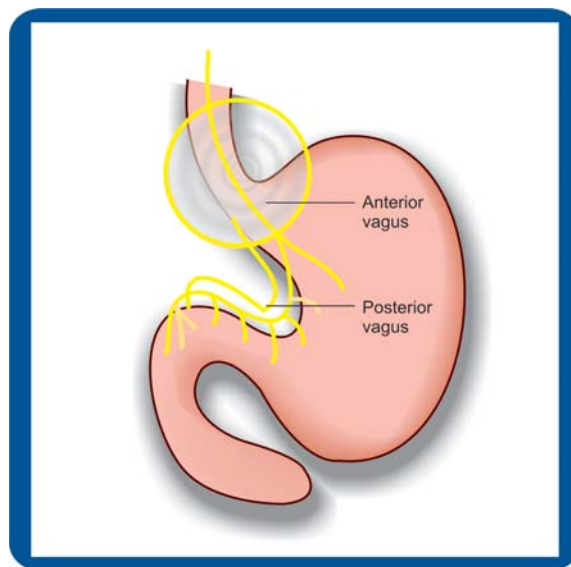
place a double row of staples across the end of a segment. The staple line can be 30, 60 or 90 mm long. The flattened gut is held between the jaws of the instrument. When the stapler is actuated, the staples are pushed through both the layers of the flat tube and the anvil is struck so that they are turned over and closed. It is usually unnecessary to reinforce the linear closure with sutures because the B-shaped closure is secure and hemostatic. The stomach, duodenum and rectum can be closed using linear staplers and the bowel to be resected can be cut away by using a scalpel against the fired stapling device before its removal.

Advantages and disadvantages: Using a mechanical stapler does not guarantee a perfect result. The staplers reduce the time involved in fashioning an anastomosis and facilitate certain operations that can be difficult to complete by hand, such as esophageal resection or low anterior resection of the rectum. *On the other hand there are many situations where the stapler is inappropriate (e.g., choledochojejunostomy) or unnecessary (most small bowel anastomosis).* **A gastroenterology surgeon should be versatile and try to acquire experience in both methods of gastrointestinal anastomosis.**

Basic rules of sound surgical technique apply to stapled as well as to sutured anastomoses. It should be realized that a hand sewn insecure anastomosis cannot be rescued by an expensive mechanical device. Adequate blood supply, absence of sepsis, freedom from tension and adequately cleared serosal surfaces are necessary for proper healing of any type of anastomosis. Manipulation of a stapled anastomosis should be accomplished with respect for the delicacy of the tissues involved.

Chapter 6

Vagotomy



TRUNCAL VAGOTOMY

Step 1: Position of patient: Supine with about 20 degrees reverse Trendelenburg position.



Figure 6.1: Position of patient

Step 2: Incision: Upper midline incision.



Figure 6.2: Upper midline incision

Step 3: Anterior vagotomy: The anterior vagus is identified by vision on the anterior surface of the lower end of the esophagus. The nerve trunk is cut and about 1.25 cm of it is excised. **Posterior vagotomy:** The posterior vagus nerve is better palpated than seen is identified behind and to the right of the esophagus. Under direct vision, the nerve is divided like the anterior nerve.

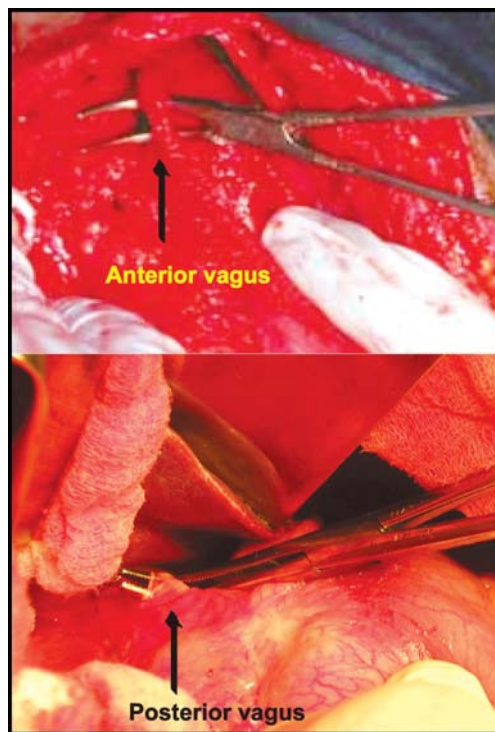


Figure 6.3: Anterior and posterior vagotomy

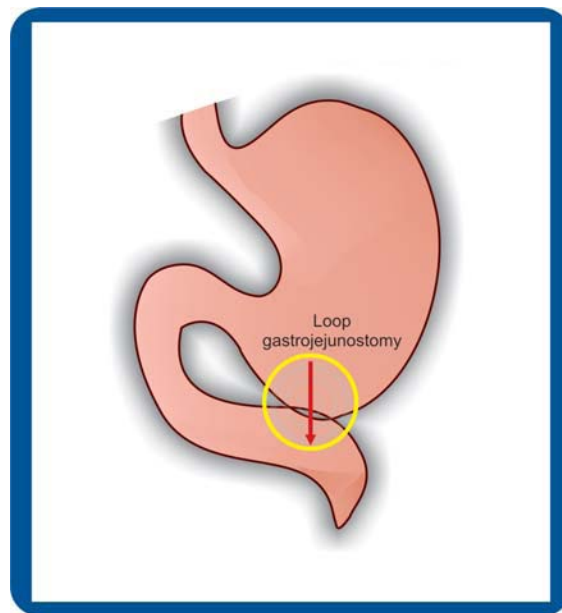
Step 4: Closure: Wound closed in layers

Note: It is necessary to ensure perfect hemostasis in the area of division of the nerves.



Figure 6.4: Wound closure

Gastrojejunostomy



RETROCOLIC LOOP GASTROJEJUNOSTOMY

Step 1: Position of patient: Supine with about 20 degrees reverse Trendelenburg position.



Figure 7.1: Position of patient

Step 2: Incision: Upper midline incision.



Figure 7.2: Upper midline incision

Step 3: Creating a window in the transverse mesocolon: The transverse mesocolon is visualized by lifting the transverse colon. An avascular portion of the mesocolon is selected, usually to the left of the middle colic vessels, and is opened with a pair of scissors for about 7 cm.

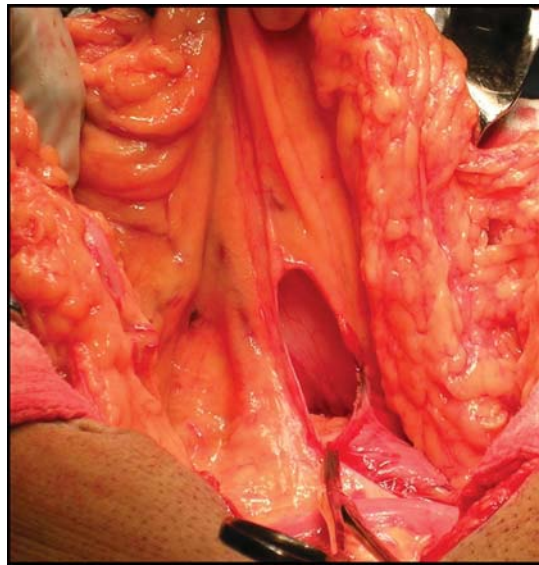


Figure 7.3: Creating a window in the transverse mesocolon

Step 4: Selection of site for anastomosis: The posterior wall of the stomach is visualized and the site for anastomosis is selected and marked by applying two Babcock's forceps. The posterior layer of the window in the transverse colon may be sutured with several sutures to the posterior wall of the stomach so that it lies about 2 cm proximal to the gastrojejunostomy site.

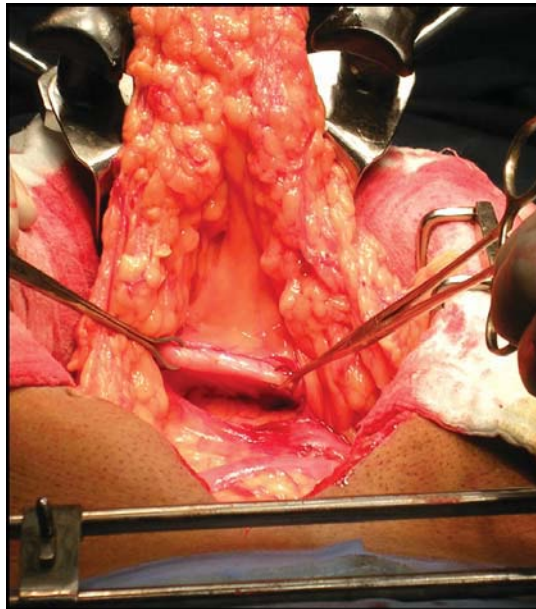


Figure 7.4: Selection of site for anastomosis

Step 5: Selection of loop of jejunum: The loop of jejunum is selected so that the afferent limb is as short as possible, and marked, similar to the length of the stomach, by applying two Babcock's forceps.

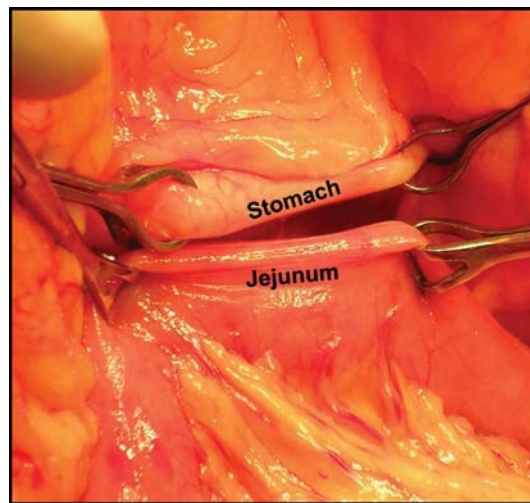


Figure 7.5: Selection of loop of jejunum

Step 6: First layer anastomosis: With 3/0 silk, continuous or interrupted seromuscular suturing is done between the stomach and jejunum, as the first layer. They must be deep enough to include the submucosa. In the jejunum, this should be placed midway between the mesenteric and antimesenteric borders.

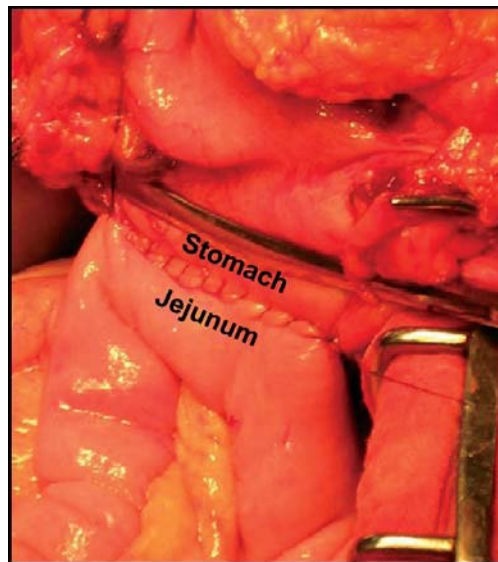


Figure 7.6: First layer anastomosis

Step 7: Opening the bowel: Stomach and the jejunum are opened longitudinally for anastomosis. The stomach is best opened by cautery about 0.5 cm from the posterior row. If large submucosal vessels are encountered, it is better to ligate them with chromic catgut or Vicryl. As soon as the stomach is opened, the fluid should be removed by suction. The jejunum is opened next. The jejunal opening should be slightly smaller than the gastric opening as it will stretch during the performance of the anastomosis.

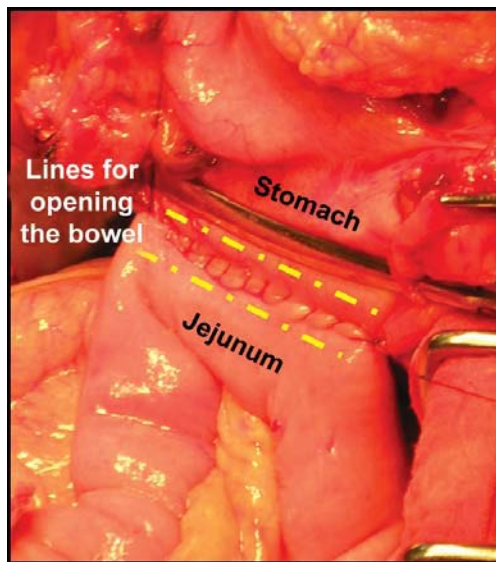


Figure 7.7: Opening the bowel

Step 8: Second and third layer anastomosis: The posterior inner layer (second layer) sutures are made with 3/0 continuous absorbable sutures, encompassing the entire thickness of the walls of the stomach and jejunum together. This continuous suturing is continued to the anterior inner layer. This should be hemostatic. Inversion of the anterior layer is done by Connell technique.

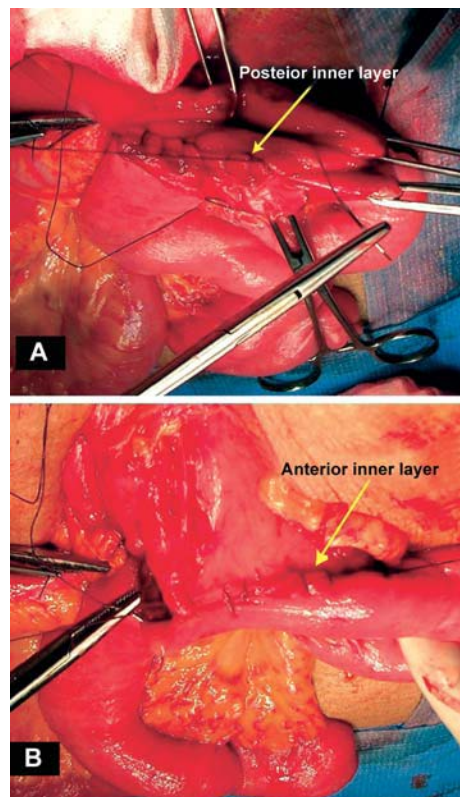


Figure 7.8: Second and third layer anastomosis

Step 9: Fourth layer anastomosis: The anterior outer layer (fourth layer) seromuscular suturing is performed by approximating the stomach and jejunum with 3/0 silk.

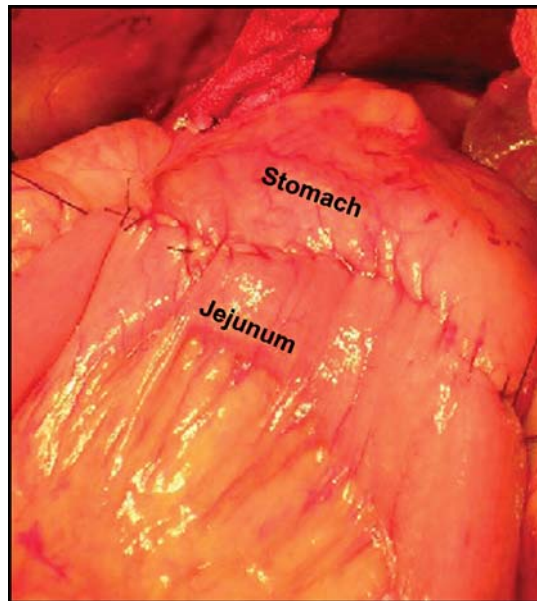


Figure 7.9: Fourth layer anastomosis

Step 10: Obliteration of the window in mesocolon:

The anterior layer of the window of the transverse mesocolon is fixed to the anterior surface of the stomach with interrupted silk sutures of 3/0 silk, to prevent internal herniation of the small bowel.

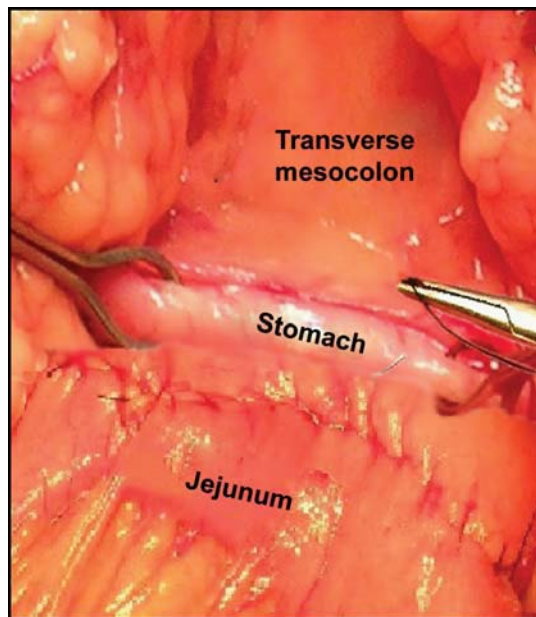


Figure 7.10: Obliteration of the window in mesocolon

Step 11: Closure of abdomen: Continuous single layer closure is done with 1/0 non absorbable suture like Prolene or Nylon. Skin is stapled with or without approximation of subcutaneous tissues.



Figure 7.11: Closure of abdomen

ANTECOLIC LOOP GASTROJEJUNOSTOMY

The construction of the antecolic loop gastrojejunostomy is similar to the retrocolic anastomosis, but it lies in front of the transverse colon. There is no necessity to open the transverse mesocolon.

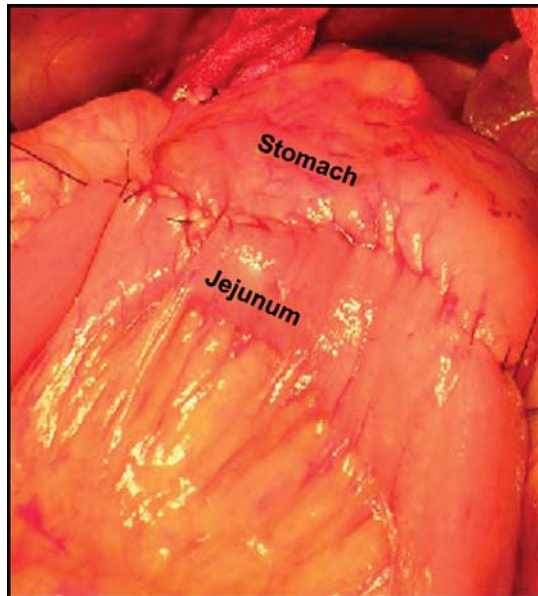
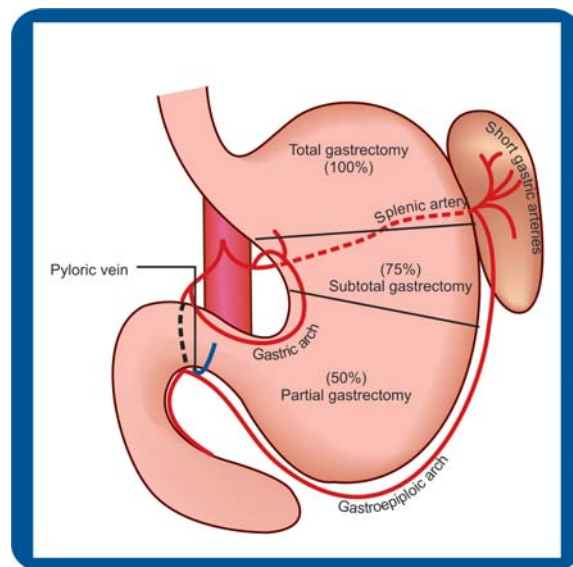


Figure 7.12: Antecolic loop gastrojejunostomy

Chapter 8

Gastrectomy



PARTIAL GASTRECTOMY WITH BILLROTH II RECONSTRUCTION

Step 1: Position of patient: Supine with about 20 degrees reverse Trendelenburg position.



Figure 8.1: Position of patient

Step 2: Incision: Upper midline incision.



Figure 8.2: Upper midline incision

Step 3: Exposure: Upper abdomen is exposed well with the help of good self-retaining retractors. The costal margins should be elevated and retracted upwards.

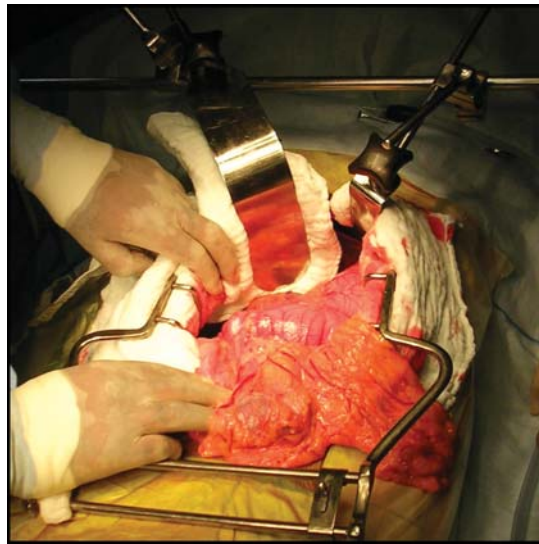


Figure 8.3: Exposure of upper abdomen

Step 4: Division of gastrohepatic ligament: The gastrohepatic ligament is divided and a small window is created to enter the lesser sac, to inspect the posterior aspect of the stomach especially in malignancies for its extension and infiltration.

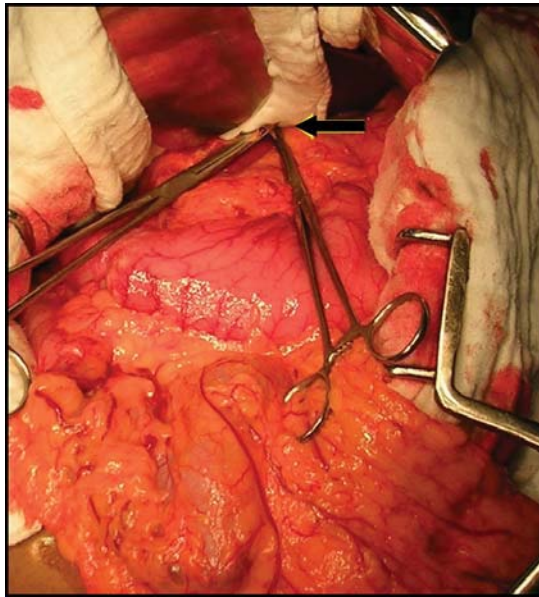


Figure 8.4: Division of gastrohepatic ligament

Step 5: Mobilization of greater curvature: By holding the stomach with the left hand, with four fingers behind the stomach and the thumb anteriorly, the omentum is dissected from the stomach. Gastroepiploic arch is preserved in benign pathologies and it is included in the resection, for malignant illnesses.

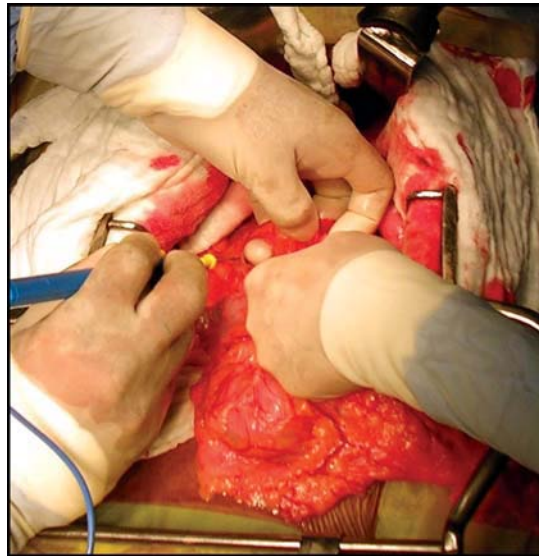


Figure 8.5: Mobilization of greater curvature

Step 6: Marking the line of resection on the greater curvature: The division of gastrocolic ligament is extended upto the line of resection, and a suture is placed on the greater curvature at the line of resection of the stomach.

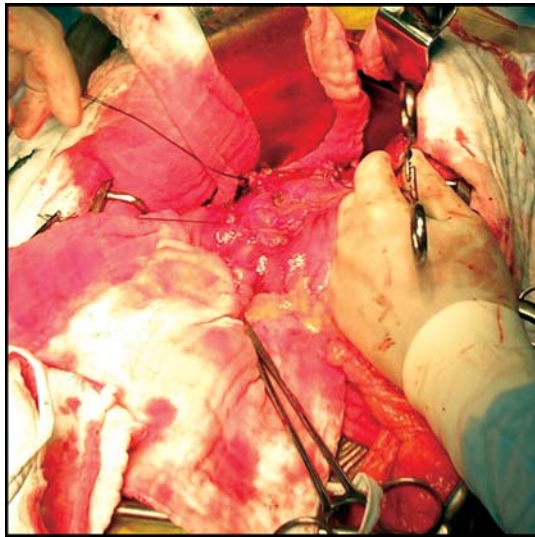


Figure 8.6: Marking the line of resection on the greater curvature

Step 7: Division of left gastroepiploic vessels: The left gastroepiploic artery is divided between ligatures at the point of resection of the greater curvature.

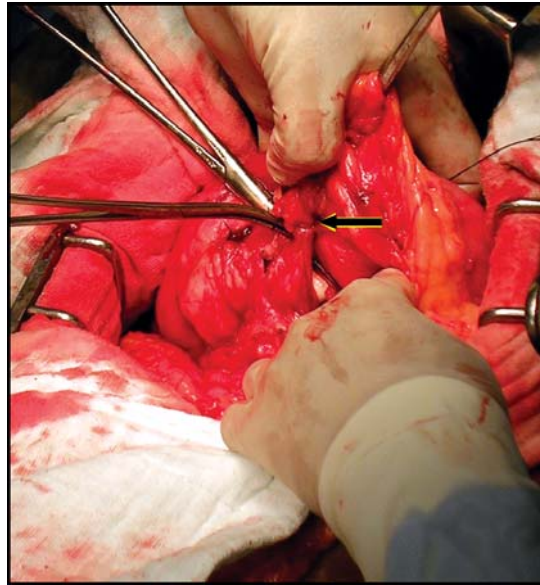


Figure 8.7: Division of left gastroepiploic vessels

Step 8: Division of right gastroepiploic vessels: The right gastroepiploic vessel is identified by retracting the pylorus upwards just at its origin from the gastroduodenal artery.

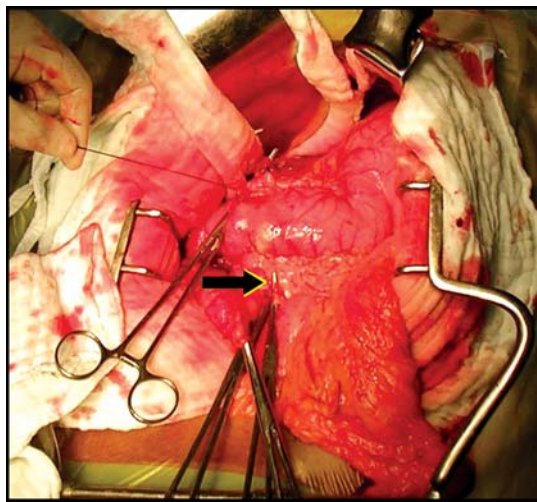


Figure 8.8: Division of right gastroepiploic vessels

Step 9: Ligation of right gastric vessels: Along the lesser curve, the right gastric vessels are divided between ligatures close to the duodenum. The neurovascular arch along the lesser curvature is dissected well, between ligatures.

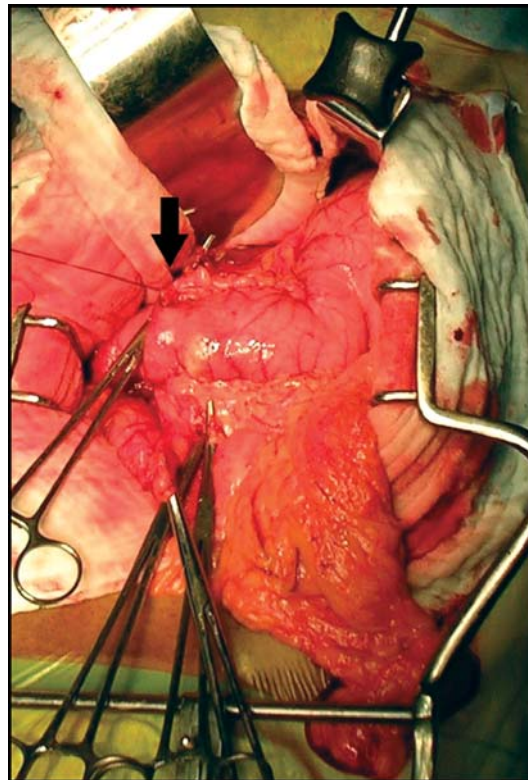


Figure 8.9: Ligation of right gastric vessels

Step 10: Division of duodenum: Stomach is retracted to the left and the duodenum is separated well from the pancreas, and duodenum divided between clamps or with linear stapler.

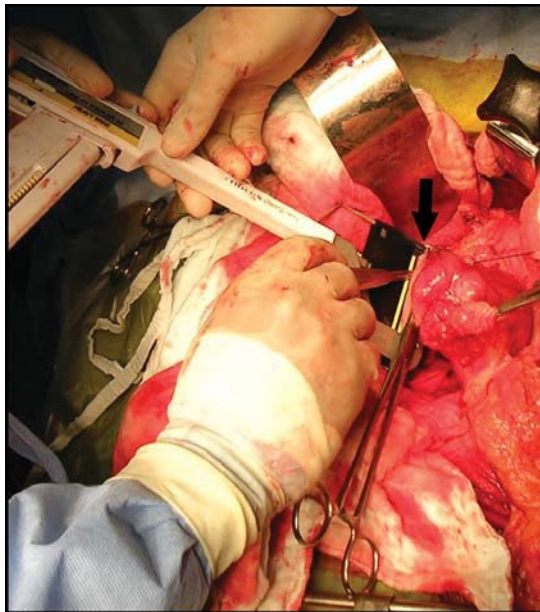


Figure 8.10: Division of duodenum

Step 11: Closure of duodenum: If divided by using clamps, the duodenum should be sutured in two layers, the first with interrupted 2/0 absorbable (Vicryl) sutures and the second with non-absorbable (silk) sutures. When a linear stapling is done, it is advisable to invert the stapled edge of the duodenum and fix it to the peripancreatic tissues.

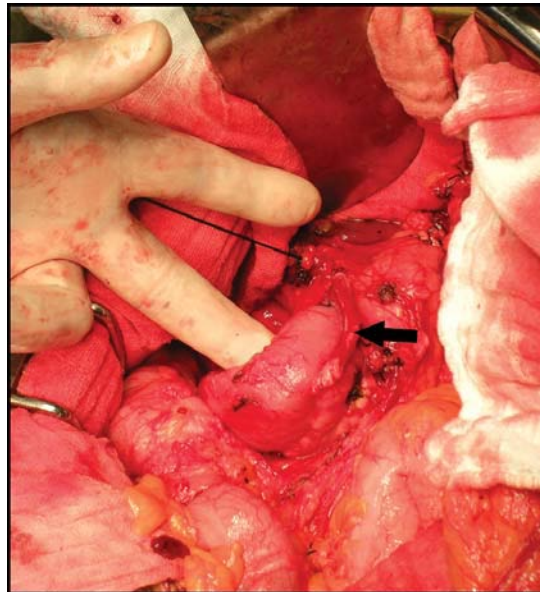


Figure 8.11: Closure of duodenum

GASTROJEJUNOSTOMY (HAND SEWN TECHNIQUE)

Step 12: First layer anastomosis: With 3/0 silk, continuous or interrupted seromuscular suturing is done between the stomach and jejunum, as the first layer. They must be deep enough to include the submucosa. In the jejunum, this should be placed midway between the mesenteric and antimesenteric borders.

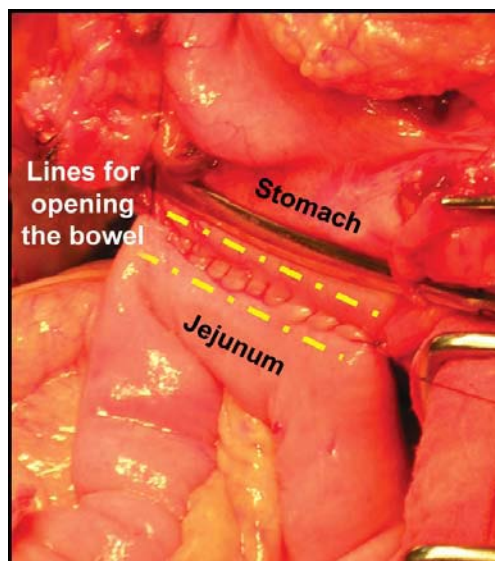


Figure 8.12: First layer anastomosis

Step 13: Second and third layer anastomosis: The posterior inner layer (second layer) sutures are made with 3/0 continuous absorbable sutures, encompassing the entire thickness of the walls of the stomach and jejunum together. This continuous suturing is continued to the anterior inner layer (third layer) after the division of the stomach. This should be hemostatic. Inversion of the anterior layer is done by Connell technique.

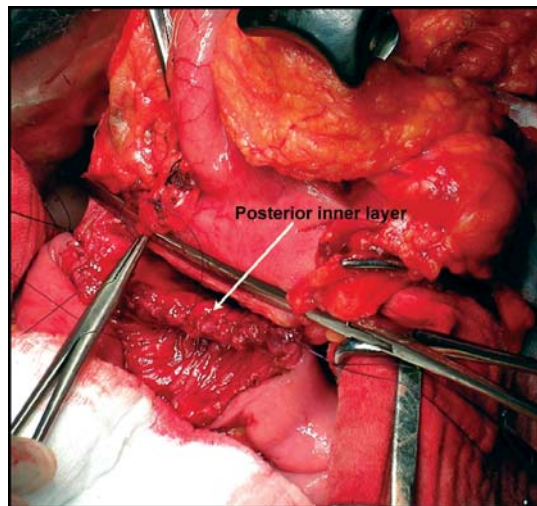


Figure 8.13: Second and third layer anastomosis

Step 14: Fourth layer anastomosis: The 3/0 silk tied at the corners is continued as the fourth layer. The suturing is started at one end and after continuous seromuscular suturing is completed at the other end.

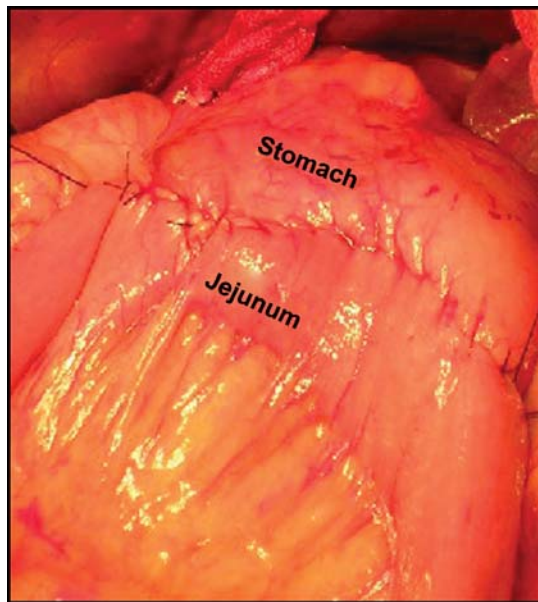


Figure 8.14: Fourth layer anastomosis

Step 15: Closure of abdomen: Continuous single layer closure is done with 1/0 non absorbable suture like Prolene or Nylon. Skin is stapled with or without approximation of subcutaneous tissues. A tube drain is left in situ near the duodenal stump to take care of the duodenal leak if it occurs, which serves the function of a controlled fistula.



Figure 8.15: Closure of abdomen

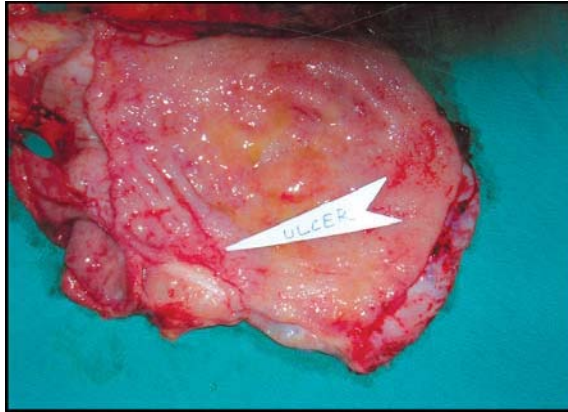
Resected partial gastrectomy specimen

Figure 8.16: Resected partial gastrectomy specimen

TOTAL GASTRECTOMY WITH ESOPHAGO-JEJUNOSTOMY (ROUX EN Y CONSTRUCTION)

Step 1 to Step 11: Same as in partial gastrectomy, but the entire stomach needs to be mobilized upto the esophago-gastric junction.

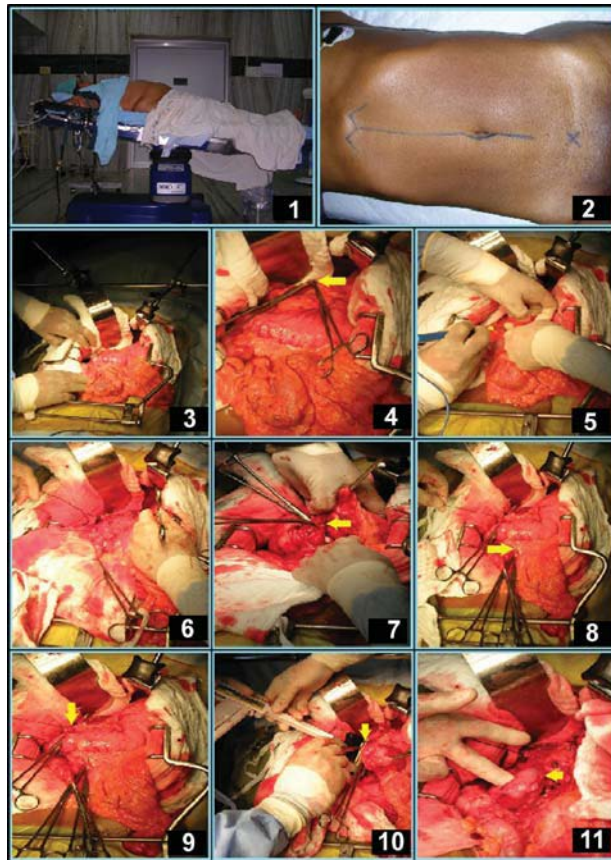


Figure 8.17: Total gastrectomy with esophago-jejunostomy

Step 12: Jejunal transection for Roux en Y construction: The jejunum is transected at about 15-20 cm from the ligament of Treitz.

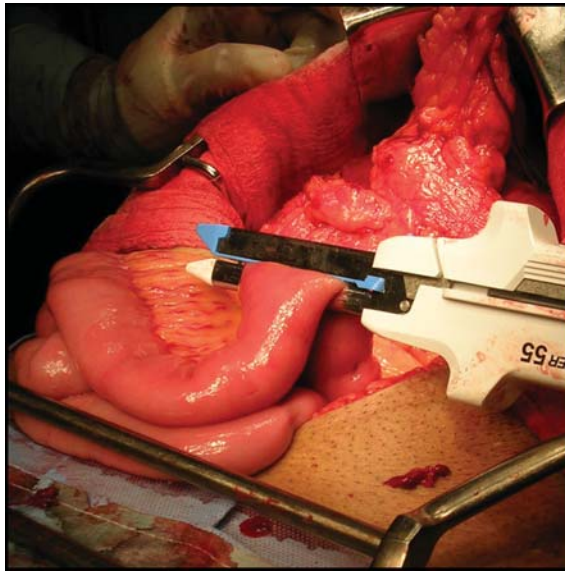


Figure 8.18: Jejunal transection for Roux en Y construction

Step 13: Creation of esophago-jejunostomy:

Maintaining the vascular arch, the distal jejunum is taken through the window in the transverse mesocolon, upto the lower end of the esophagus. The esophagus is transected and end to side esophago-jejunostomy is created. A side to side jejuno jejunostomy is done to form a pouch as a good size stomach reservoir.

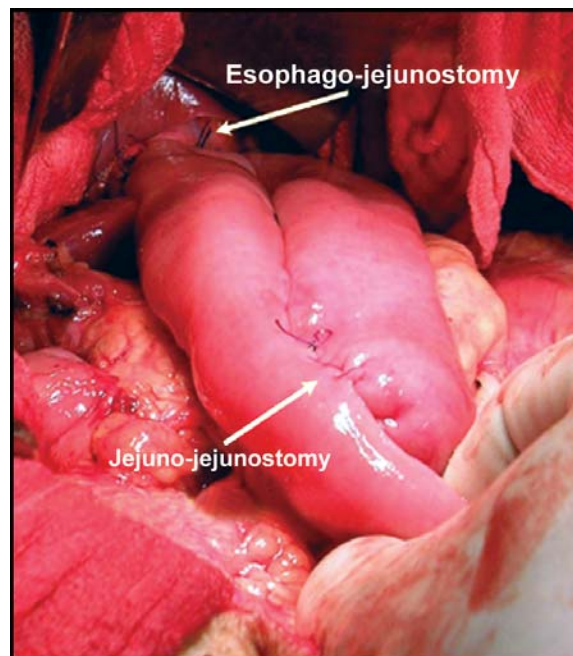
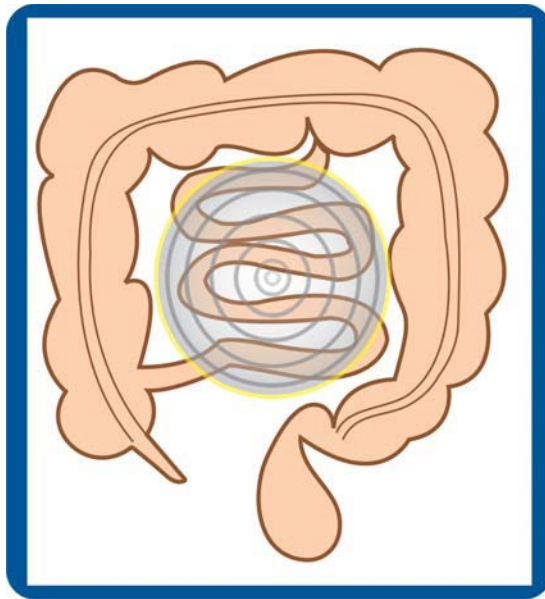


Figure 8.19: Creation of esophago-jejunostomy

Resected total gastrectomy specimen

Figure 8.20: Resected total gastrectomy specimen

Ileal Resection



ILEAL RESECTION

Step 1: Position of patient: Supine



Figure 9.1: Position of patient

Step 2: Incision: Lower midline incision**Figure 9.2:** Lower midline incision

Step 3: Division of mesenteric vessels: Since ileum is a mobile organ, it is held with the left hand and the levels of resection are marked depending on the pathology. The mesentery is defined well and the vessels are divided between ligatures.

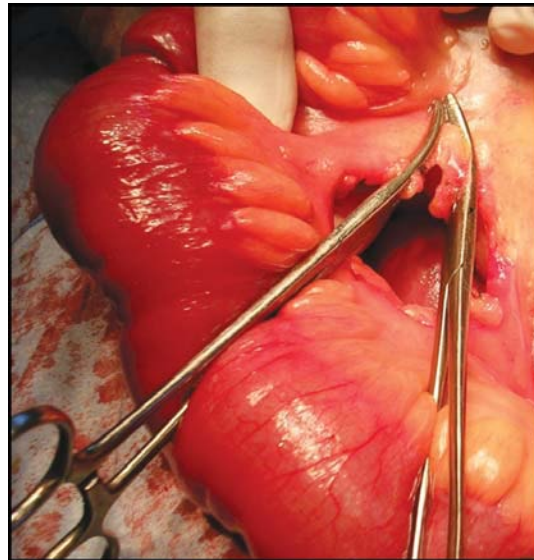


Figure 9.3: Division of mesenteric vessels

Step 4: Application of intestinal clamps: Non-crushing intestinal clamps are applied on the retainable parts of the bowel and crushing clamps are applied on the side of resection.



Figure 9.4: Application of intestinal clamps

Step 5: Division of bowel and approximation of divided ends: The bowel is divided between clamps and the diseased ileum is removed. The divided ends (held with non-crushing clamps) are approximated without tension.

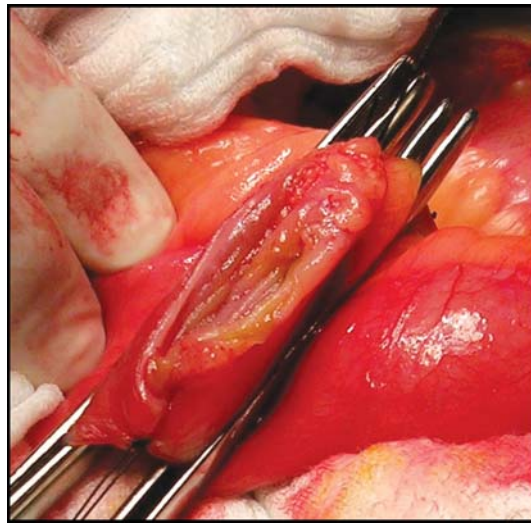


Figure 9.5: Division of bowel and approximation of divided ends

Step 6: Anastomosis: End to end ileo-ileal anastomosis is done with classical four layer anastomosis. **First layer:** The first layer of full thickness hemostatic continuous suturing is done with 3/0 absorbable material (Vicryl).



Figure 9.6: Anastomosis

Step 7: Second layer: The suturing of the first layer is continued anteriorly and completed.

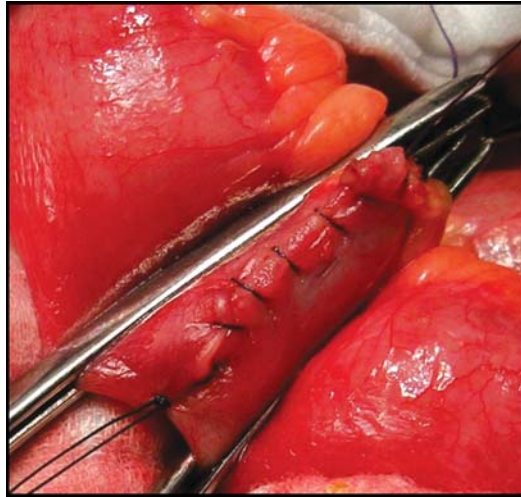


Figure 9.7: Second layer

Step 8: Third and fourth layers: A continuous seromuscular suturing is done with 3/0 non-absorbable material (silk) all round.

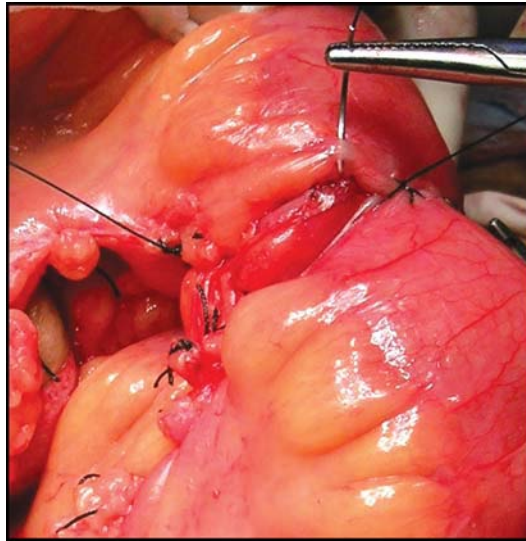


Figure 9.8: Third and fourth layers

Step 9: Closure of mesentery: The mesentery is closed with interrupted 2/0 non-absorbable sutures.

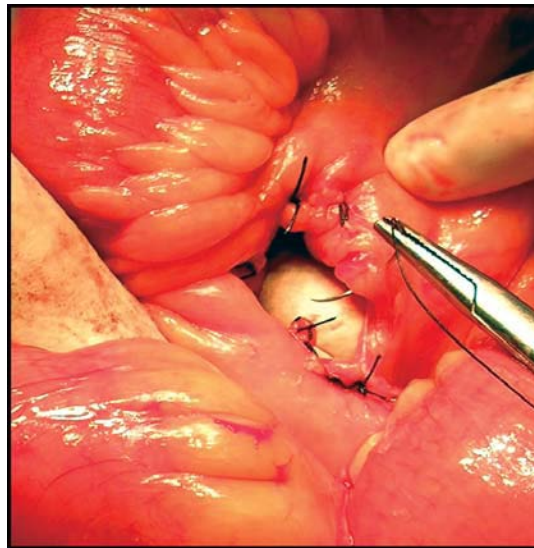


Figure 9.9: Closure of mesentery

Step 10: Wound closure: The wound is closed in layers with a tube drain at the site of anastomosis.



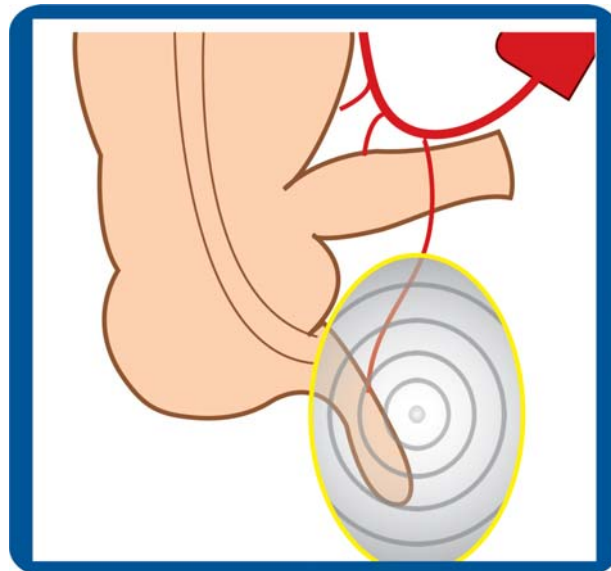
Figure 9.10: Wound closure

Resected ileum



Figure 9.11: Resected ileum

Appendicectomy



OPEN APPENDICECTOMY

Step 1: Position of patient: Supine



Figure 10.1: Position of patient

Step 2: Incision: McBurney's incision (5 cm incision, at the junction of the lateral one-third and the medial two thirds, placed perpendicular to an arbitrary line joining the umbilicus and the right anterior superior iliac spine). Alternately, a transverse incision at the same point (Lanz incision) may be preferred for better cosmetic result. A lateral extension may be required in select situations where difficulty is encountered in reaching the base of the appendix.



Figure 10.2: Mc Burney's incision

Step 3: Incising the subcutaneous tissues: The skin and the subcutaneous tissues are incised in the same line.



Figure 10.3: Incising the subcutaneous tissues

Step 4: Splitting the external oblique aponeurosis:

A small incision is made in the tendinous fibers of the external oblique aponeurosis, and split in the same line, upwards and laterally and downwards and medially with the help of scissors.

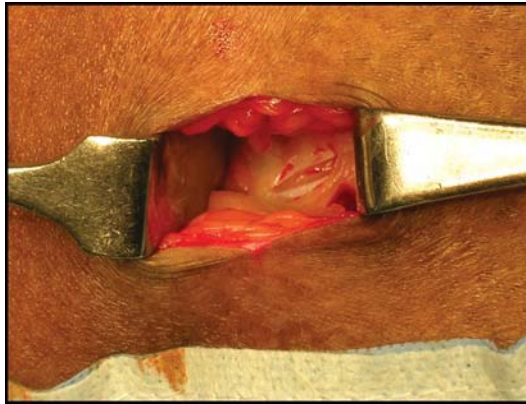


Figure 10.4: Splitting the external oblique aponeurosis

Step 5: Splitting the internal oblique and transversus abdominis muscles: A straight artery forceps is introduced into the fibers of the internal oblique and transversus abdominis muscles, they are split and separated with the help of the Czerny retractors.

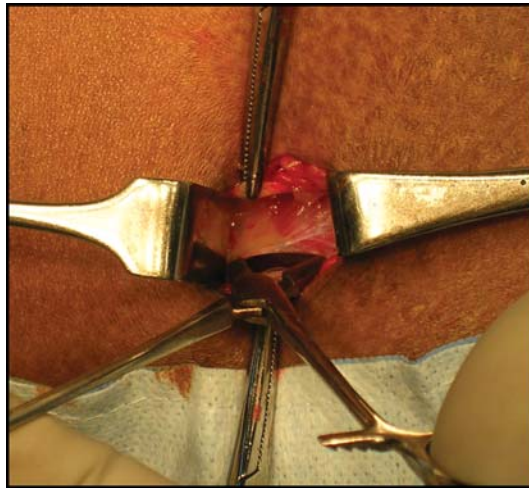


Figure 10.5: Splitting the internal oblique and transversus abdominis muscles

Step 6: Opening the peritoneum: Retraction of the muscle fibers in the previous step would allow the exposure of the peritoneum. The peritoneum is picked with straight artery forceps, and a small incision is made in the peritoneum. The incision is extended in the line of the skin incision, and the retractors inserted deeper to expose the abdominal cavity.

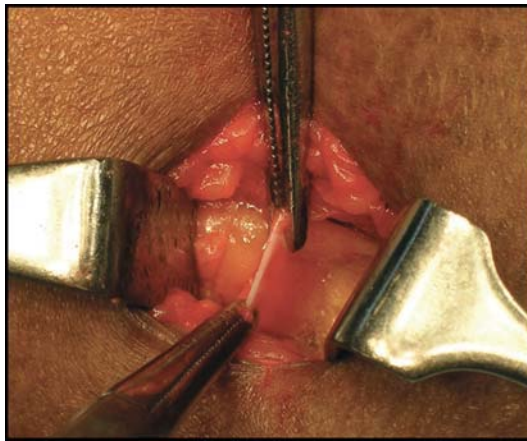


Figure 10.6: Opening the peritoneum

Step 7: Identification of the appendix: The taenia coli of the caecum are identified without any difficulty. The caecum should be picked up with the help of Turtle forceps and the taeniae should be traced towards the inferior pole of the caecum, where the base of the appendix is identified. When the appendix is lying freely, the appendix itself can be seen but should be traced to its base.

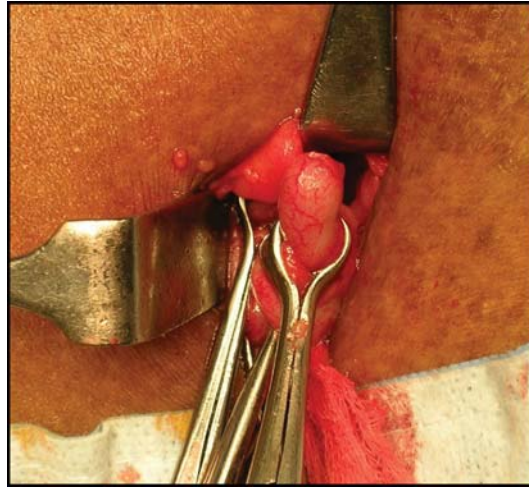


Figure 10.7: Identification of the appendix

Step 8: Delivery of the appendix: The appendix is held with two Babcock forceps and the mesoappendix should be displayed well.

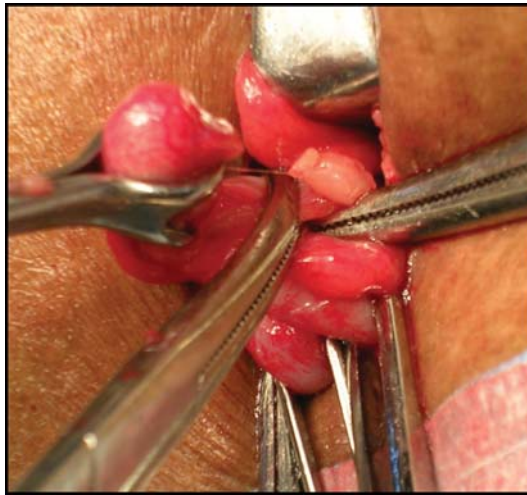


Figure 10.8: Delivery of the appendix

Step 9: Division of the mesoappendix: Small windows are made in the avascular area of the mesoappendix, and the vascular pedicle (appendicular artery) is divided between ligatures.

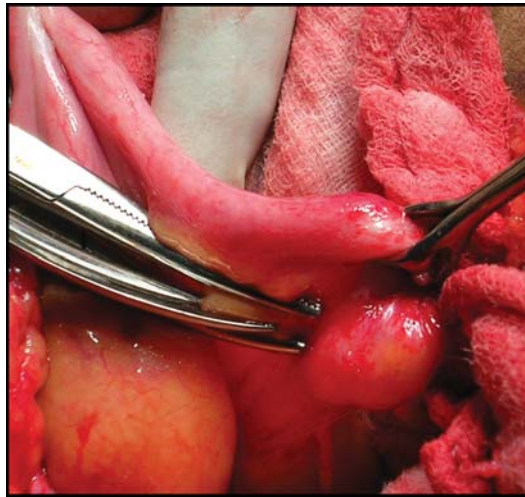


Figure 10.9: Division of the mesoappendix

Step 10: Division of the mesoappendix from the

tip: If the mesoappendix is edematous and the vascularity is not clearly visible, the mesoappendix should be divided between ligatures, starting at the tip of the appendix to its base.



Figure 10.10: Division of the mesoappendix from the tip

Step 11: Crushing the base of the appendix: The appendix is held vertically, and crushed near its base with a straight artery forceps.

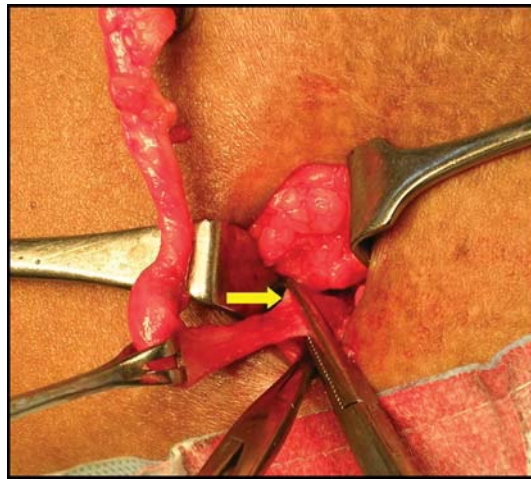


Figure 10.11: Crushing the base of the appendix

Step 12: Division of the appendix: The straight artery clamp is shifted distal to the crushed site. The appendix is ligated with 2/0 absorbable suture at the crushed site and divided between the ligature and the artery clamp with a scalpel, and the specimen removed.

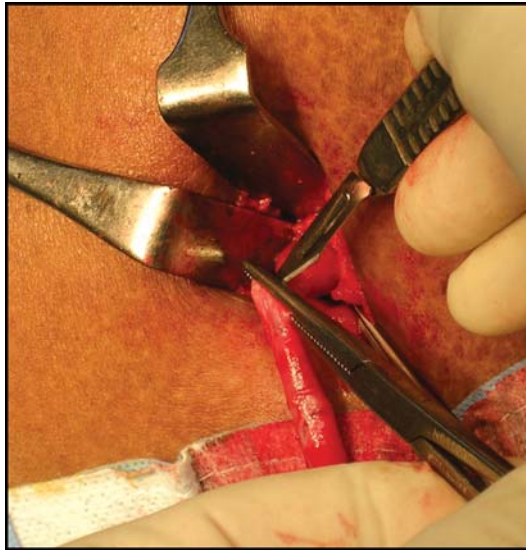


Figure 10.12: Division of the appendix

Step 13: Application of Povidone iodine: Povidone iodine is applied to the appendicular stump to disinfect it.

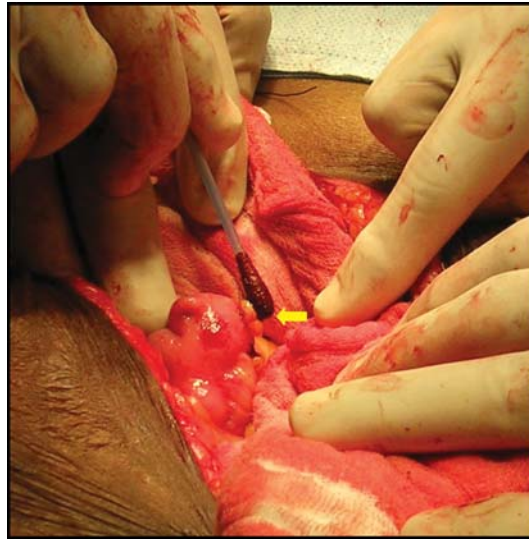


Figure 10.13: Application of Povidone iodine

Step 14: Invagination of appendicular stump: The appendix stump is invaginated into the caecum, by holding the stump with tissue forceps and buried with purse string sutures or Z suture, with 2/0 absorbable material.



Figure 10.14: Invagination of appendicular stump

Step 15: Wound closure: Wound closed in layers with continuous 2/0 absorbable sutures.



Figure 10.15: Wound closure

Step 16: Skin closure: Skin closed with staples.



Figure 10.16: Skin closure

Excised appendix

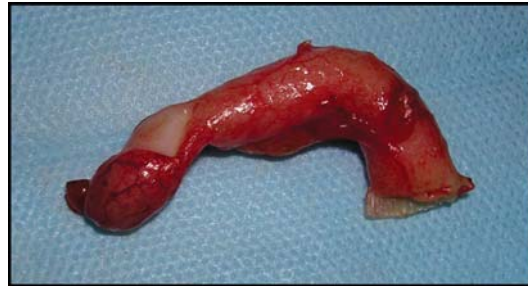


Figure 10.17: Excised appendix

LAPAROSCOPIC APPENDICECTOMY

Step 1: Operating room arrangement: The imaging instruments, the diathermy devices, suction apparatus, and the instrument trolley are arranged in a comfortable manner for the procedure to be done without any difficulty.



Figure 10.18: Operating room arrangement

Step 2: Position of the patient: Supine position with 20 degrees reverse Trendelenburg (head up) position with left lateral tilt.

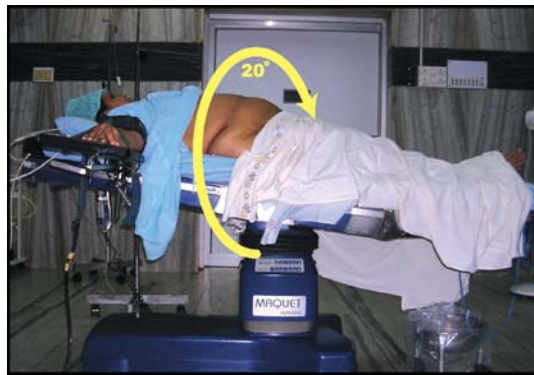


Figure 10.19: Position of the patient

Step 3: Establishment of pneumoperitoneum: A small incision is made in the infraumbilical skin fold to facilitate the insertion of Veress needle into the abdomen. The needle is inserted by lifting the abdominal wall with the left hand. After confirmation of its presence in the abdominal cavity, the needle is connected to the insufflator. The peritoneal cavity is distended with carbon dioxide until a pressure of 12-15 mm Hg is obtained.

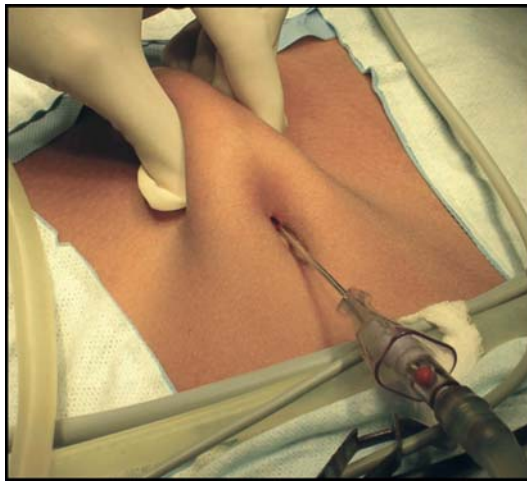


Figure 10.20: Establishment of pneumoperitoneum

Step 4: Insertion of trocar for camera: A 10 mm incision is made at the site of the previous incision (umbilical port), and a 10 mm trocar is inserted into the abdominal cavity directing it downwards.

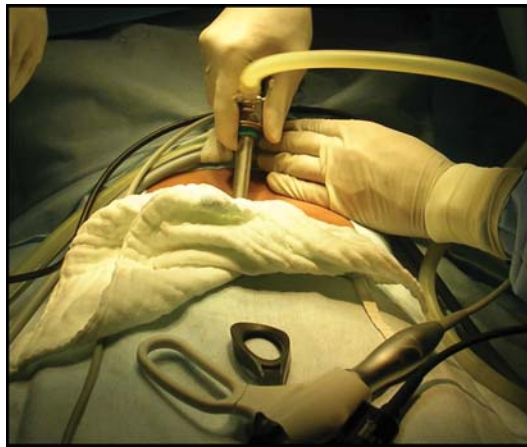


Figure 10.21: Insertion of trocar for camera

Step 5: Exploration of abdomen: The camera is inserted into the umbilical port and turned all round to examine the entire abdominal cavity, and also to determine the base of the appendix.

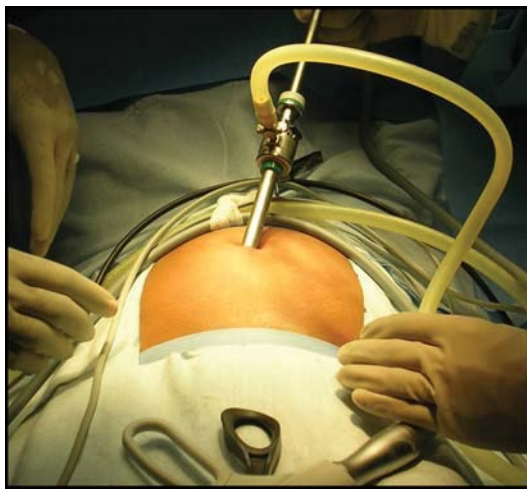


Figure 10.22: Exploration of abdomen

Step 6: Insertion of first accessory cannula: The abdominal wall is illuminated near the base of the appendix by the light source. An accessory 5 mm trocar is inserted near the base of the appendix, under direct laparoscopic vision. This will help in holding the appendix.



Figure 10.23: Insertion of first accessory cannula

Step 7: Insertion of second accessory cannula:

Another 10 mm accessory trocar is inserted in the midline just above the pubic symphysis (hypogastric port), under direct laparoscopic vision.



Figure 10.24: Insertion of second accessory cannula

Step 8: Position of all three ports: Camera is shifted to the hypogastric port and the dissection is carried on through the umbilical port.

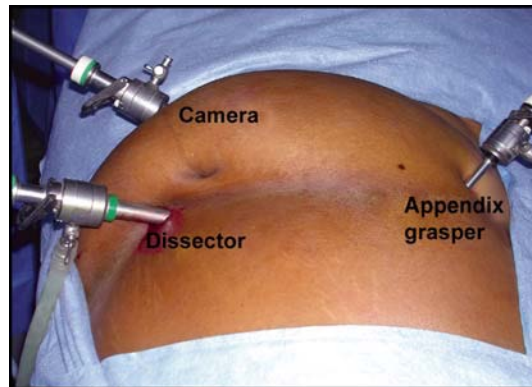


Figure 10.25: Position of all three ports

Step 9: Dissection of the appendix: The appendix is lifted with the grasping forceps through the first accessory port. The dissection is carried out starting from the tip of the appendix proceeding to the base, with diathermy coagulation.



Figure 10.26: Dissection of the appendix

Step 10: Ligation of the appendix: Two 1/0 absorbable pretied laparoscopic ligatures (arrows) are used to ligate the appendicular stump.

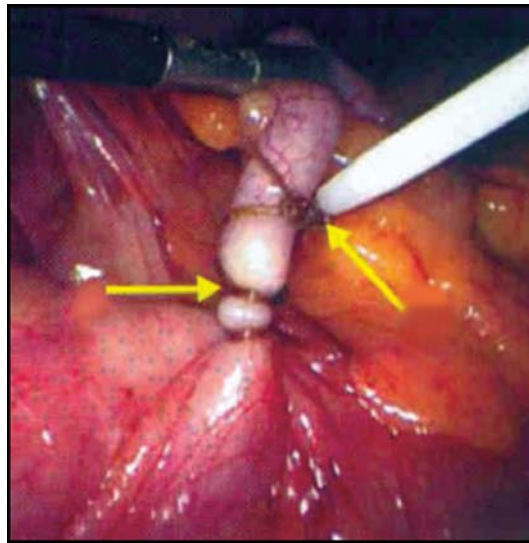


Figure 10.27: Ligation of the appendix

Step 11: Division of the appendix: The appendix is divided with scissors between ligatures [Alternatively this can be divided using an intestinal stapling device (linear cutter)].

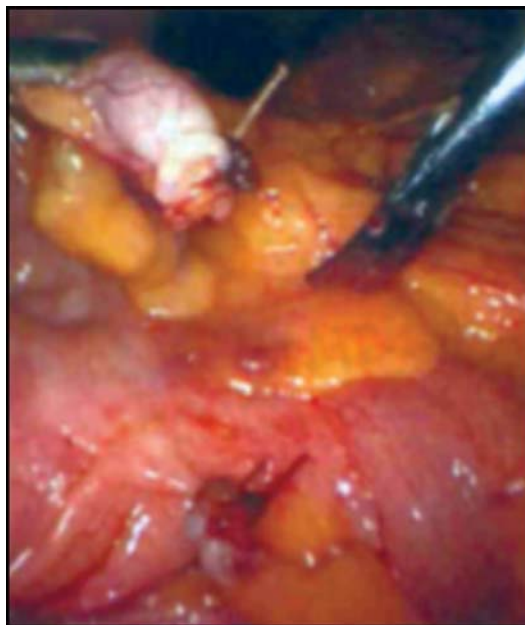


Figure 10.28: Division of the appendix

Step 12: Removal of the appendix: The appendix is removed through the 10 mm cannula without contaminating the anterior abdominal wall.

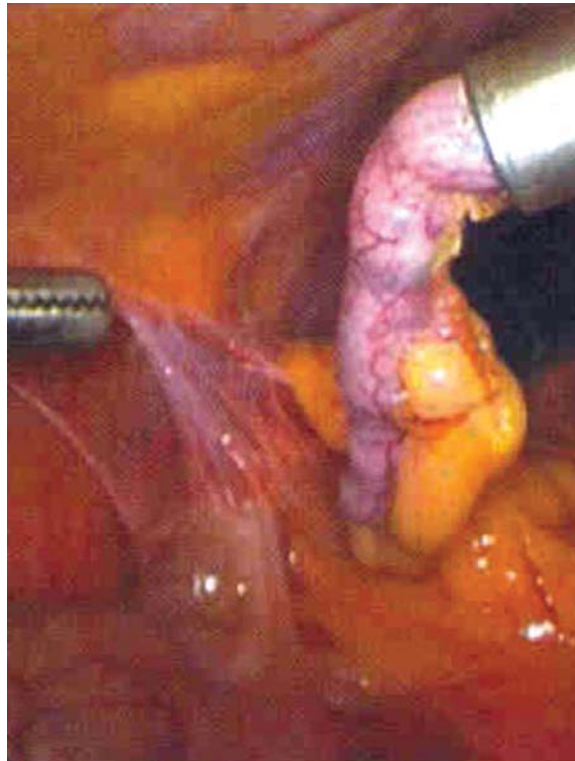


Figure 10.29: Removal of the appendix

Step 13: Wound closure: The umbilical incision needs to be closed meticulously, the rent in the linea alba with 1/0 non-absorbable suture. The accessory wounds may be closed with skin sutures or staples.



Figure 10.30: Wound closure

Excised appendix

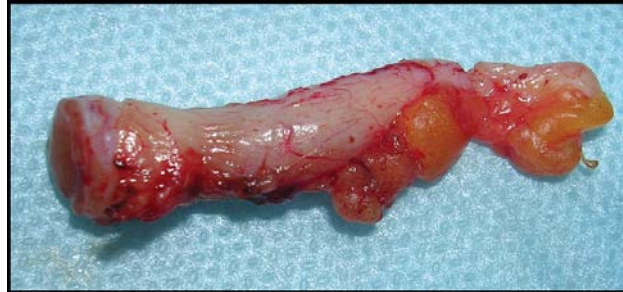
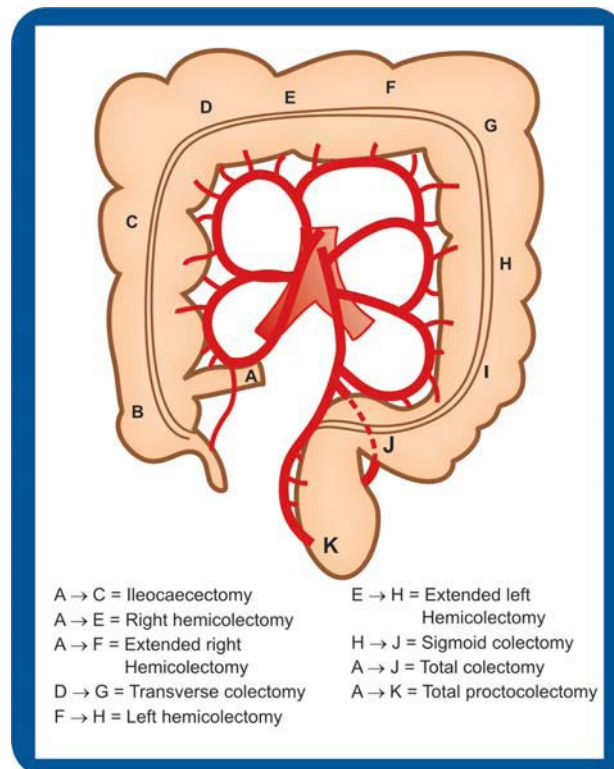


Figure 10.31: Excised appendix

Colectomy



RIGHT HEMICOLECTOMY (ILEOCOLECTOMY)

Step 1: Position of the patient: Supine



Figure 11.1: Position of the patient

Step 2: Incision: Right lower paramedian incision



Figure 11.2: Incision

Step 3: Mobilization of caecum and ascending colon

colon: After exploration of the abdomen, the caecum and ascending colon are mobilized by incising the peritoneum and retracted towards midline, the incision is extended proximally upto the mid-transverse colon through the omentum.



Figure 11.3: Mobilization of caecum and ascending colon

Step 4: Safeguarding the right ureter and gonadal vessels: The right ureter and gonadal vessels are to be safeguarded next.

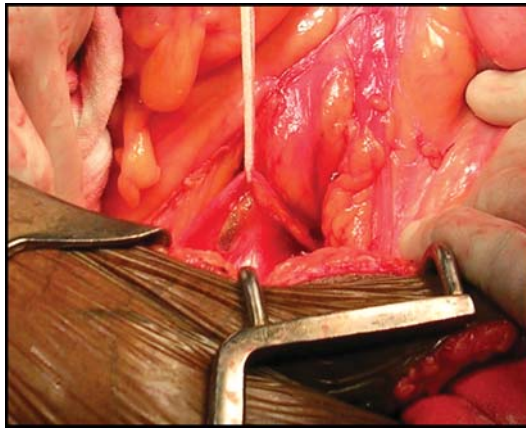


Figure 11.4: Safeguarding the right ureter and gonadal vessels

Step 5: Complete mobilization: The right colon should be completely mobilized and detached from all its attachments.

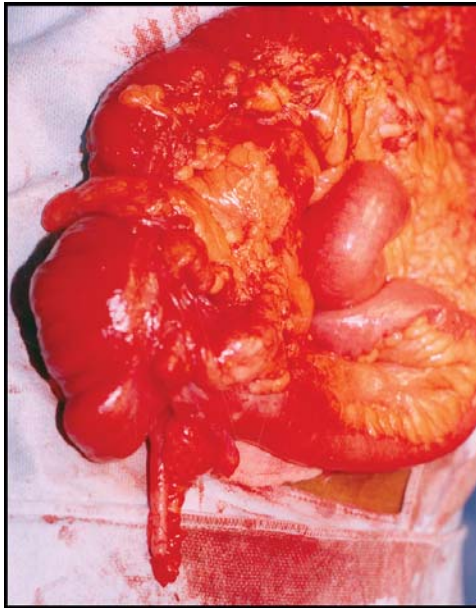


Figure 11.5: Complete mobilization

Step 6: Division of mesocolic vessels: The vessels are divided between ligatures, upto the lines of resection.

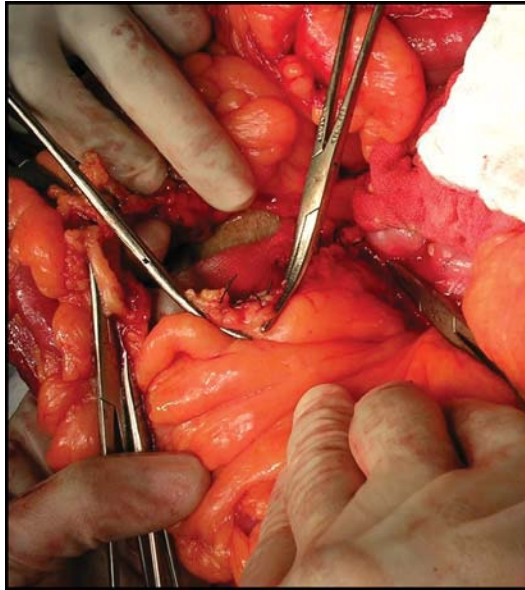


Figure 11.6: Division of mesocolic vessels

Step 7: Division of bowel: The terminal ileum and the mid transverse colon are divided with non-crushing clamps, to preserve vascularity and prevent spillage.

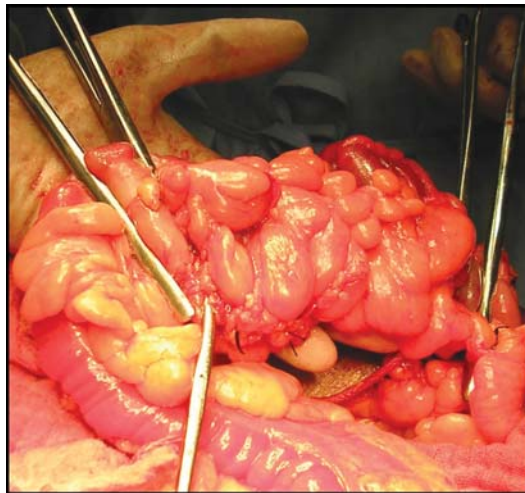


Figure 11.7: Division of bowel

Step 8: Anastomosis of resected ends: Ileo-colic anastomosis is done with classical four layer hand sewn method.

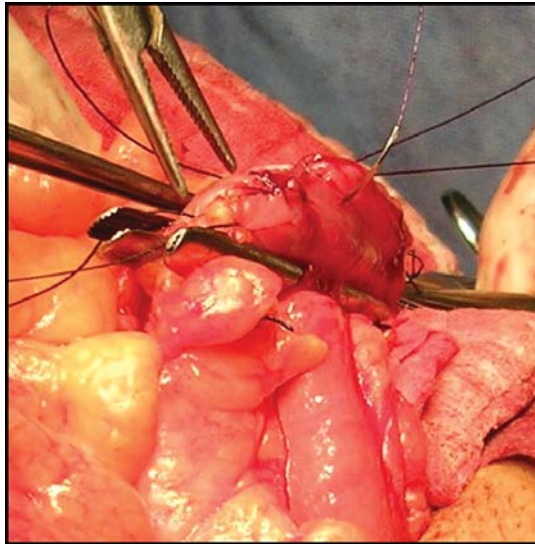


Figure 11.8: Anastomosis of resected ends

Step 9: Closure of mesentery: The mesentery is closed with interrupted 2/0 non-absorbable sutures.

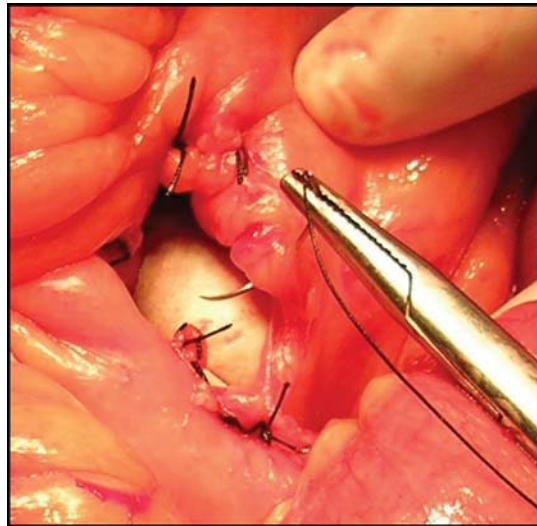


Figure 11.9: Closure of mesentery

Step 10: Wound closure: The wound is closed in layers with a tube drain at the site of anastomosis.



Figure 11.10: Wound closure

Right hemicolectomy specimens



Figures 11.11A and B: Right hemicolectomy specimens

LEFT HEMICOLECTOMY

Step 1: Position of the patient: Supine



Figure 11.12: Position of the patient

Step 2: Incision: Left lower paramedian incision



Figure 11.13: Incision

Step 3: Mobilization of sigmoid and descending colon: After exploration of the abdomen, the sigmoid and descending colon are mobilized by incising the peritoneum and retracted towards midline.

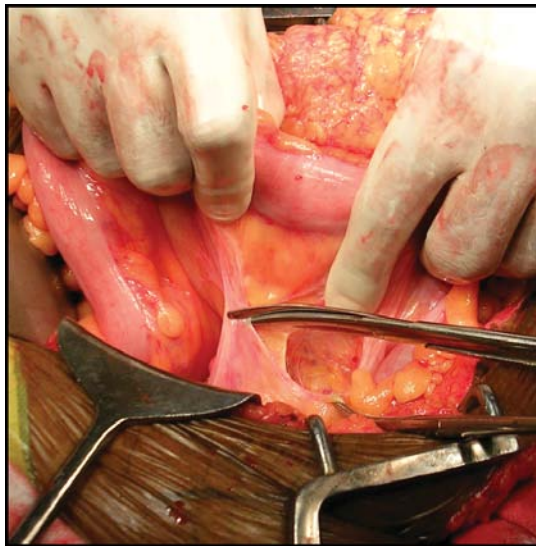


Figure 11.14: Mobilization of sigmoid and descending colon

Step 4: Identification of left ureter: The left ureter and gonadal vessels are to be identified and safeguarded.

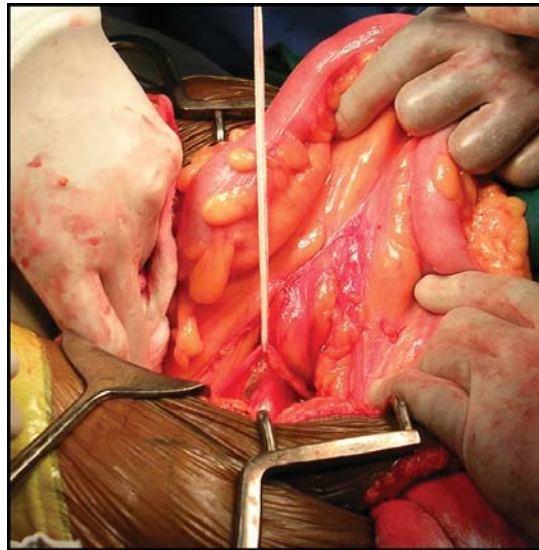


Figure 11.15: Identification of left ureter

Step 5: Extension of incision on peritoneum: The incision is extended proximally upto the mid-transverse colon by releasing the splenic flexure.

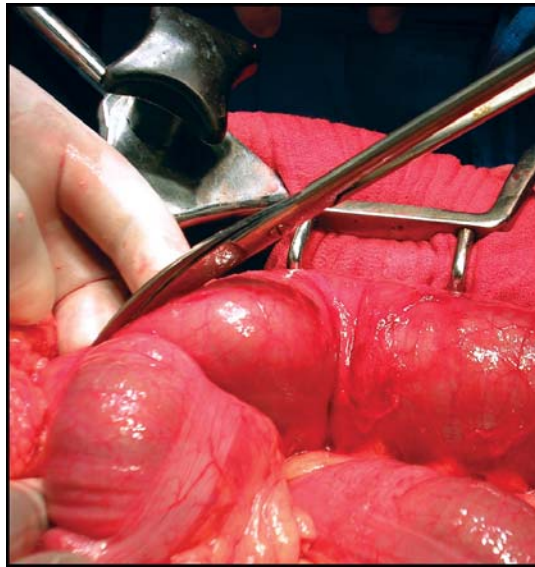


Figure 11.16: Extension of incision on peritoneum

Step 6: Retraction of left colon: The transverse colon, splenic flexure and the descending colon are retracted well.

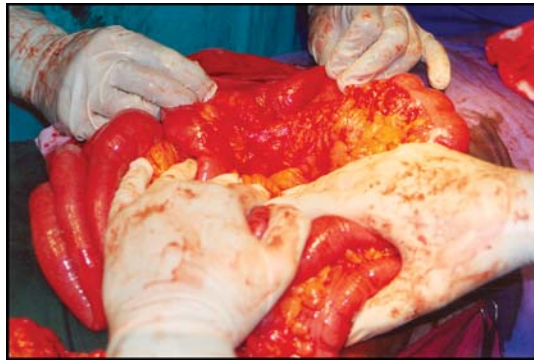


Figure 11.17: Retraction of left colon

Step 7: Division of mesocolic vessels: The vessels are divided between ligatures, upto the lines of resection.

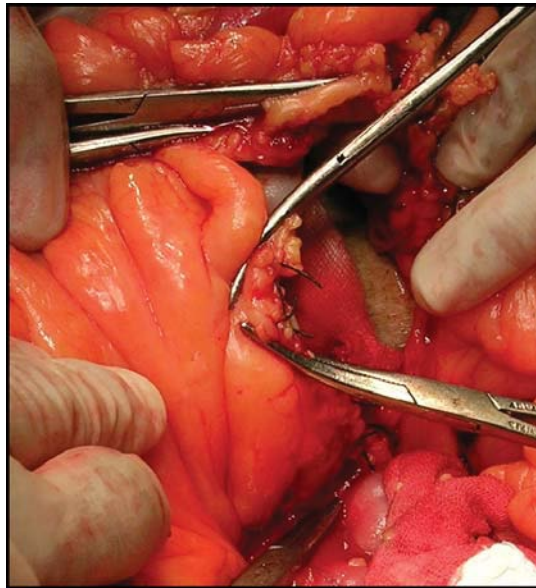


Figure 11.18: Division of mesocolic vessels

Step 8: Division of bowel: The sigmoid and the mid transverse colon are divided between non-crushing clamps, to preserve vascularity and prevent spillage.

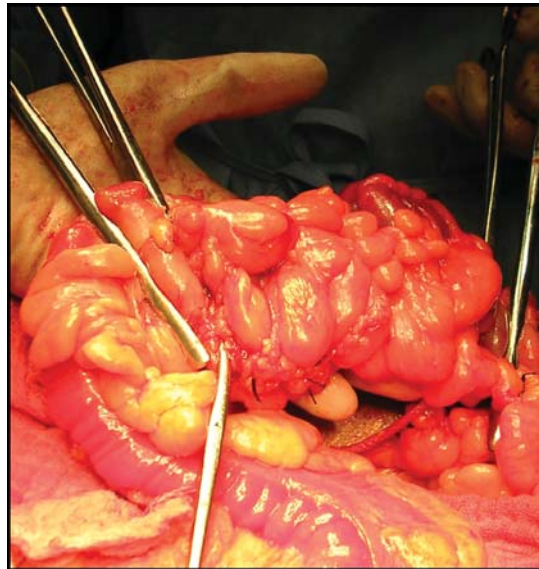


Figure 11.19: Division of bowel

Step 9: Anastomosis of resected ends: Colo colic anastomosis is done with classical four layer hand sewn method.

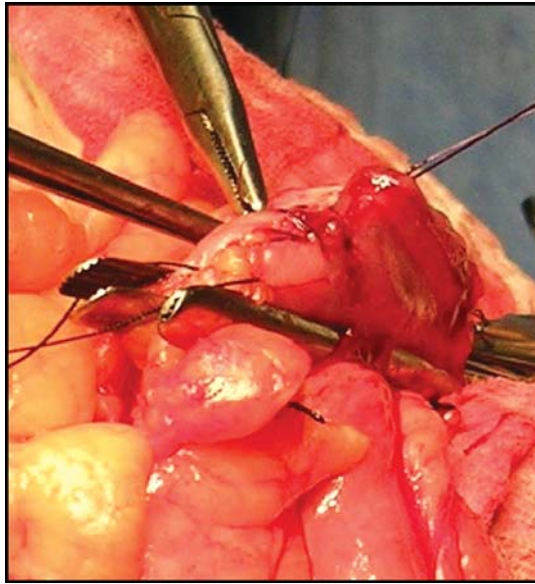


Figure 11.20: Anastomosis of resected ends

Step 10: Closure of mesocolon: The mesocolon is closed with interrupted 2/0 non-absorbable sutures.

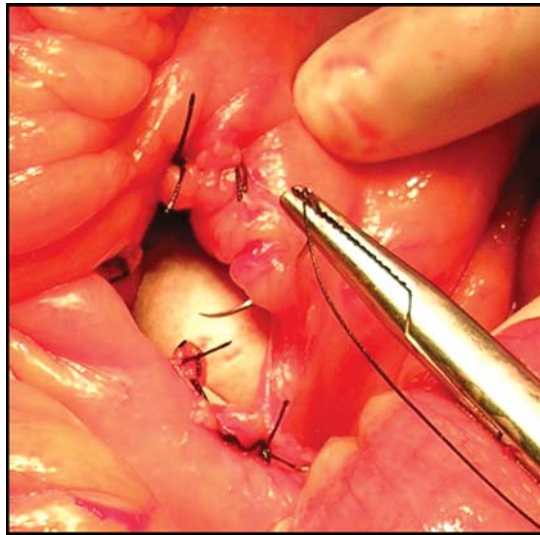


Figure 11.21: Closure of mesocolon

Step 11: Wound closure: The wound is closed in layers with a tube drain at the site of anastomosis.



Figure 11.22: Wound closure

Left hemicolectomy specimen



Figure 11.23: Left hemicolectomy specimen

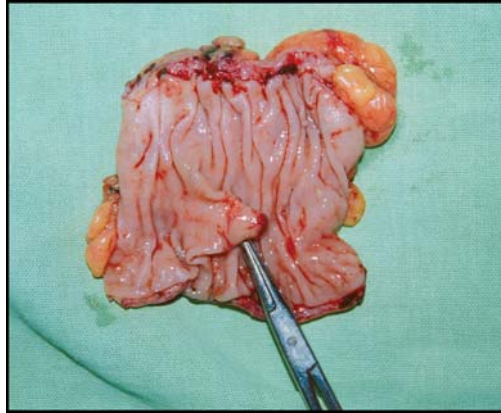
Segmental colectomy specimen for benign lesion

Figure 11.24A: Segmental colectomy specimen for benign lesion

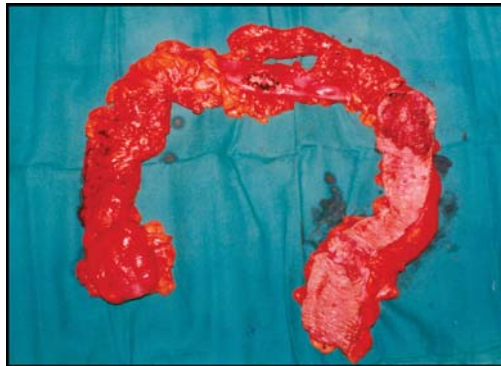
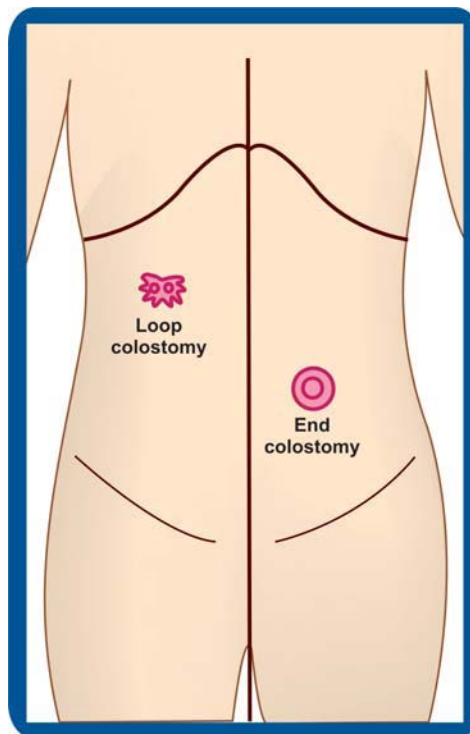
Total colectomy specimen for multicentric malignancy in multiple polyposis

Figure 11.24B: Total colectomy specimen for multicentric malignancy in multiple polyposis

Colostomy



TERMINAL COLOSTOMY

Step 1: Skin incision: At the marked site for colostomy, the skin is picked with Kocker's forceps. A circular incision is made to excise a disc of skin and subcutaneous fat approximately 2 cm diameter.



Figure 12.1: Skin incision

Step 2: Incision on rectus sheath: A cruciate incision is made in the exposed anterior rectus sheath.

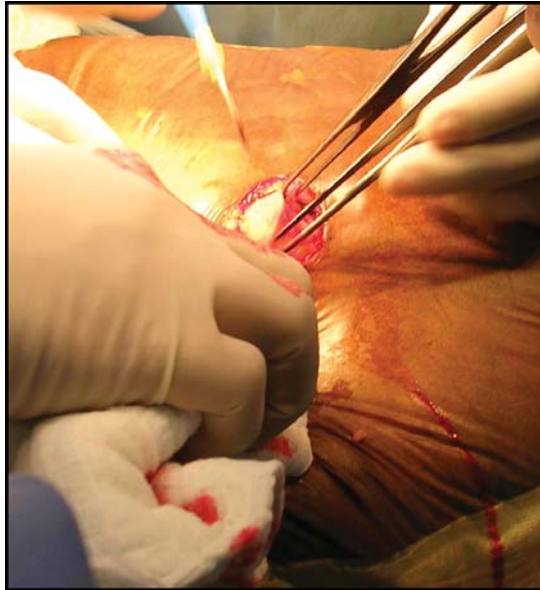


Figure 12.2: Incision on rectus sheath

Step 3: Splitting of rectus abdominis muscle: The muscle fibers are split using Mayo's scissors. The defect should accommodate two fingers comfortably.

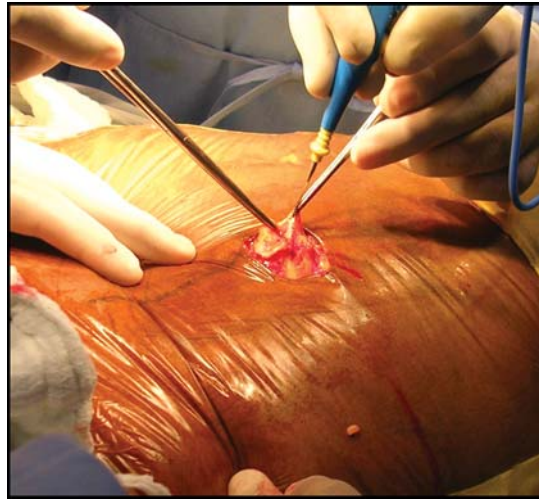


Figure 12.3: Splitting of rectus abdominis muscle

Step 4: Fixing the peritoneum to the skin: The peritoneum is fixed to subcutaneous tissues at equidistant places, to prevent a herniation in the subcutaneous plane.

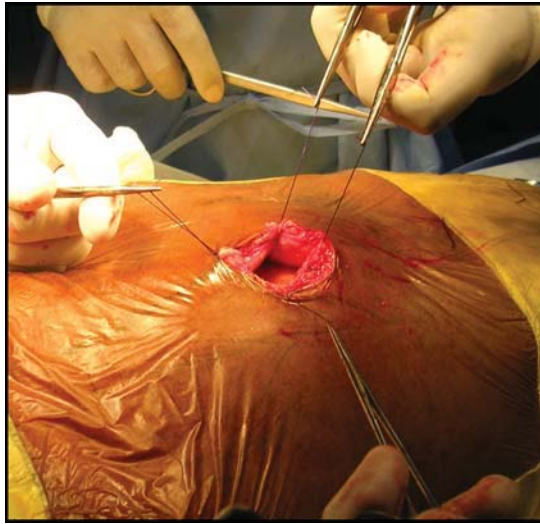


Figure 12.4: Fixing the peritoneum to the skin

Step 5: Delivery of colon: The colon is delivered through the colostomy opening.

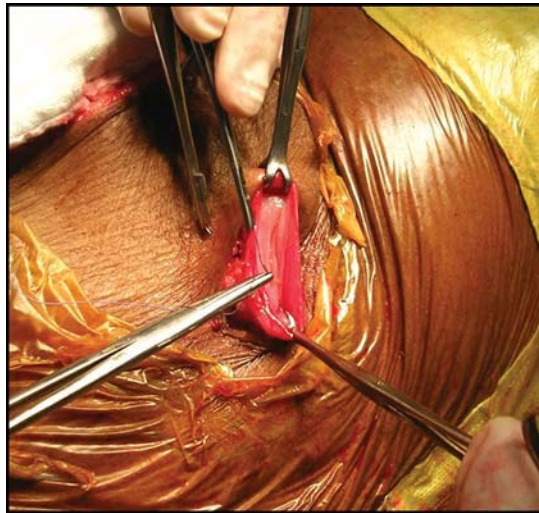


Figure 12.5: Delivery of colon

Step 6: Closure of lateral space: Before the main abdominal incision is closed, it is important to close the space between the mesocolon and the abdominal wall (lateral space) with non-absorbable sutures to prevent the possible complication of internal herniation of small bowel.



Figure 12.6: Closure of lateral space

Step 7: Mucocutaneous suturing: The clamp on the colon is removed and mucocutaneous suturing is done with 3/0 absorbable sutures. The sutures should be taken through the seromuscular layer avoiding mucosal perforation.

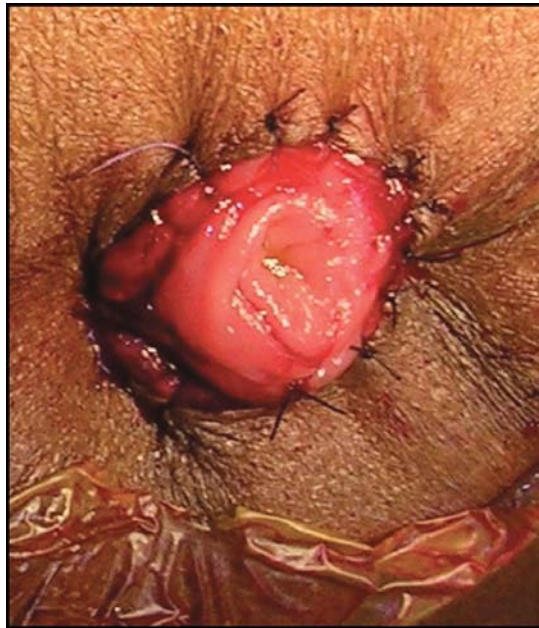


Figure 12.7: Mucocutaneous suturing

Step 8: Fitting the appliance: A disposable colostomy bag is applied before shifting out of the operating room.



Figure 12.8: Fitting the appliance

LOOP COLOSTOMY

Step 1: Position: Supine



Figure 12.9: Supine position

Step 2: Skin incision: A 6-7 cm transverse incision, the center of which lies midway between the umbilicus and the right costal margin, over the lateral border of the right rectus muscle.

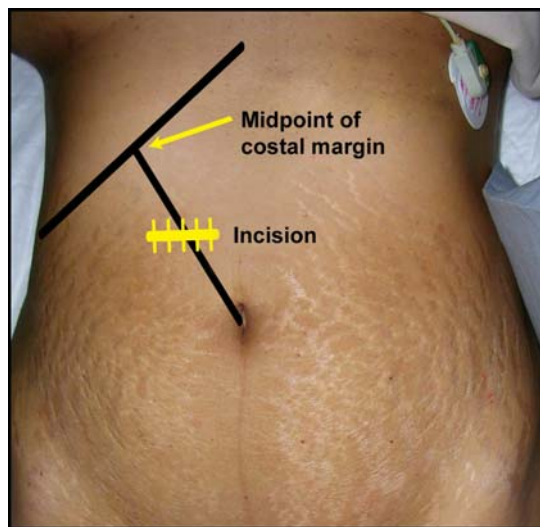


Figure 12.10: Skin incision

Step 3: Deepening the incision: The incision is deepened in the same line till the abdomen is opened.

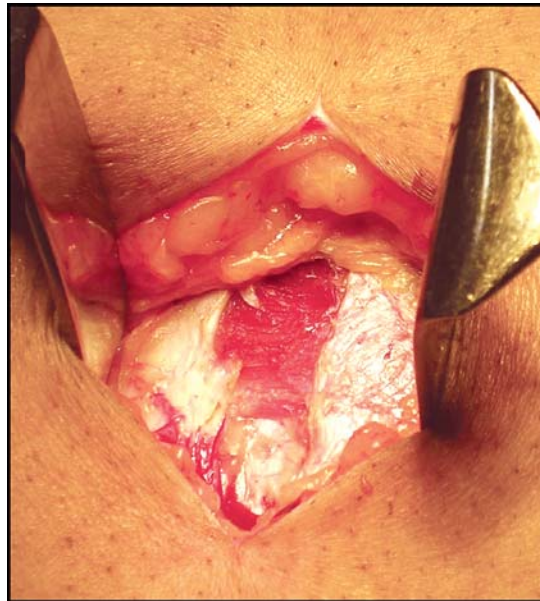


Figure 12.11: Deepening the incision

Step 4: Preparation of colon: The transverse colon is picked with the omentum, and the omentum is disconnected from the free edge of the transverse colon.

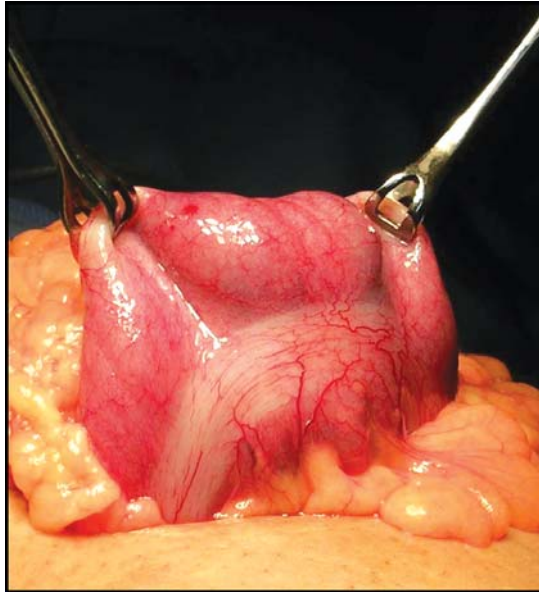


Figure 12.12: Preparation of colon

Step 5: Stabilizing the colon: A window is created in the transverse mesocolon and a rod or a tube is passed through the window and the colon is stabilized.

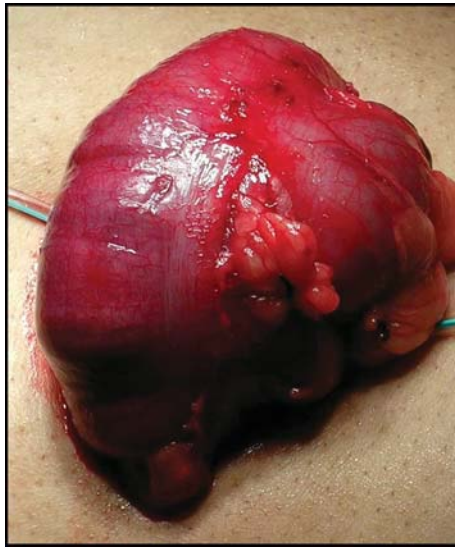


Figure 12.13: Stabilizing the colon

Step 6: Opening the colon: The colon may be opened with diathermy either longitudinally or transversely.

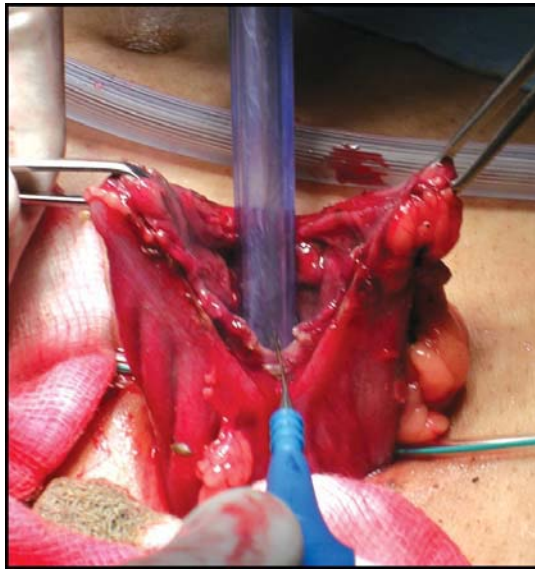


Figure 12.14: Opening the colon

Step 7: Mucocutaneous suturing: Mucocutaneous suturing is done with 2/0 absorbable interrupted sutures.



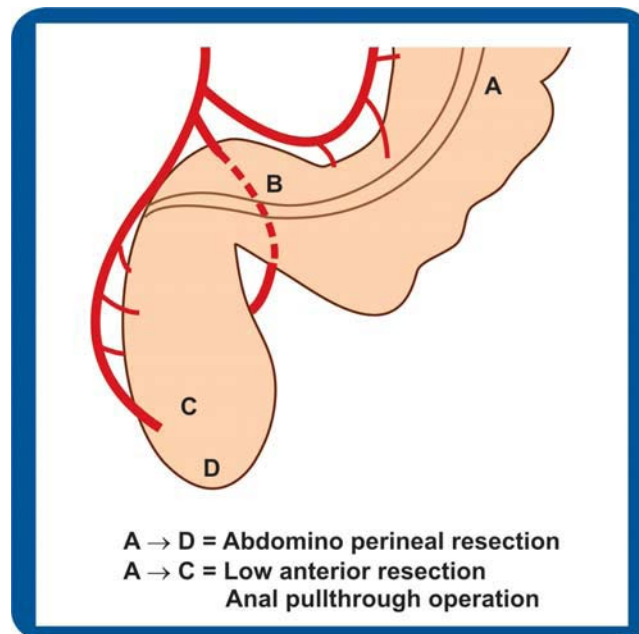
Figure 12.15: Mucocutaneous suturing

Step 8: Fitting the appliance: A colostomy bag may be fitted immediately in the operation theater.



Figure 12.16: Fitting the appliance

Colorectal Resections



Step 1: Position of the patient: Lithotomy Trendelenburg position with a sandbag beneath the sacrum. The legs should be positioned on the stirrups so as to avoid compression of peroneal nerve.



Figure 13.1A



Figure 13.1B

Figures 13.1A and B: Lithotomy Trendelenburg position

Step 2: Position of the surgeon and assistants:

Operating surgeon stands to the left of the patient and the first assistant to the right of the patient. The second assistant is next to the surgeon. The nurse is next to the first assistant, with the instrument trolley over the patient's pubic region.



Figure 13.2: Position of the surgeon and assistants

ABDOMINO PERINEAL RESECTION (APR)

Preliminary step 1: Site for colostomy should be chosen and marked in the ward, patient sitting or standing, preferably in the left lower quadrant at the apex of the infraumbilical skin fold, for the patient to see and manage on her/his own.



Figure 13.3: Site for colostomy marked as patient

Preliminary step 2: Urinary bladder should be catheterized with Foley's catheter. 2/0 purse string suture should be applied to occlude the anal opening totally.

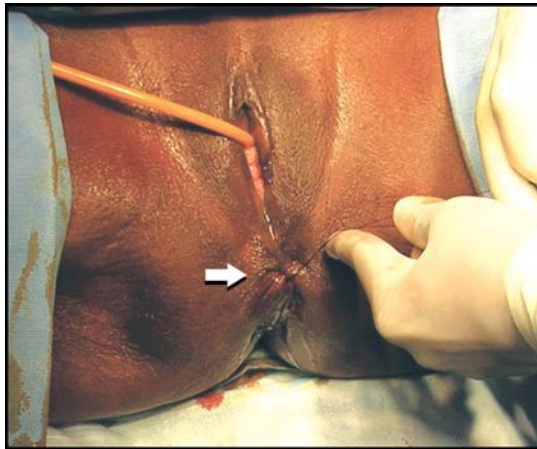


Figure 13.4: Catheterization of urinary bladder

ABDOMINAL DISSECTION

Step 1: Incision: Left lower paramedian or midline incision extending above the umbilicus encircling it.

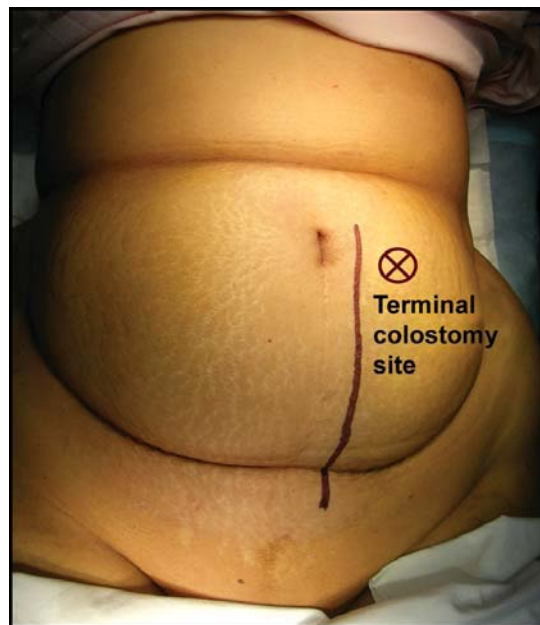


Figure 13.5: Left lower paramedian or midline incision

Step 2: Release of sigmoid colon: Exposure is maintained with self-retained retractors. After exploration, congenital adhesions in the paracolic gutter are divided. The peritoneum along the base of the rectosigmoid mesentery in the left gutter is picked with tissue forceps and incised with scissors. It is extended proximally to the planned site of transection.

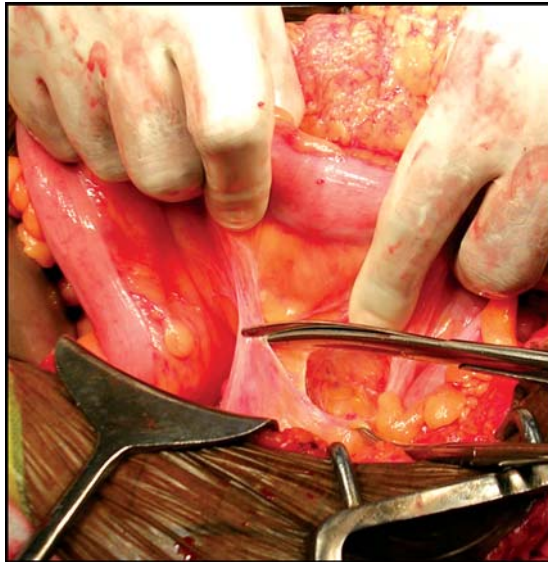


Figure 13.6: Release of sigmoid colon

Step 3: Identification of left ureter: The incision is extended distally towards the pelvic brim and to the base of the urinary bladder. The left ureter should be identified during this step.

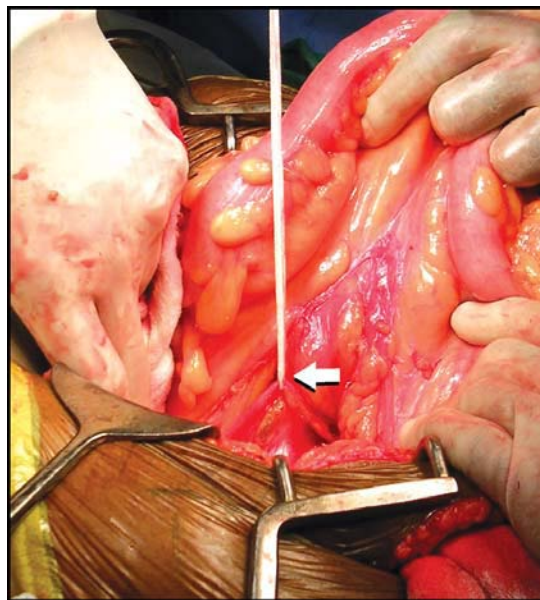


Figure 13.7: Identification of left ureter

Step 4: Release of sigmoid colon from the right

side: The sigmoid colon is retracted to the left and the peritoneum on the right side of the mesentery is incised. It is extended proximally to the aortic bifurcation. It is extended distally towards the pelvic brim to the base of the bladder and joined with the left incision above the floor of the rectovesical pouch. The right ureter should be identified at this stage.

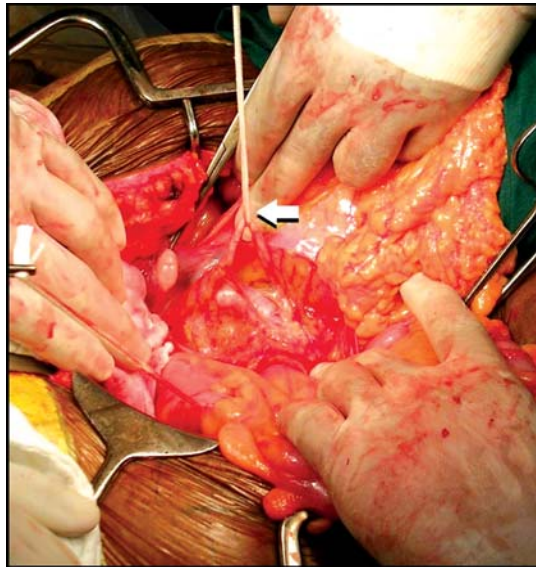


Figure 13.8: Release of sigmoid colon from the right side

Step 5: Entry into presacral space: Traction is maintained on the sigmoid colon and the presacral space is entered with the right index finger, and blunt dissection is carried out to displace the rectum anteriorly.

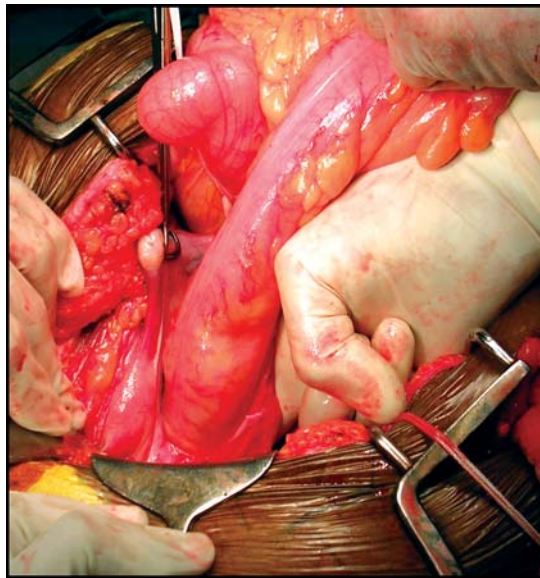


Figure 13.9: Entry into presacral space

Step 6: Anterior dissection: Anteriorly, the rectum is mobilized by sharp dissection, by retracting the urinary bladder (in males) and the uterus (in females) anteriorly.

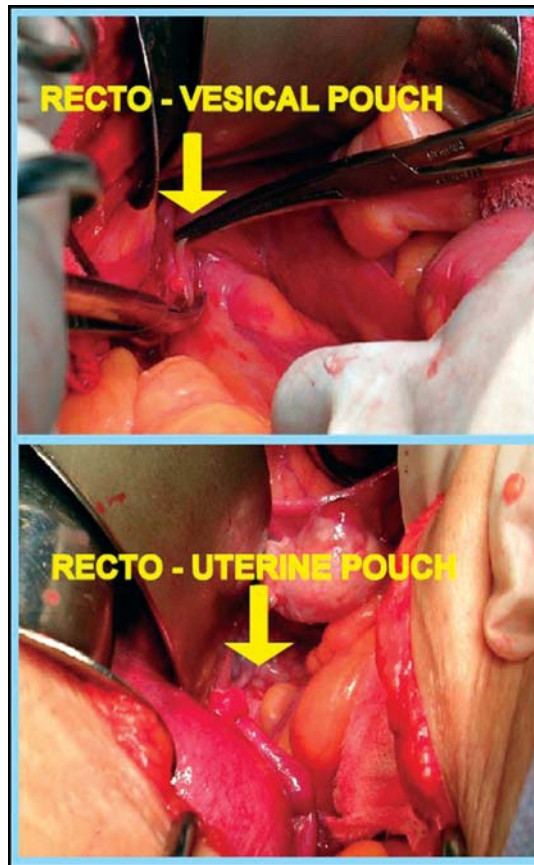


Figure 13.10: Anterior dissection

Step 7: Left lateral dissection: Next is to mobilize the rectum from the left lateral wall. This will involve division of lateral ligaments which may contain the branches of left middle rectal vessels. The ligaments are thinned out by the index and middle fingers, and divided between ligatures.

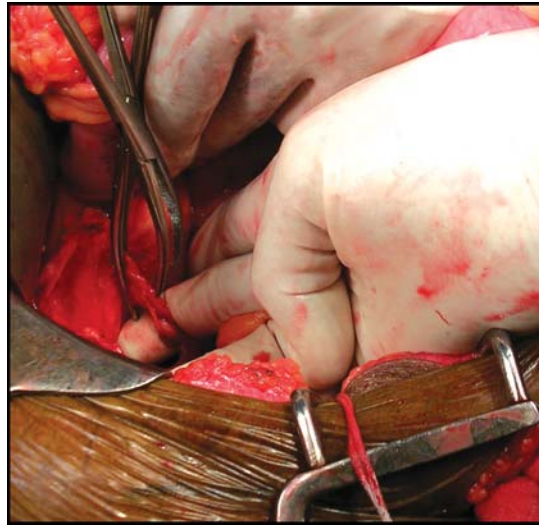


Figure 13.11: Left lateral dissection

Step 8: Right lateral dissection: The rectum needs to be mobilized from the right lateral wall. The lateral ligaments are thinned out as in the left side and divided between ligatures, as it may contain the right middle rectal vessels.

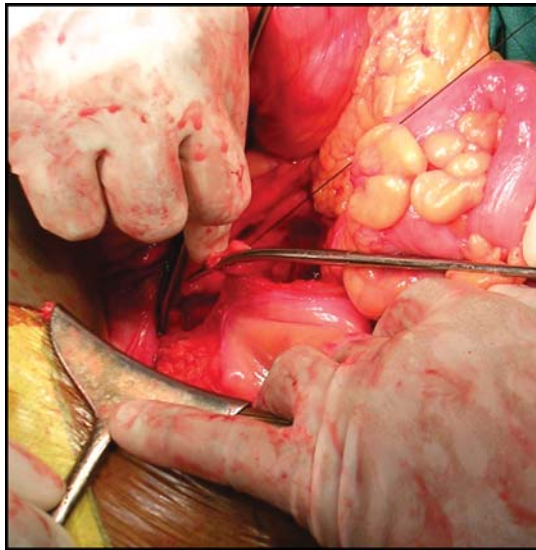


Figure 13.12: Right lateral dissection

Step 9: Establishment of separation of rectum: The separation of colon and rectum from all its attachments on all sides should be established by pulling it up and also sweeping the fingers all round the rectum as far down as possible.

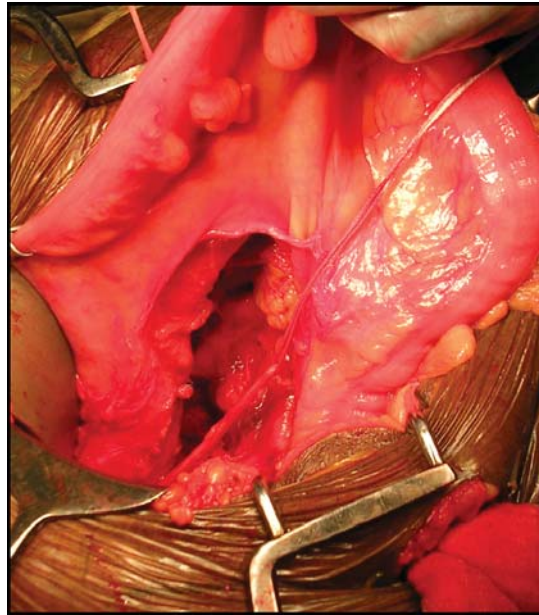


Figure 13.13: Establishment of separation of rectum

Step 10: Ligation of inferior mesenteric vessels:

The branches of inferior mesenteric vessels are isolated and divided between ligatures.

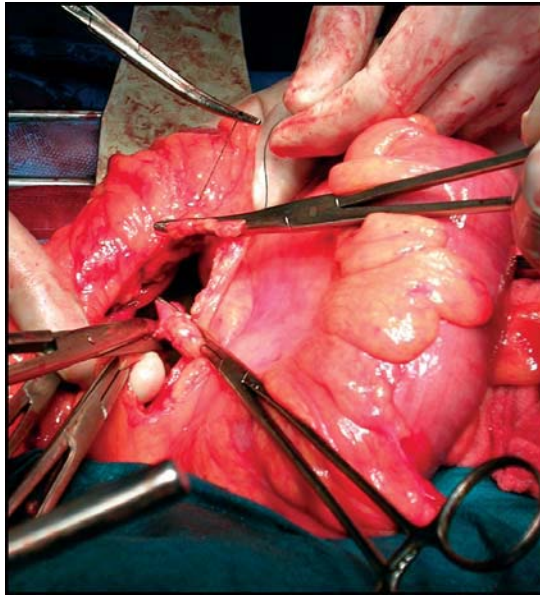


Figure 13.14: Ligation of inferior mesenteric vessels

Step 11: Division of colon: The colon is divided between clamps (non-crushing clamp proximally and the crushing clamp distally) at the marked site.

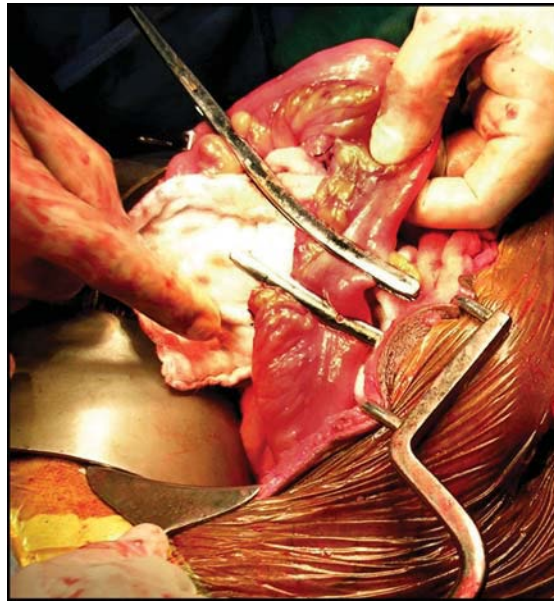


Figure 13.15: Division of colon

PERINEAL DISSECTION

Step 12: Incision: The perineal surgeon starts his surgical procedure with an elliptical incision enclosing the closed anal opening. The incision extends to the tip of the coccyx.



Figure 13.16: Incision

Step 13: Lateral dissection: The dissection begins laterally. The perianal fat is divided with cautery to enter the ischiorectal fossa. The anterior branches of inferior rectal arteries are divided between ligatures. The same is performed on both sides.

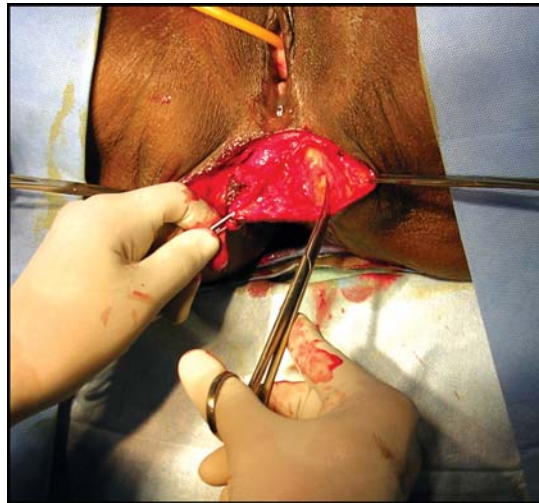


Figure 13.17: Lateral dissection

Step 14: Anterior dissection: The anterior dissection is carried out by deepening at the posterior border of the deep transverse perineal muscle.

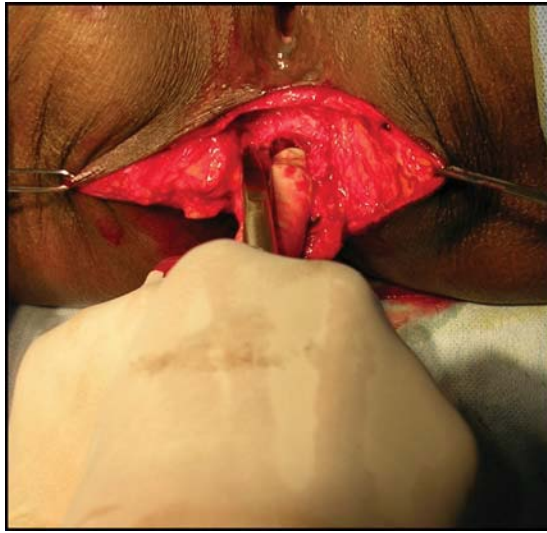


Figure 13.18: Anterior dissection

Step 15: Posterior dissection: The posterior dissection is carried out by dividing the anococcygeal ligament with scissors. The presacral space is entered along a plane close to the tip of the coccyx, and dividing the levator ani muscles in the posterior midline. This step is guided by the abdominal surgeon, and the dissectors meet.

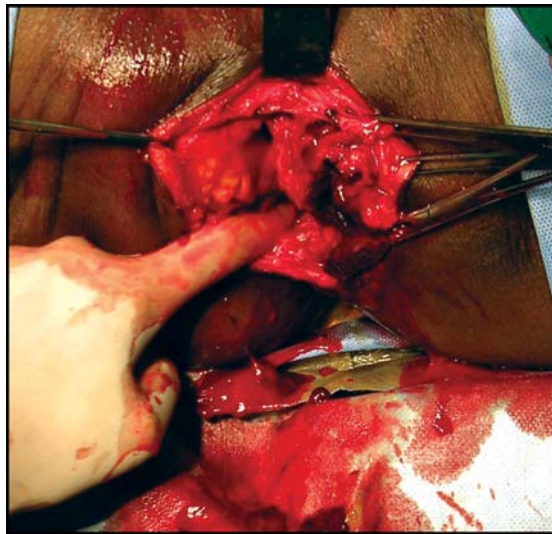


Figure 13.19: Posterior dissection

Step 16: Removal of specimen: The specimen is free from all its attachments, and it is removed by the perineal surgeon.

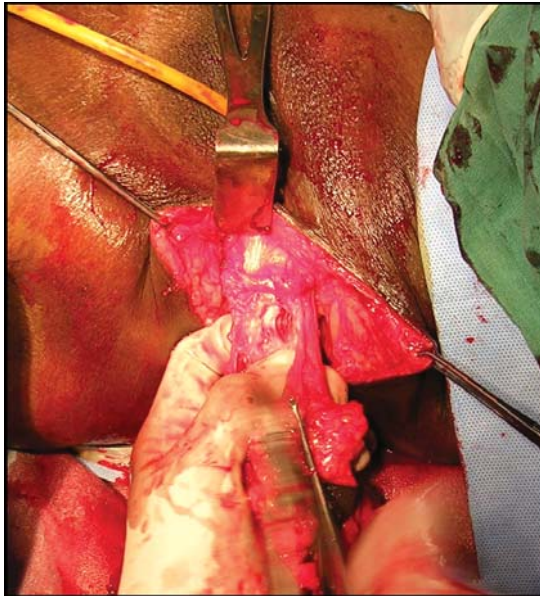


Figure 13.20: Removal of specimen

Step 17: Hemostasis: A perfect hemostasis should be established in the resected area and the pelvic cavity is irrigated well.



Figure 13.21: Hemostasis

Step 18: Closure of pelvic peritoneum: The pelvic peritoneum is closed by the first assistant (now abdominal surgeon).

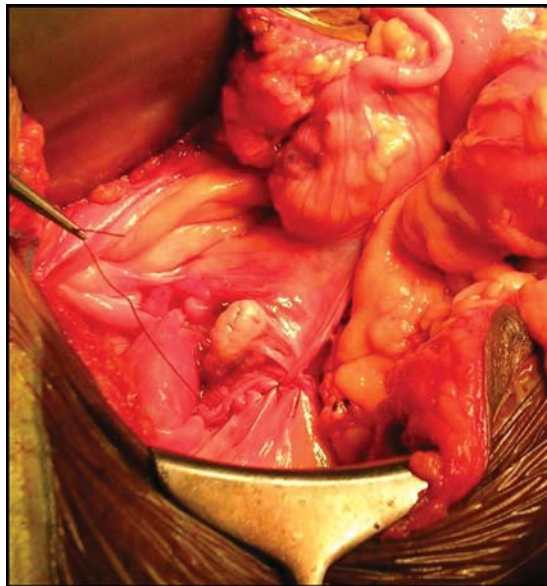


Figure 13.22: Closure of pelvic peritoneum

Step 19: Creation of colostomy: Terminal colostomy is created (see chapter Colostomy) and the abdomen is closed.



Figure 13.23: Creation of colostomy

Step 20: Closure of perineal wound: The perineal wound is closed with interrupted 2/0 absorbable sutures with a drainage tube in situ.



Figure 13.24: Closure of perineal wound

Note: When the abdomino perineal resection is performed synchronously by two operating teams, the perineal dissection can be started when the resectability is assessed and confirmed by the abdominal surgeon.

Final appearance: Final appearance after abdominoperineal resection.



Figure 13.25: Final appearance after abdominoperineal resection

Resected ano-recto-colon

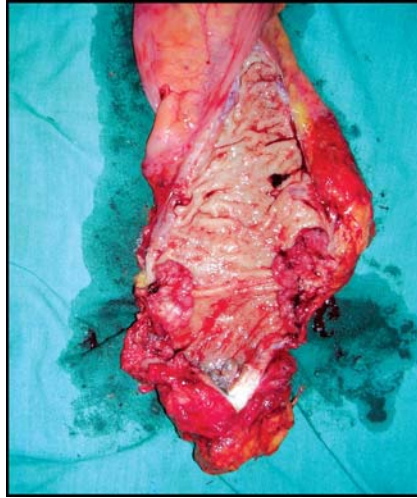


Figure 13.26: Resected ano-recto-colon

LOW ANTERIOR RESECTION

Steps 1 to 9: Steps are the same as performed by the abdominal surgeon during abdominoperineal resection.

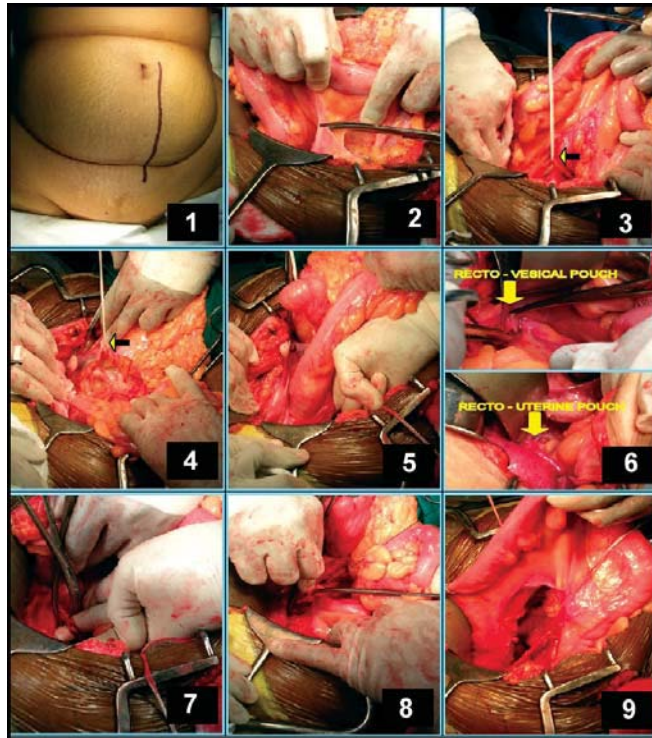


Figure 13.28: Steps of low anterior resection

Step 10: Ligation of inferior mesenteric vessels:

The branches of inferior mesenteric vessels are isolated and divided between ligatures.

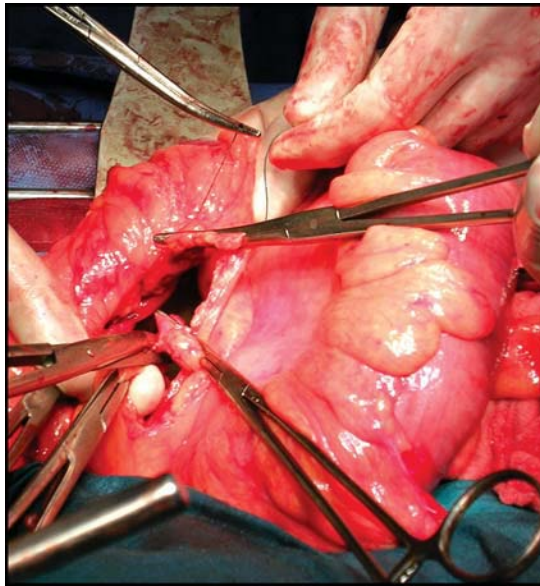


Figure 13.29: Ligation of inferior mesenteric vessels

Step 11: Release of splenic flexure: The splenic flexure must be released from all its attachments so that there is no tension on the colo-rectal anastomosis.

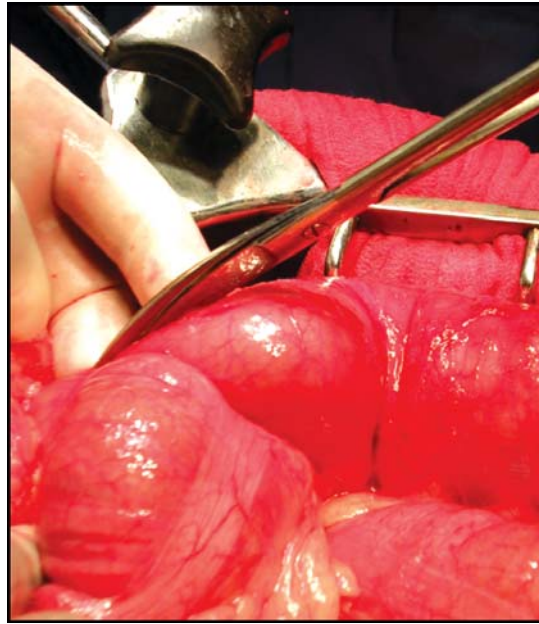


Figure 13.30: Release of splenic flexure

Step 12: Division of rectal stump: The rectum is divided between the right angled clamps or the linear staples giving a good tumor clearance.

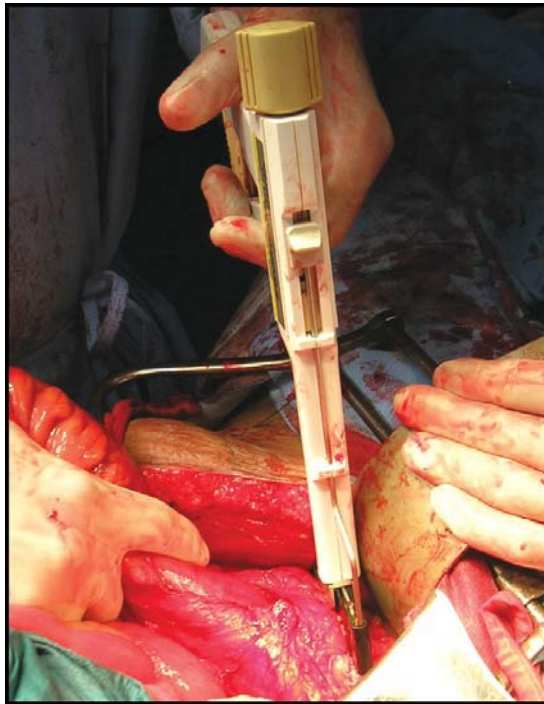


Figure 13.31: Division of rectal stump

Step 13: Division of colon: The pelvic colon is divided between clamps at the marked site and the specimen removed.

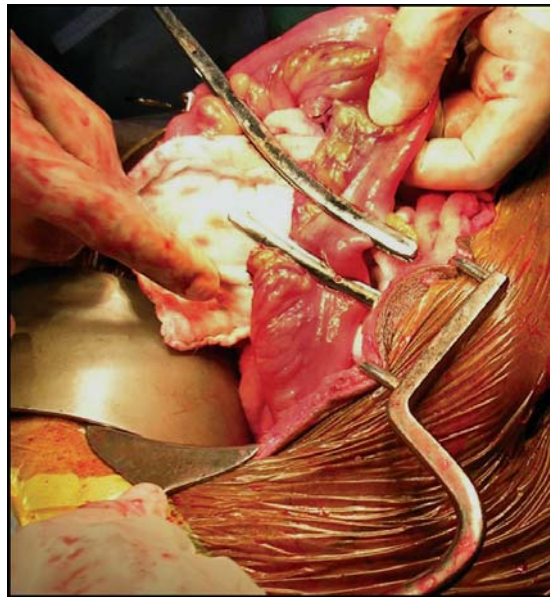


Figure 13.32: Division of colon

STAPLED COLO-RECTAL ANASTOMOSIS

Step 14: Introduction of circular stapler: The circular stapler is introduced through the anus.

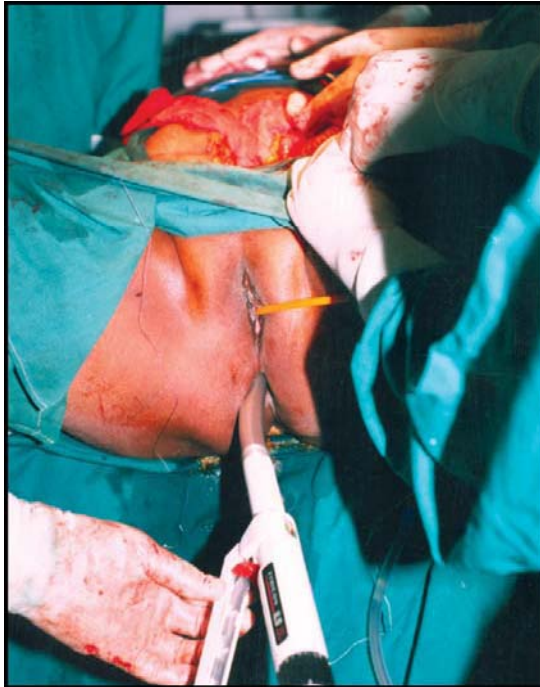


Figure 13.33: Introduction of circular stapler

Step 15: Completion of stapled colo-rectal anastomosis: The stapler is activated and the colo-rectal anastomosis is completed.

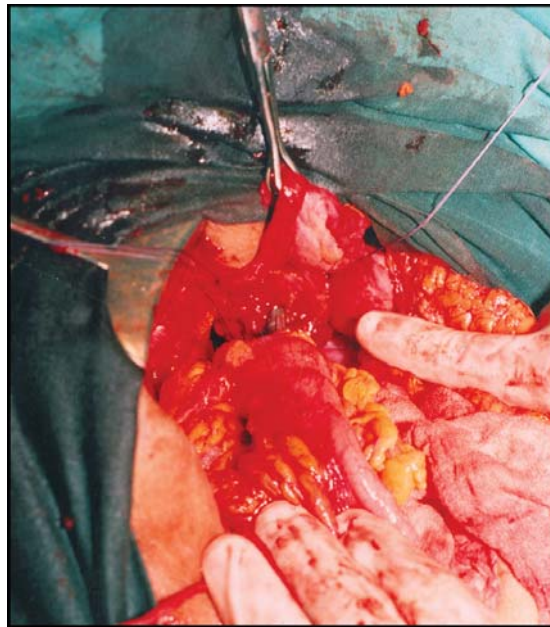


Figure 13.34: Completion of stapled colo-rectal anastomosis

HAND SEWN COLO-RECTAL ANASTOMOSIS

Step 14A: Single layer anastomosis: Single layer full thickness anastomosis is done with non-absorbable interrupted sutures.

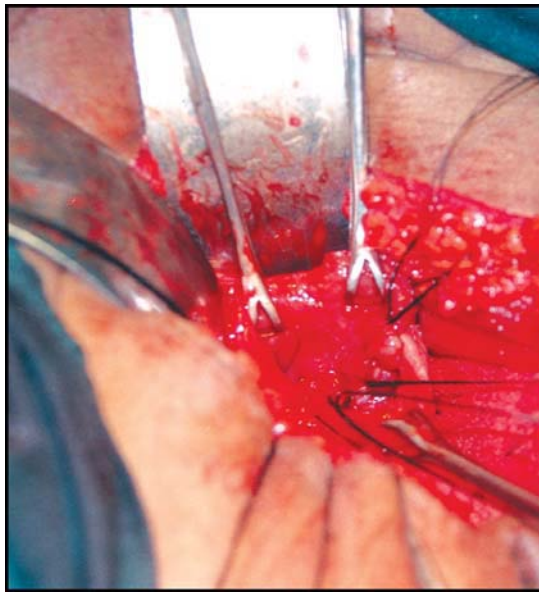


Figure 13.35: Single layer anastomosis

Step 15A: Completion of hand sewn colo-rectal anastomosis: The end to end anastomosis is completed.

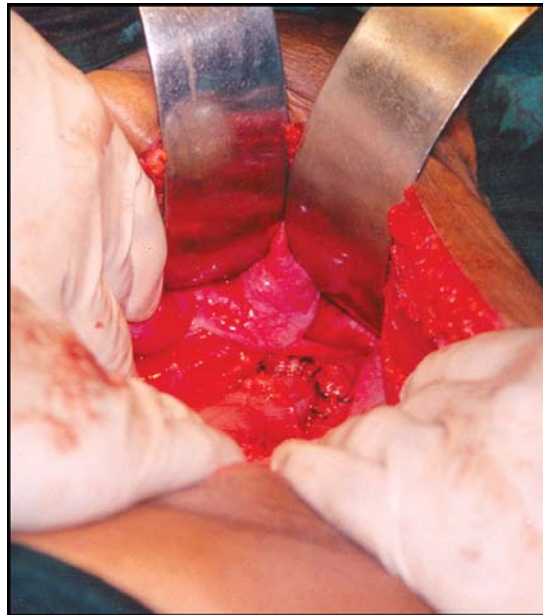


Figure 13.36: Completion of hand sewn colo-rectal anastomosis

Resected specimen of colo-rectum

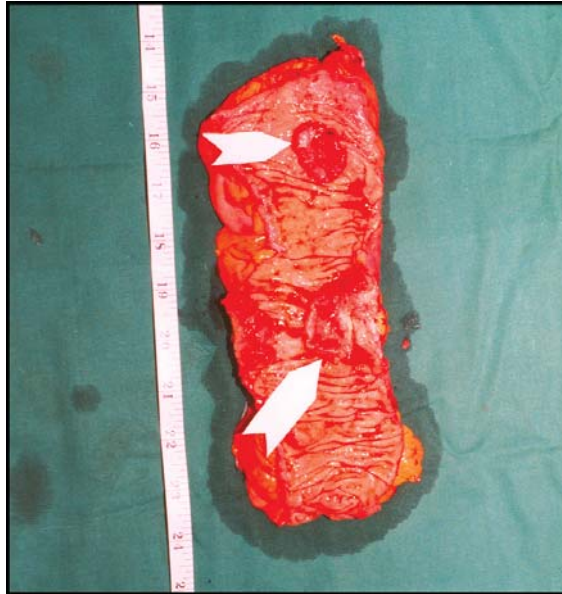


Figure 13.37: Resected specimen of colo-rectum

ANAL PULL-THROUGH OPERATION

Steps 1 to 9: Steps are the same as in anterior resection.

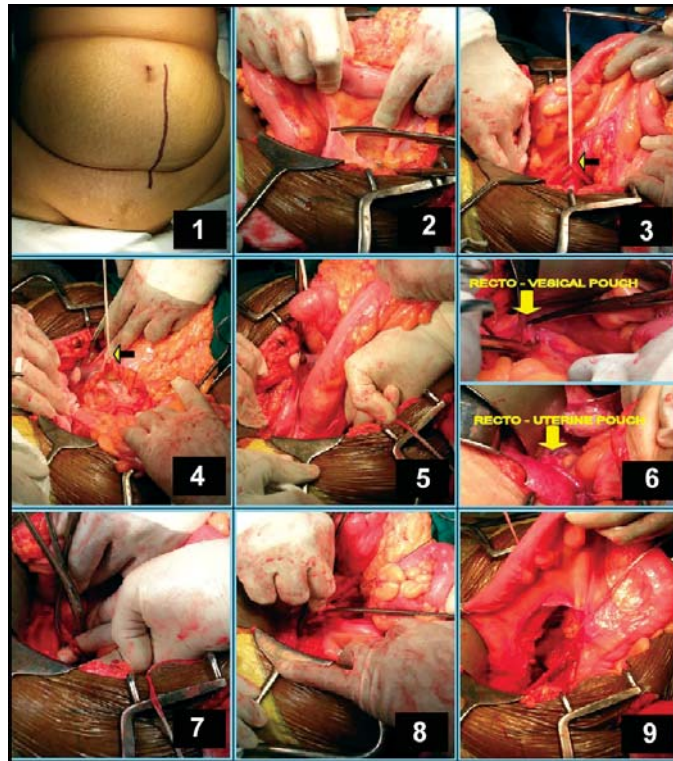


Figure 13.38: Steps of anal pull-through operation

Steps 10 to 13: Steps are the same as in anterior resection.

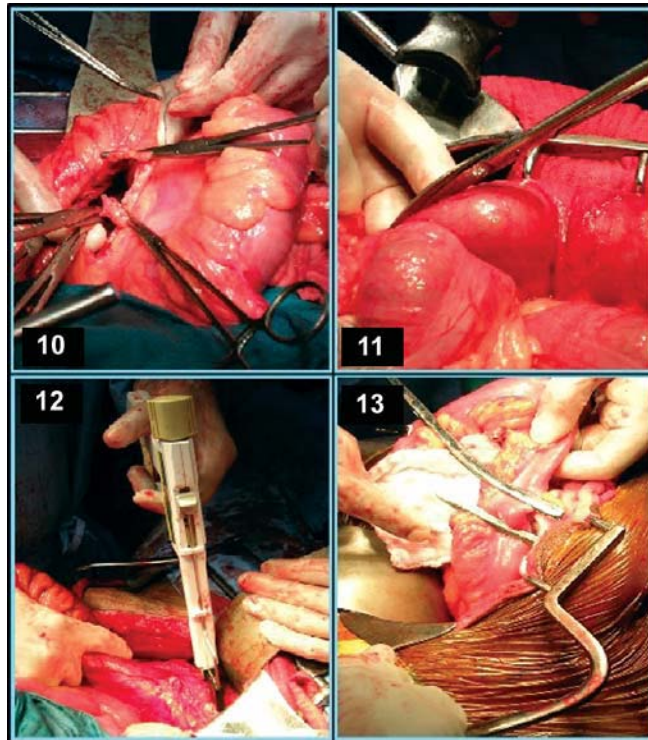


Figure 13.39: Steps of anal pull-through operation

Step 14: Colo-rectal anastomosis: The colo-rectal anastomosis is done outside the body, by pulling the colonic stump invaginated through the rectal stump.



Figure 13.40: Colo-rectal anastomosis

Resected specimen of colo-rectum

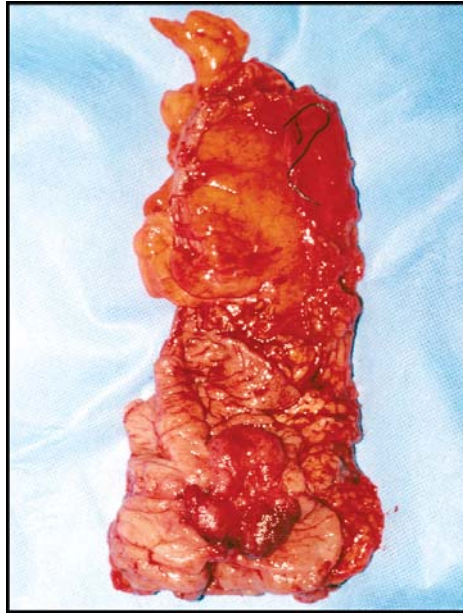
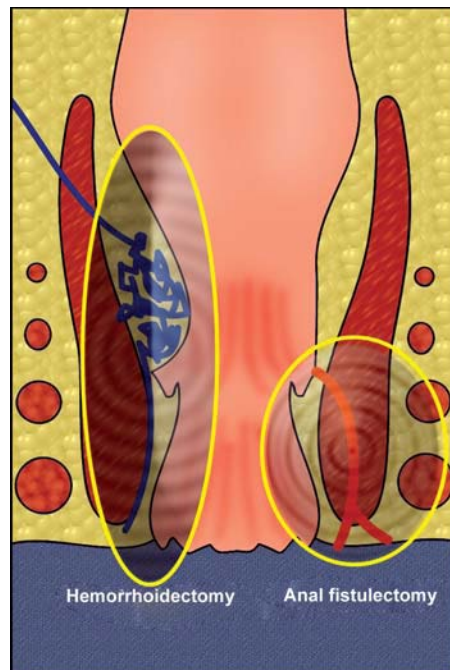


Figure 13.41: Resected specimen of colo-rectum

Chapter 14

Ano Rectal Operations



OPEN HEMORRHOIDECTOMY

Step 1: Position of the patient: Full lithotomy position with buttocks raised with sand bag.



Figure 14.1: Lithotomy position of the patient

Step 2: Exposure of pile masses: The pile masses are viewed through the proctoscope (for internal piles). Third degree pile masses are visible from outside.

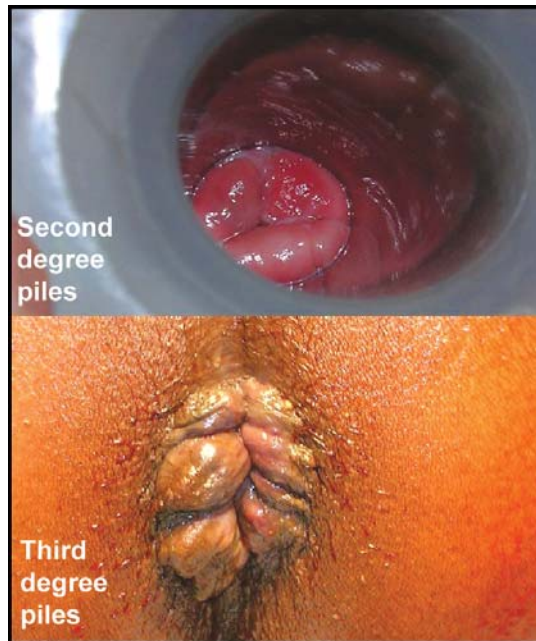


Figure 14.2: Exposure of pile masses

Step 3: Isolation of pile masses: The pile masses are held with straight artery forceps and pulled down.



Figure 14.3: Isolation of pile masses

Step 4: Start of dissection: The hemorrhoids are dissected one by one. The artery forceps holding the pile mass is pulled downwards with the left hand, and the skin is cut at the base of the piles with scissors.

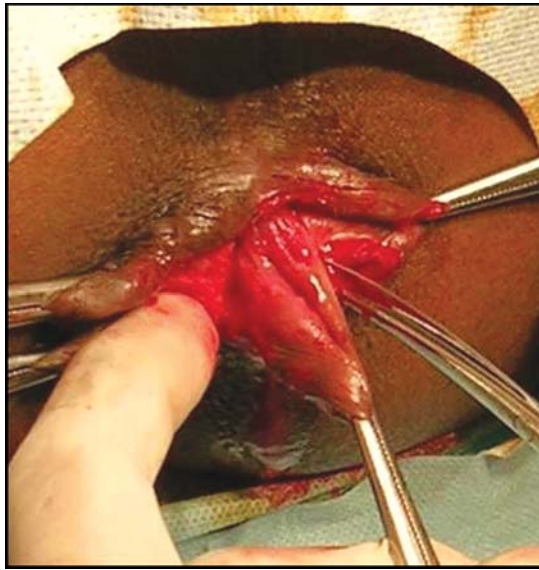


Figure 14.4: Start of dissection

Step 5: Deeper dissection: The dissection is carried on deeper, safeguarding the internal sphincter muscle.

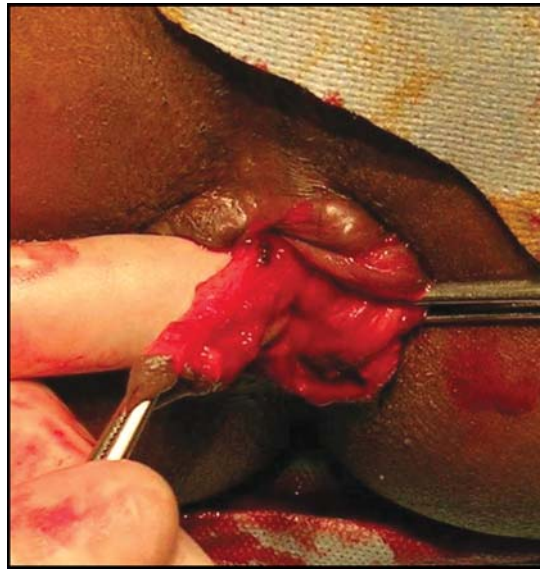


Figure 14.5: Deeper dissection

Step 6: Ligation of pedicle: The pedicle is transfixed and ligated with thick non-absorbable sutures. The ends of the ligatures are left long. The pedicle is allowed to retract.

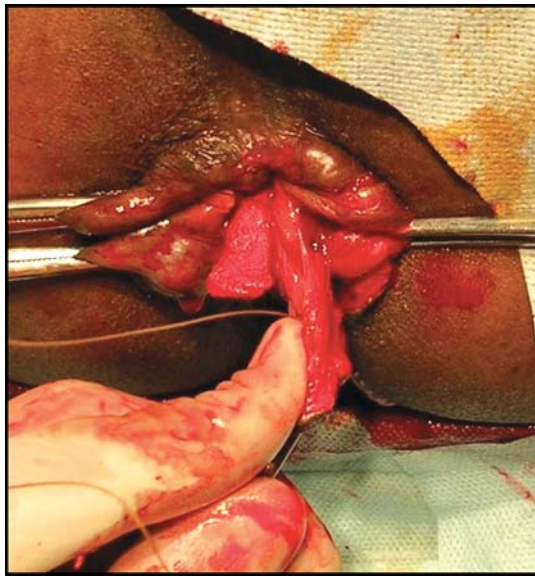


Figure 14.6: Ligation of pedicle

Surgery for other pile masses: The steps 4,5 and 6 are repeated for each pile mass.

Step 7: Final appearance: The final appearance should resemble the leaves of a clover.



Figure 14.7: Final appearance

Step 8: Dressing: Betadine gauze packs are applied over the raw area, a thick pad of cotton wool is then laid over the perineum which is held by a T bandage.



Figure 14.8: Dressing

ANAL FISTULECTOMY

Step 1: Position of the patient: Full lithotomy position with buttocks raised with sand bag.



Figure 14.9: Position of the patient

Clinical photograph of fistula in ano

Figure 14.10: Clinical photograph of fistula in ano

Step 2: Establishment of presence of fistula: The exit of the injected color dye establishes the existence of an intercommunicating fistula in ano with multiple external openings.



Figure 14.11: Establishment of presence of fistula

Step 3: Start of dissection: An incision circumscribing the entire fistula is made and dissection is started with a knife(A) and followed by diathermy(B).

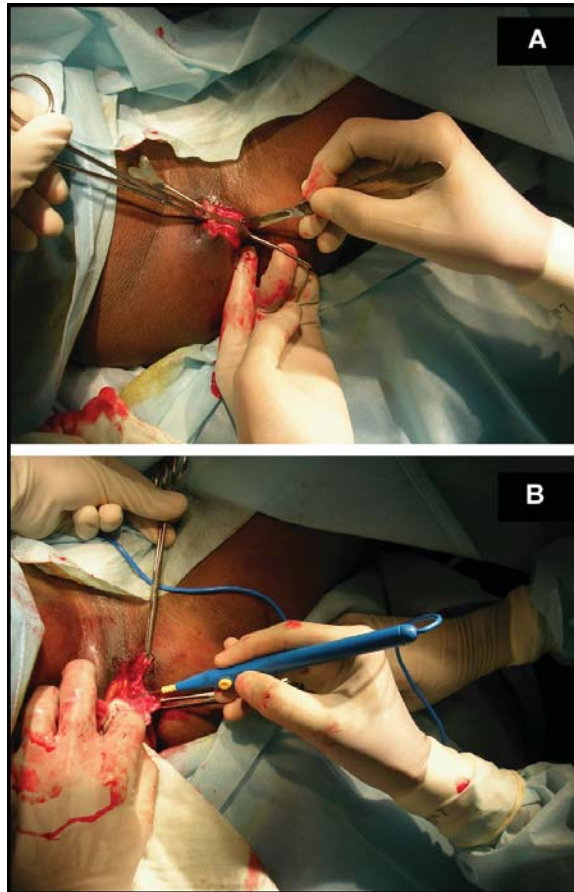


Figure 14.12: Start of dissection

Step 4: Deeper dissection: The dissection is carried on deeper with scissors, safeguarding the internal sphincter muscle, and all tissues stained by the dye should be removed.



Figure 14.13: Deeper dissection

Step 5: Wound appearance: The wound is left open or closed as per the choice of surgeon. Open wound heals by secondary intention.

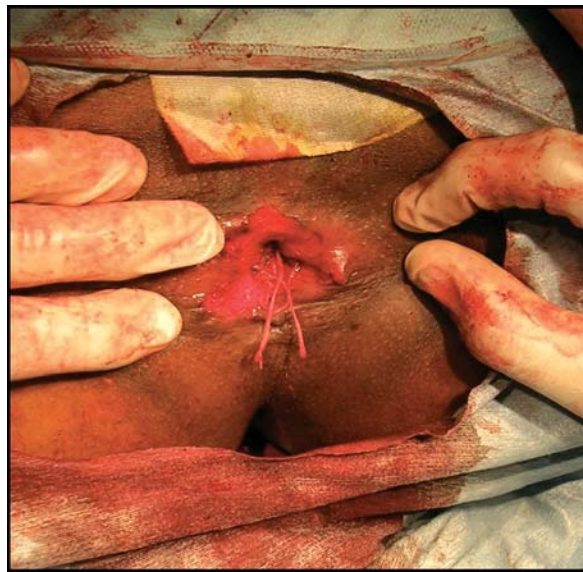


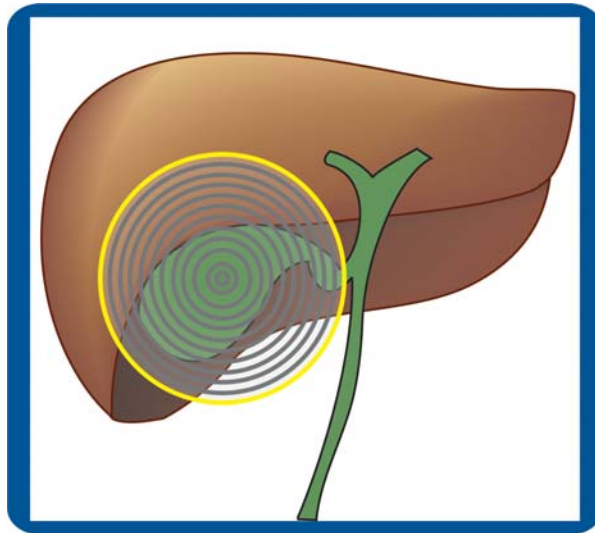
Figure 14.14: Wound appearance

Step 6: Dressing: Betadine gauze packs are applied over the raw area, a thick pad of cotton wool is then laid over the perineum which is held by a T bandage.



Figure 14.15: Dressing

Cholecystectomy



OPEN CHOLECYSTECTOMY

Step 1: Position: Supine with a small sandbag below the right lower chest.



Figure 15.1: Supine position

Step 2: Skin incision: Kocher's right subcostal incision.



Figure 15.2: Kocher's incision

Step 3: Deepening the incision: After incising the skin and the subcutaneous planes, the anterior rectus sheath, rectus abdominis muscle, posterior rectus sheath and the peritoneum are incised in the same line with cutting diathermy, and the abdominal cavity entered.



Figure 15.3: Deepening the incision

Step 4: Pull the liver down: After exploration of the abdomen, the right hand of the surgeon is passed over the liver to introduce air which will push the liver downwards.

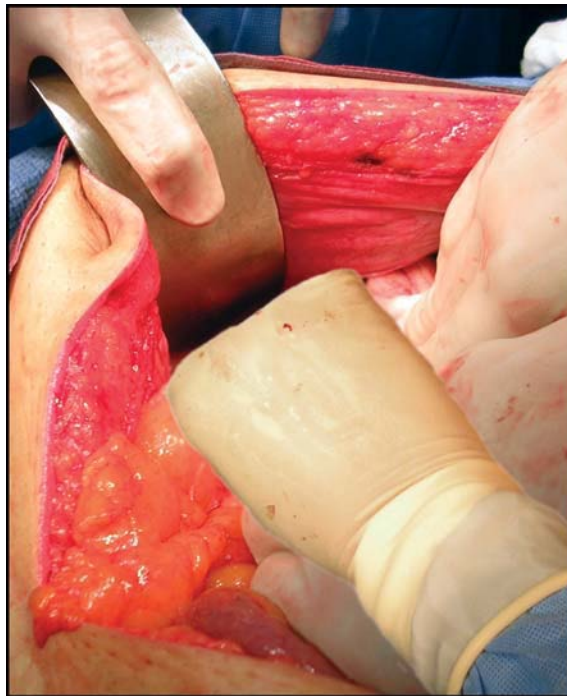


Figure 15.4: Pull the liver down

Step 5: Exposure of gallbladder and CBD: **1.** The liver is retracted upwards with a deep long blade Dever's retractor. **2.** The first assistant places two sponges, one to pull the stomach and duodenum by his right hand, to the left of the patient and the other sponge to pull the colon and bowel downwards with his left hand. **3.** A wet sponge is kept behind the free edge of the lesser omentum to lift the common bile duct forward. (Special retractors can be used to retract the liver upwards instead of an assistant).

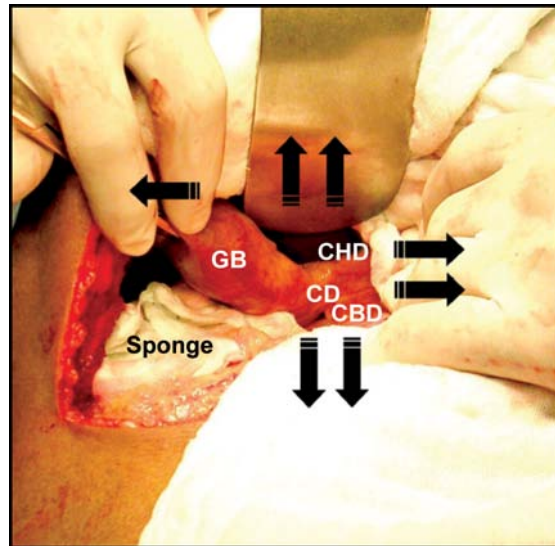


Figure 15.5: Exposure of gallbladder and CBD

Step 6: Exposure of gallbladder: The gallbladder is held with a sponge holding forceps at its fundus, and the Hartmann's pouch with another sponge holder, and traction is applied to open the angle between the cystic duct and the common bile duct.

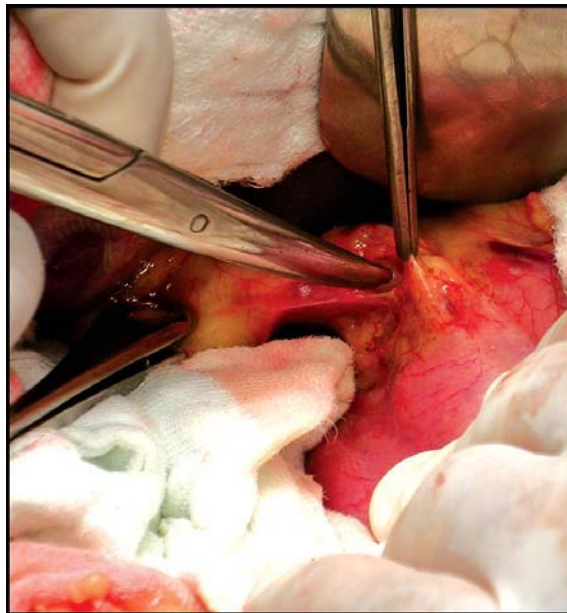


Figure 15.6: Exposure of gallbladder

Step 7: Isolation of the cystic duct: The peritoneal reflection at the angle of the cystic duct and the common bile duct is snipped and the peritoneum is incised anteriorly upwards. The cystic duct is exposed well and hooked with a right angled forceps.

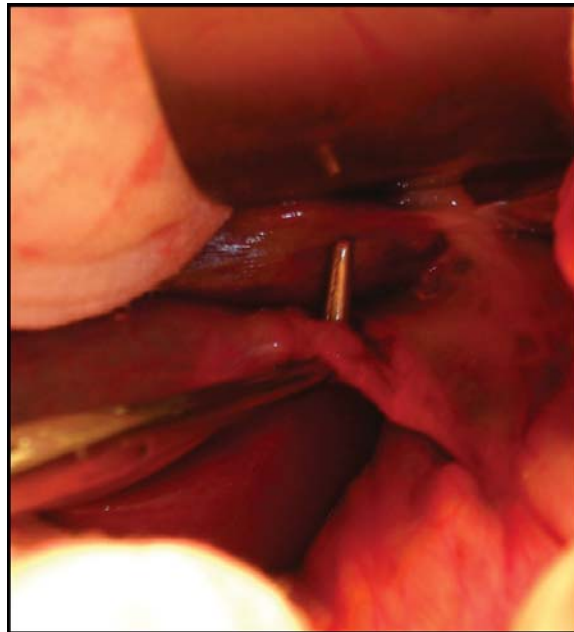


Figure 15.7: Isolation of the cystic duct

Step 8: Division of cystic duct: The cystic duct is divided between ligatures.

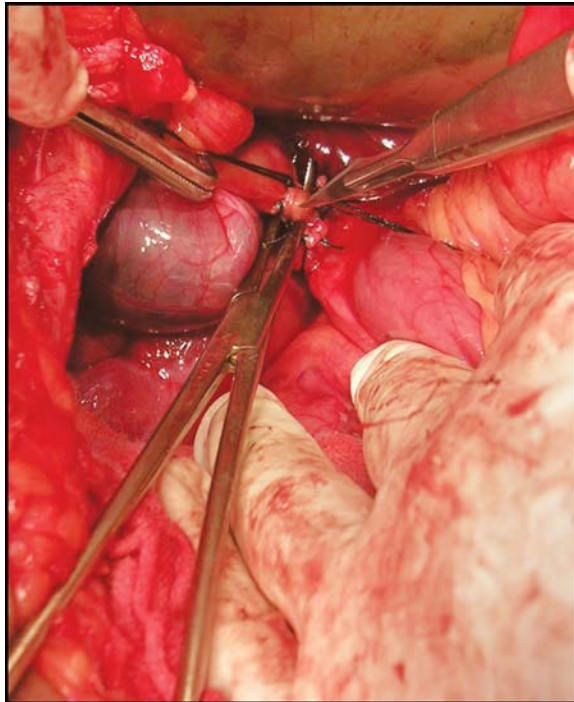


Figure 15.8: Division of cystic duct

Step 9: Division of the cystic artery: The cystic artery is identified in the Calot's triangle and is divided between ligatures.

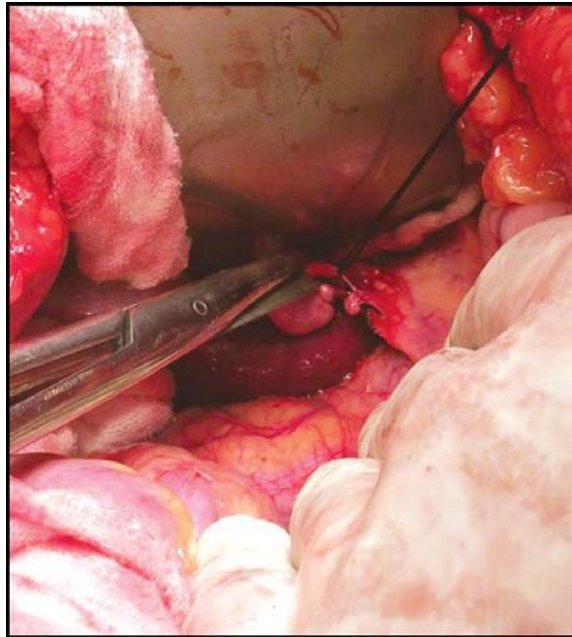


Figure 15.9: Division of the cystic artery

Step 10: Removal of gallbladder: Now the gallbladder is free from its ductal attachments, and the peritoneum attaching the gallbladder to the liver is incised all round and the gallbladder is removed from its bed.

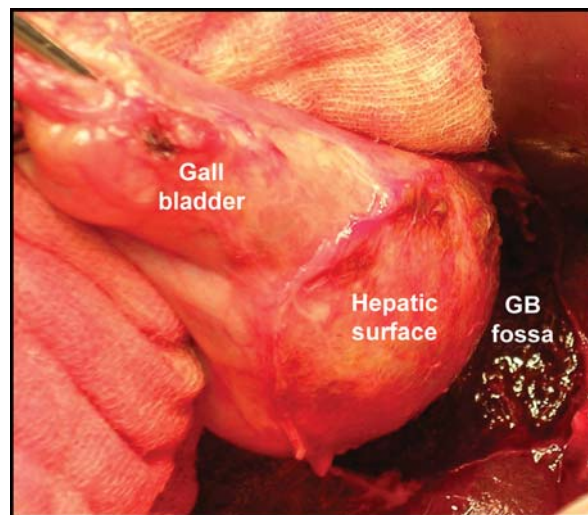


Figure 15.10: Removal of gallbladder

Step 11: Hemostasis: Perfect hemostasis is achieved by coagulation and any minor duct discharging bile from the gallbladder fossa should be ligated by transfixation.

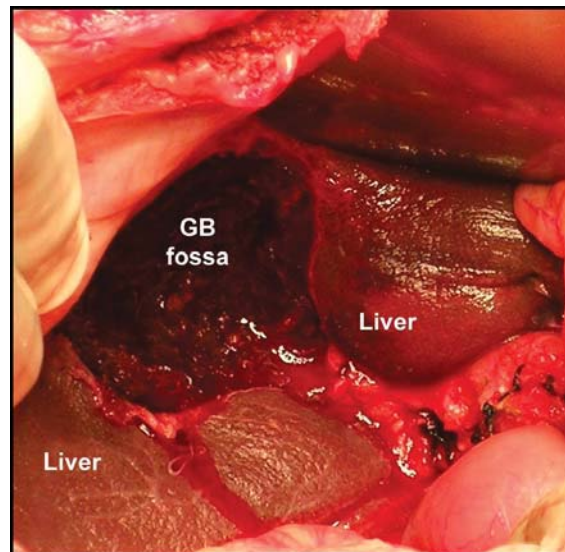


Figure 15.11: Hemostasis

Step 12: Closure of abdomen: Three layer closure:

First layer: The first of the three layers (peritoneum and transversalis together with the posterior rectus sheath) is closed with continuous absorbable sutures.

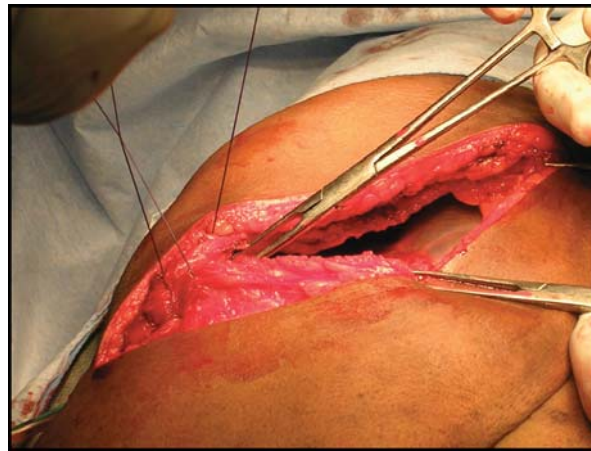


Figure 15.12: Closure of abdomen

Step 13: Closure of second layer: The next is to approximate the second layer (external and internal oblique with anterior rectus sheath including the rectus abdominis muscle).

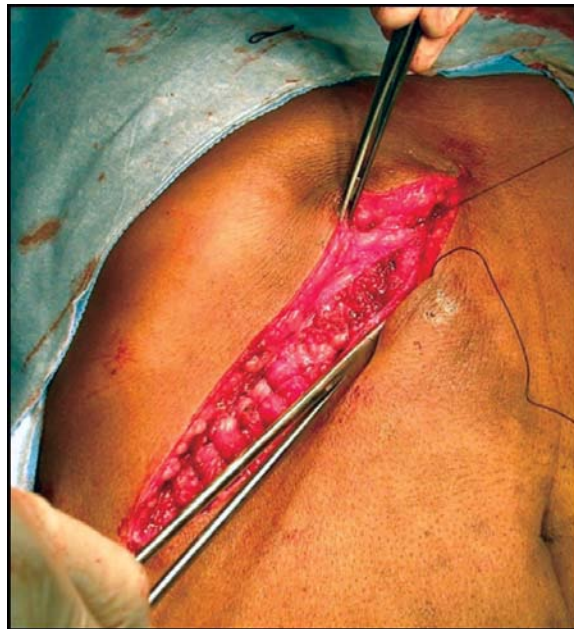


Figure 15.13: Closure of second layer

Step 14: Closure of skin: The last to approximate the subcutaneous tissue with absorbable sutures and finally skin with staples.



Figure 15.14: Closure of skin

Excised gallbladder with stones



Figure 15.15: Excised gallbladder with stones

LAPAROSCOPIC CHOLECYSTECTOMY

Step 1: Operating room arrangement: The imaging instruments, the diathermy devices, suction apparatus, and the instrument trolley are arranged in a comfortable manner for the procedure to be done without any difficulty.



Figure 15.16: Operating room arrangement

Step 2: Position of the patient: Supine position with 30 degrees Trendelenburg (head down) position with left lateral tilt. Gastric decompression with nasogastric intubation is necessary.



Figure 15.17: Supine position of the patient

Step 3: Markings of entry ports: The figure shows the usual sites of marking entry into the abdominal cavity by the ports for laparoscopic cholecystectomy.

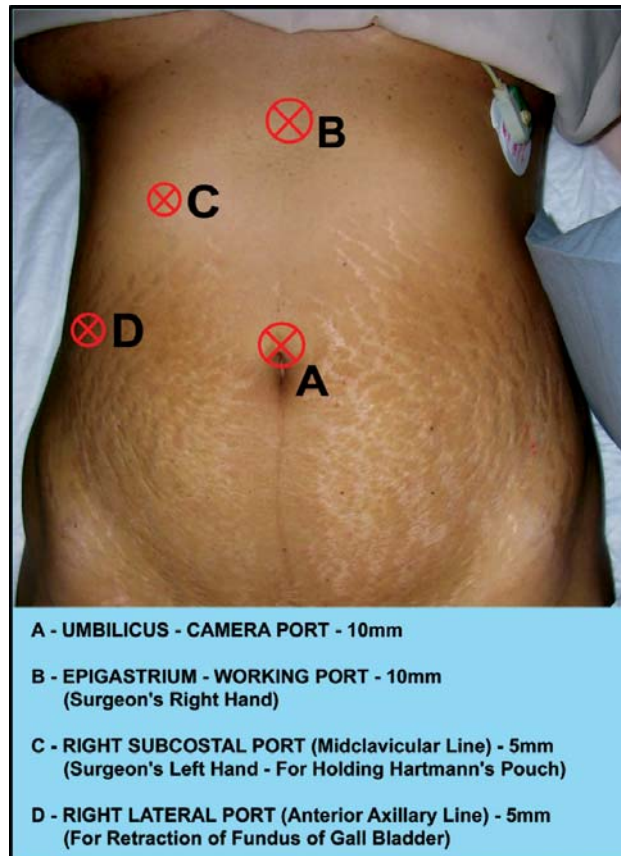


Figure 15.18: Markings of entry ports

Step 4: Establishment of pneumoperitoneum: A small incision is made in the infraumbilical skin fold to facilitate the insertion of Veress needle into the abdomen. The needle is inserted by lifting the abdominal wall with the left hand. After confirmation of its presence in the abdominal cavity, the needle is connected to the insufflator. The peritoneal cavity is distended with carbon dioxide until a pressure of 12-15 mm Hg is obtained.



Figure 15.19: Establishment of pneumoperitoneum

Step 5: Insertion of trocar for camera: A 10 mm incision is made at the site of the previous incision, and a 10 mm trocar is inserted into the abdominal cavity directing it downwards.



Figure 15.20: Insertion of trocar for camera

Step 6: Exploration of abdomen: The camera is turned 360 degrees to examine the entire abdominal cavity.

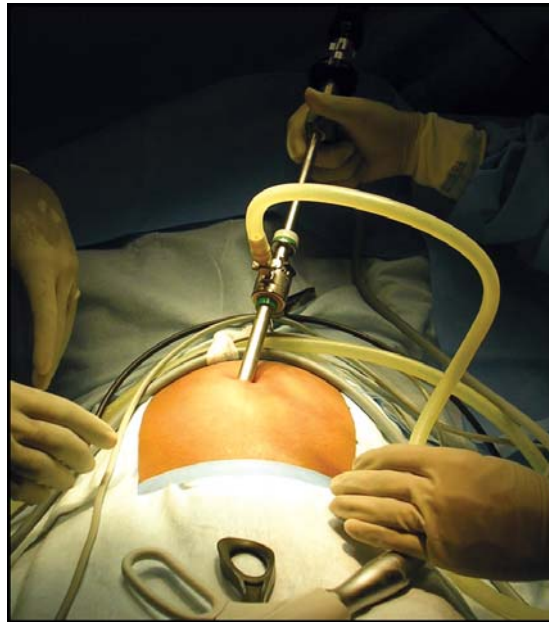


Figure 15.21: Exploration of abdomen

Step 7: Dissecting cannula: A 10 mm trocar is introduced in the midline at midpoint between the xiphisternum and the umbilicus.



Figure 15.22: Dissecting cannula

Step 8: Insertion of first accessory cannula: The abdominal wall is illuminated and a 5 mm trocar is introduced under direct laparoscopic vision in the right anterior axillary line far below the costal margin. This will help in holding the fundus of the gallbladder.



Figure 15.23: Insertion of first accessory cannula

Step 9: Insertion of second accessory cannula:

Another accessory 5 mm trocar is inserted under direct laparoscopic vision in the right mid-clavicular line below the costal margin to retract the Hartmann's pouch.



Figure 15.24: Insertion of second accessory cannula

Step 10: Position of surgeon's and assistant's hands:

The surgeon holds the Hartmann's pouch with the grasp in his left hand and gives traction to the angle of the cystic duct and common bile duct. The assistant holds the grasp holding the fundus and retracts with his left hand and uses his right hand for steadying the camera.

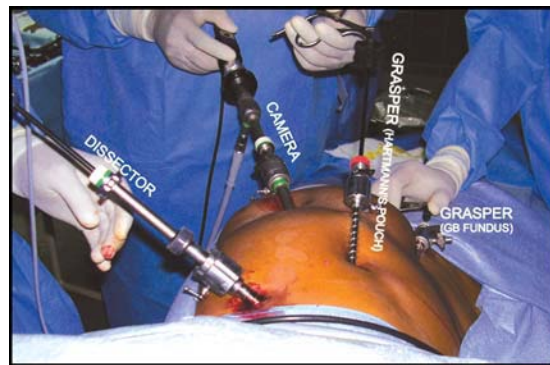


Figure 15.25: Position of surgeon's and assistant's hands

Step 11: Dissection of the infundibulum of the gallbladder: The gallbladder is dissected from the liver at the infundibulum and is separated upto the junction of the cystic duct and the common bile duct.



Figure 15.26: Dissection of the infundibulum of the gallbladder

Step 12: Division of cystic duct: Cystic duct is divided between clips two distally and one proximally.



Figure 15.27: Division of cystic duct

Step 13: Division of cystic artery: The cystic artery is dissected well with the dissector and divided between clips applied as in the division of the cystic duct.

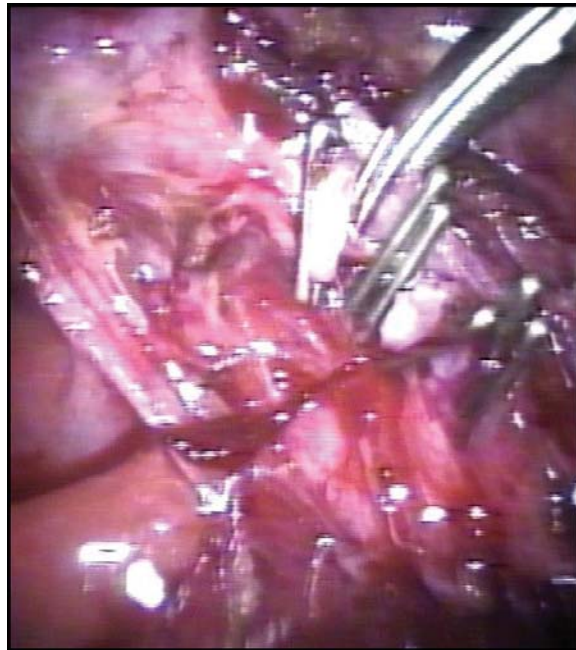


Figure 15.28: Division of cystic artery

Step 14: Removal of gallbladder from its bed: Now the gallbladder is free from its ductal attachments, and the peritoneum attaching the gallbladder to the liver is incised all round and the gallbladder is removed from its bed.



Figure 15.29: Removal of gallbladder from its bed

Step 15: Removal of gallbladder from the abdomen:

The gallbladder is held with 10 mm toothed grasp at its cystic duct end and extracted through the epigastric port along with the trocar under laparoscopic vision.

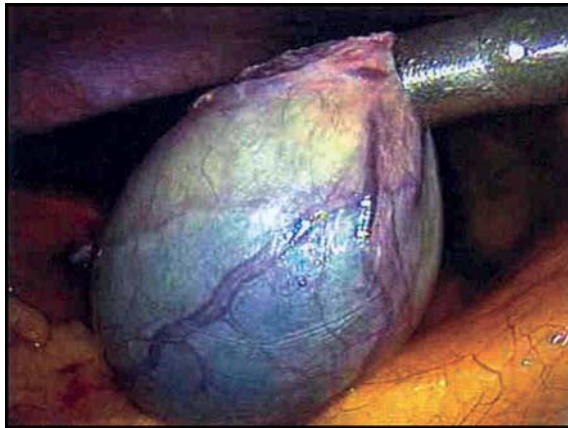


Figure 15.30: Removal of gallbladder from the abdomen

Step 16: Dilatation of epigastric wound: The epigastric wound may have to be dilated with artery forceps if there is difficulty in getting the gallbladder out due to the presence of stones.



Figure 15.31: Dilatation of epigastric wound

Step 17: Hemostasis: The gallbladder bed has to be irrigated well and perfect hemostasis established.



Figure 15.32: Hemostasis

Step 18: Wound closure: The 10 mm incisions need to be closed meticulously, the fascia with 1/0 non-absorbable suture. The accessory wounds may be closed with skin sutures or tapes.



Figure 15.33: Wound closure

Step 19: Postoperative appearance

Figure 15.34: Postoperative appearance

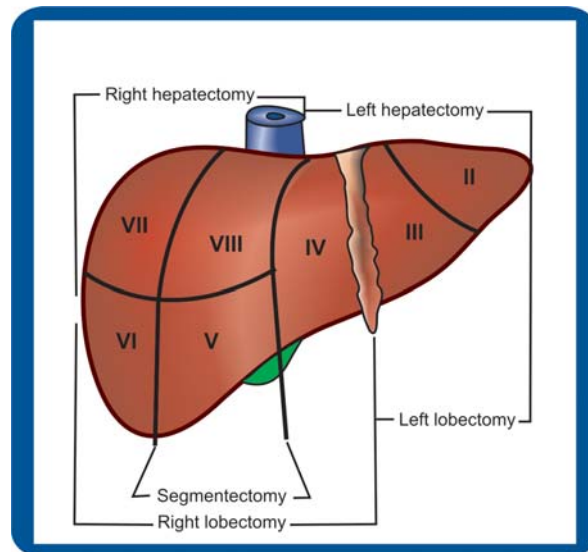
Excised gallbladder with stones



Figure 15.35: Excised gallbladder with stones

Chapter 16

Hepatic Resections



Step 1: Position: Supine with about 20 degrees reverse Trendelenburg position.



Figure 16.1: Position

Step 2: Incision: Extended right subcostal incision or a hockey stick incision.



Figure 16.2: Hockey-stick incision

Step 3: Deepening the incision: After incising the skin and the subcutaneous planes, the anterior rectus sheath, rectus abdominis muscle, posterior rectus sheath and the peritoneum are incised in the same line with cutting diathermy, and the abdominal cavity entered.



Figure 16.3; Deepening the incision

Step 4: Division of ligaments: For left lobectomy, the triangular ligament is divided taking care of the left hepatic vein, and for right lobectomy, the anterior leaf of the coronary ligament is divided using diathermy. When dissection proceeds behind the liver, the short hepatic veins between the liver and the vena cava are divided carefully between ligatures.



Figure 16.4: Division of ligaments

Step 5: Mobilization of liver: The surgeon should pass his hand over the diaphragmatic surface of the liver and pull the liver down for proper control.

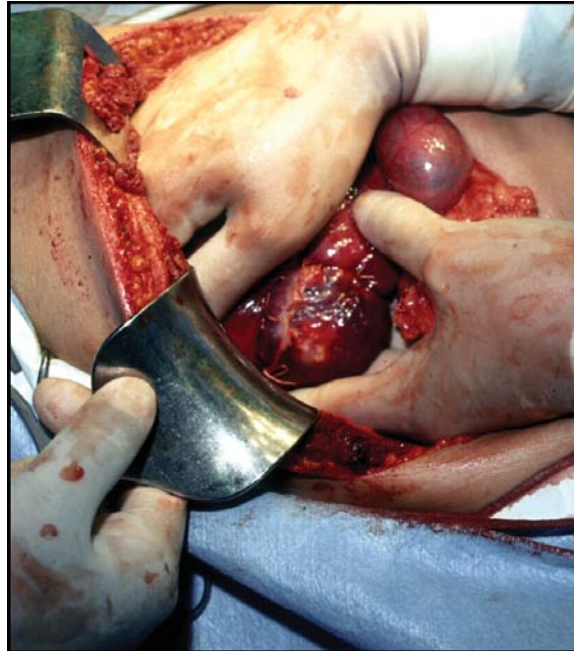


Figure 16.5: Mobilization of liver

RIGHT HEPATECTOMY

Step 6: Cholecystectomy: The gallbladder is separated from its bed, and the cystic artery and cystic duct are divided between ligatures and cholecystectomy completed.

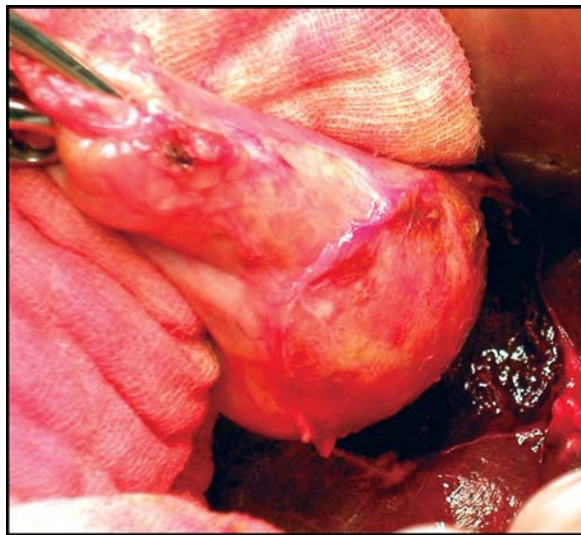


Figure 16.6: Cholecystectomy

Step 7: Control of vessels in hepatoduodenal ligament: A sling is passed round the structures in the ligament and controlled by a rubber tubing.



Figure 16.7: Control of vessels in hepatoduodenal ligament

Step 8: Clamping and division of right branch of hepatic artery: The right branch of the hepatic artery which is already encircled is clamped and divided.

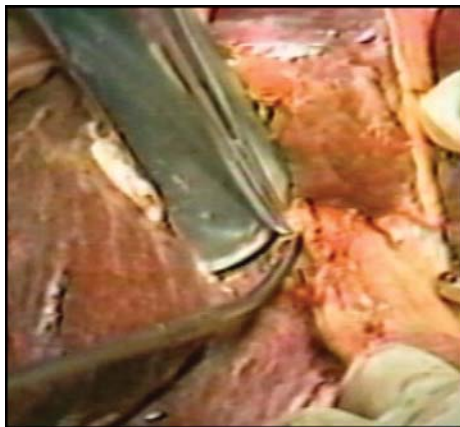


Figure 16.8: Clamping and division of right branch of hepatic artery

Step 9: Clamping and division of right branch of portal vein: The right branch of the portal vein which is already encircled is clamped and divided.

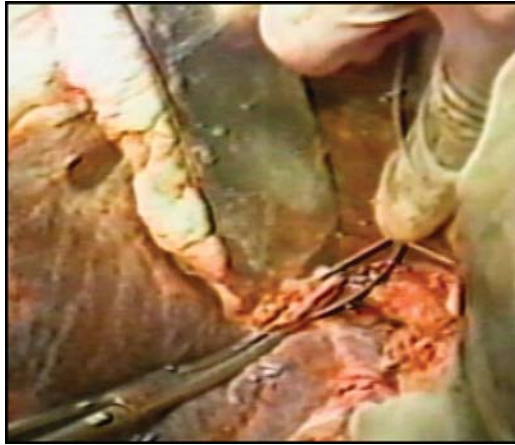


Figure 16.9: Clamping and division of right branch of portal vein

Step 10: Instruments for dissection of liver: Fingers of the surgeon, knife handle, artery forceps.



Figure 16.10: Instruments for dissection of liver

Step 11: Instruments for control of bleeding during liver dissection: Liver clamp, Hemoclip and Electrocautery. Electrocautery is a useful instrument for small resections.



Figure 16.11: Instruments for control of bleeding during liver dissection

Step 12: Instrument not to be used for liver dissection:
Knife blade.



Figure 16.12: Instrument not to be used for liver dissection

Step 13: Application of liver clamp: A long liver clamp is applied over the resectable area of the liver.

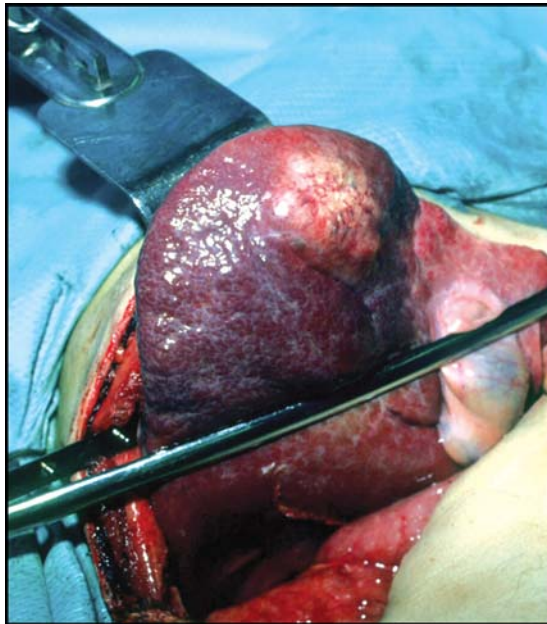


Figure 16.13: Application of liver clamp

Step 14: Determination of line of demarcation: The line of demarcation is determined by darkening of avascular segment and by incising the capsule with diathermy.



Figure 16.14: Determination of line of demarcation

Step 15: Liver dissection: The dissection on the liver is carried out by finger fracture technique, about 1 cm right to the line of demarcation, and deepened further.

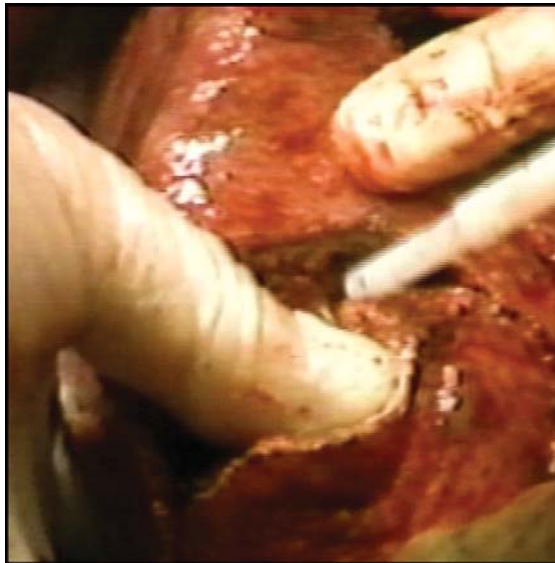


Figure 16.15: Liver dissection

Step 16: Deeper dissection of liver: As the deeper dissection is carried out, smaller vessels are divided with diathermy and larger vessels divided between ligatures or hemoclips.

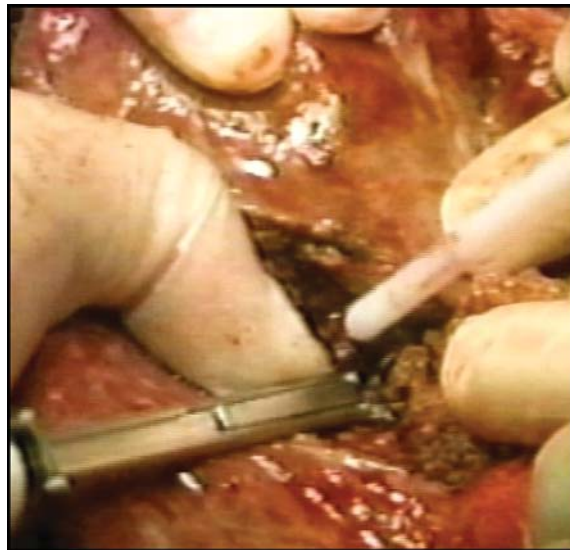


Figure 16.16: Deeper dissection of liver

Step 17: Control of right hepatic vein: The vena cava is freed from the liver, and the right hepatic vein identified and clamped.



Figure 16.17: Control of right hepatic vein

Step 18: Intraoperative ultrasonography: Intra operative ultrasonography is useful in determining the intra hepatic lesions and planning proper treatment, as it is more accurate than the conventional ultrasonography.



Figure 16.18: Intraoperative ultrasonography

Step 19: Removal of specimen: The right hepatic duct is divided and the resected right lobe of the liver is removed. The divided end of the hepatic vein is underrun with 4/0 Prolene sutures.

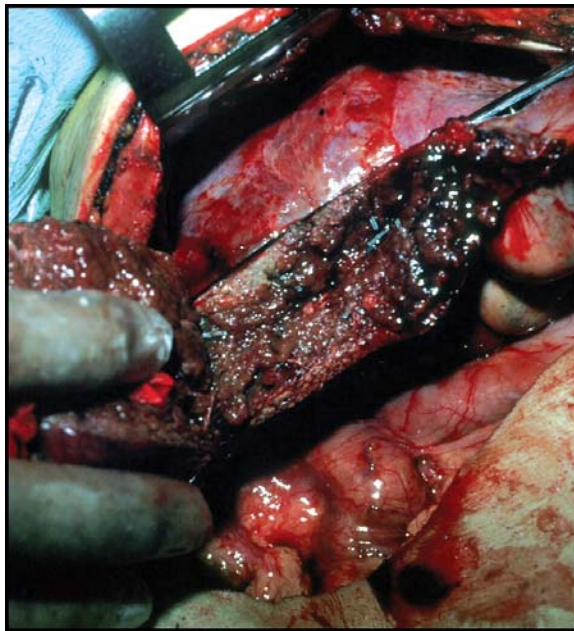


Figure 16.19: Removal of specimen

Step 20: Hemostasis: Perfect hemostasis is established by using the electrocautery liberally and transfixing all major blood vessels.

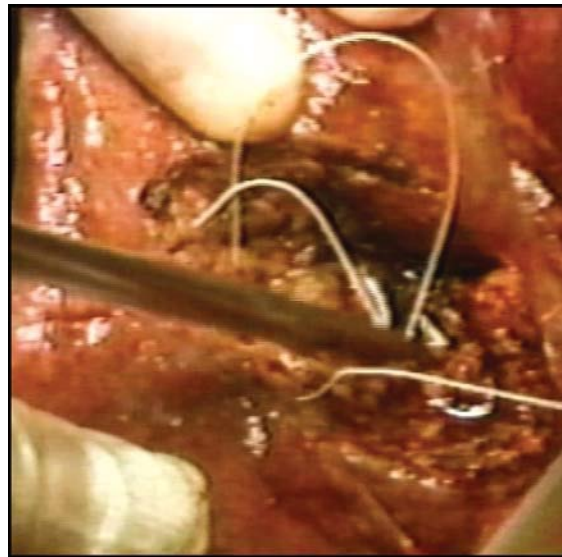


Figure 16.20: Hemostasis

Step 21: Application of hemostatic agents: Thrombin paste or hemolock is applied to the raw area to establish hemostasis.

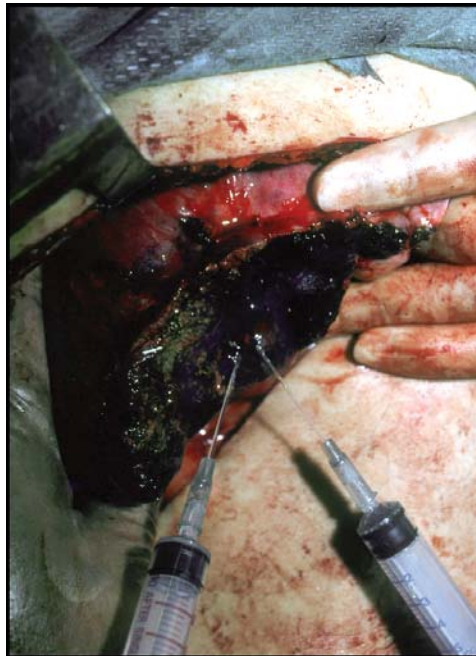


Figure 16.21: Application of hemostatic agents

Step 22: Wound closure: The wound is closed in three layers, the muscles and aponeurosis with absorbable sutures, with two large bore drains in the right subphrenic space.

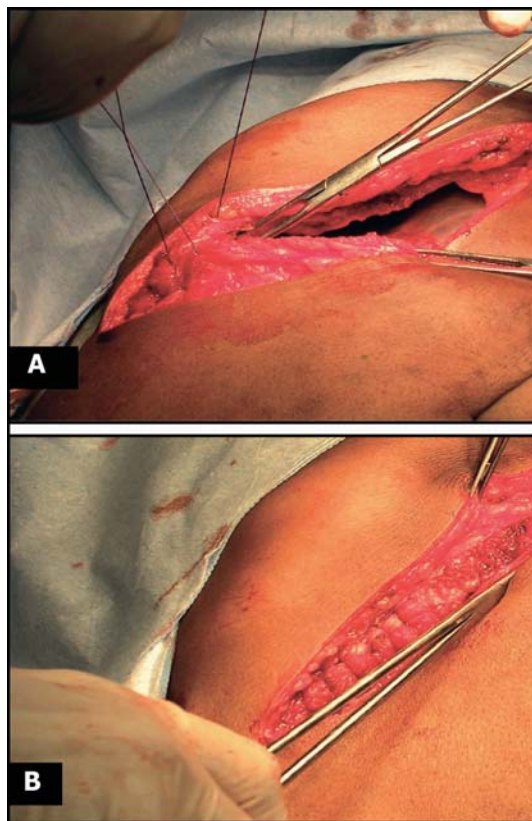


Figure 16.22: Wound closure

Step 23: Skin closure: The skin closed with staples or sutures.



Figure 16.23: Skin closure

Resected specimens of liver for primary liver malignancy

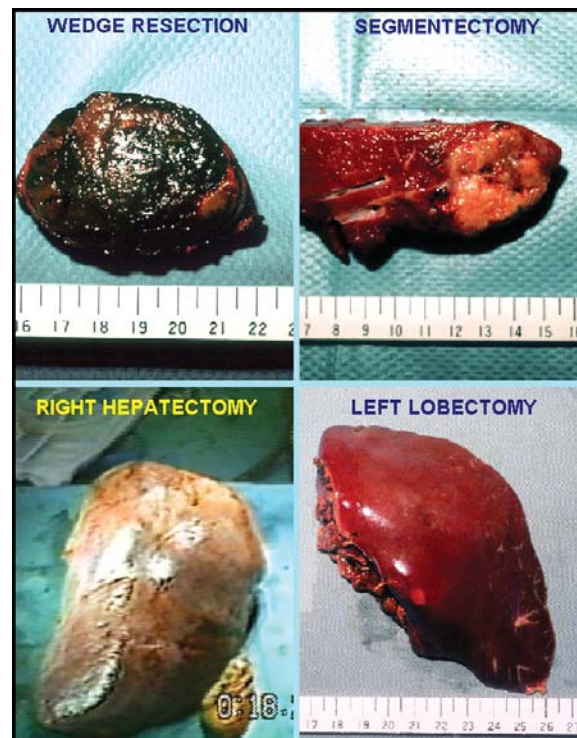


Figure 16.24: Resected specimens of liver for primary liver malignancy

Resected specimen for secondary malignancy of liver (primary colonic malignancy)

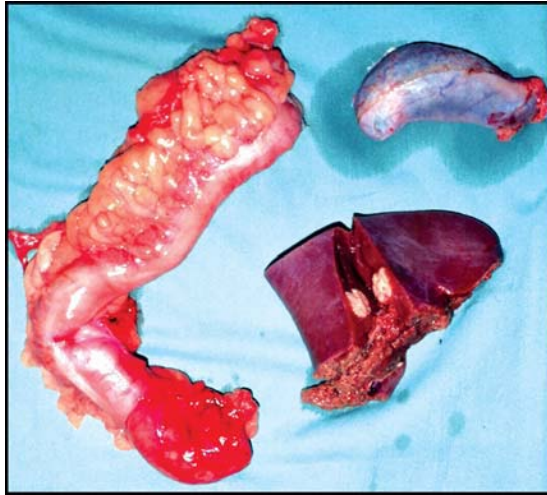
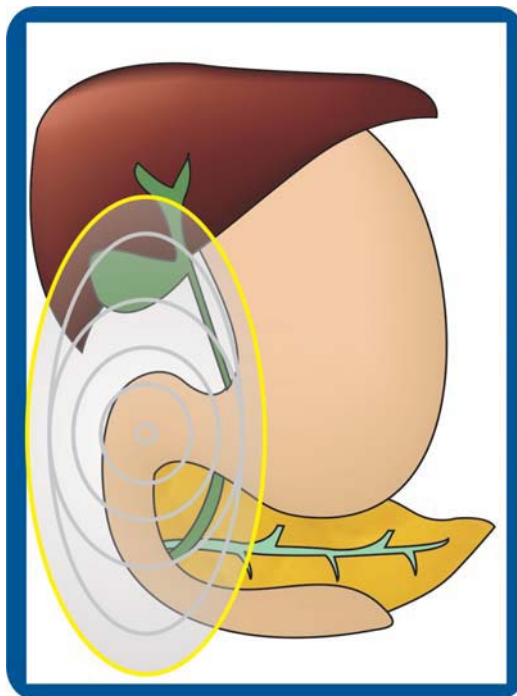


Figure 16.25: Resected specimen for secondary malignancy of liver (primary colonic malignancy)

Pancreaticoduodenectomy



Step 1: Position: Supine



Figure 17.1: Supine position

Step 2: Incision: Long midline or roof top incision.

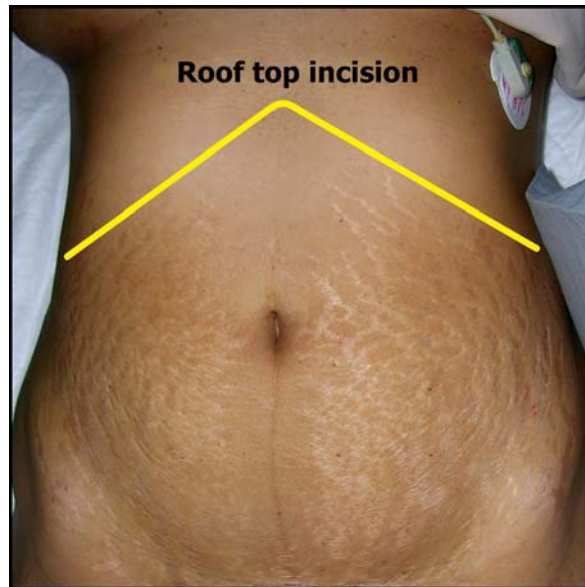


Figure 17.2: Roof top incision

Step 3: Deepening the incision: After incising the skin and the subcutaneous planes, the anterior rectus sheath, rectus abdominis muscle, posterior rectus sheath and the peritoneum are incised in the same line with cutting diathermy, and the abdominal cavity entered.



Figure 17.3: Deepening the incision

Step 4: Cholecystectomy and division of common hepatic duct: Cholecystectomy and the division of common hepatic duct are performed to facilitate the exposure of portal and superior mesenteric veins.

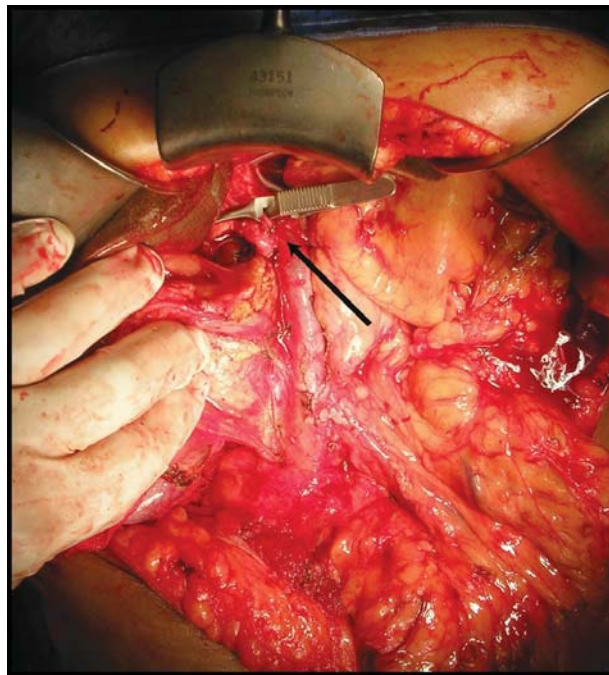


Figure 17.4: Cholecystectomy and division of common hepatic duct

Step 5: Exposure of superior mesenteric vein: Kocher maneuver is extended to the third part of duodenum, and the superior mesenteric vein is exposed fully dividing the venous branches of the vein. After assessing the involvement of the tumor, the right index finger is passed in this place encircling the duodenum.

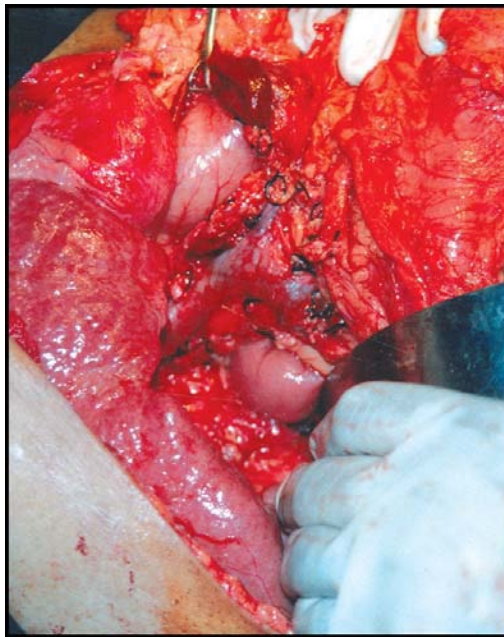


Figure 17.5: Exposure of superior mesenteric vein

Step 6: Division of duodenum: The first part of the duodenum is divided with linear cutter (A). The pancreas is divided at its neck with diathermy, protecting the portal vein (B).

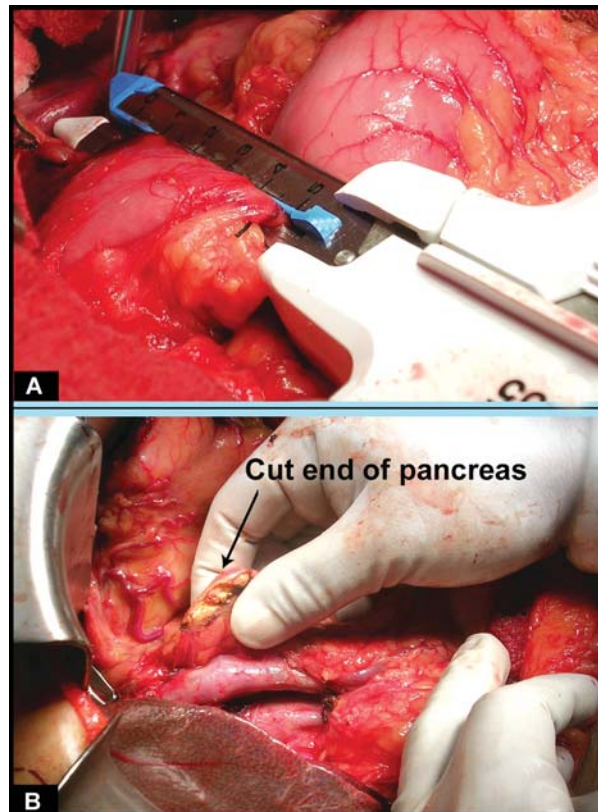


Figure 17.6: Division of duodenum

Step 7: Division of jejunum: The jejunum is divided about 10 cm from the ligament of Treitz. The mesentery is divided close to the jejunum and freed and passed behind the superior mesenteric vessels.

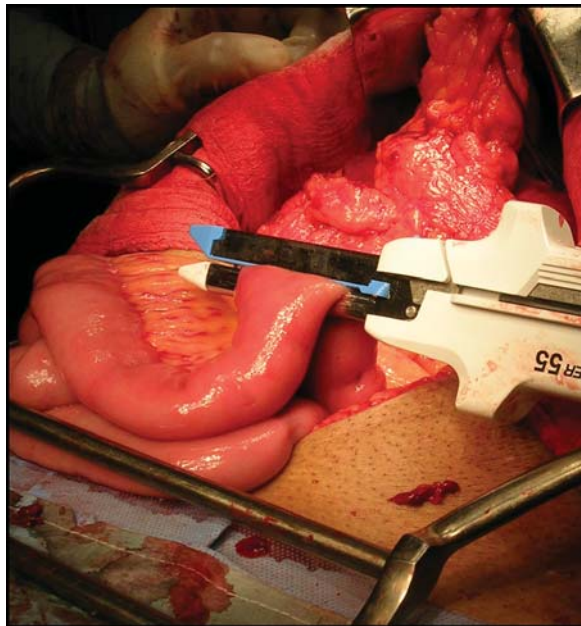


Figure 17.7: Division of jejunum

Step 8: Dissection of uncinate process: The uncinate process is dissected from all its attachments and the specimen is removed. The resected specimen consists of gallbladder, distal CBD, second, third and fourth parts of duodenum, proximal jejunum, and head neck and uncinate process of pancreas.

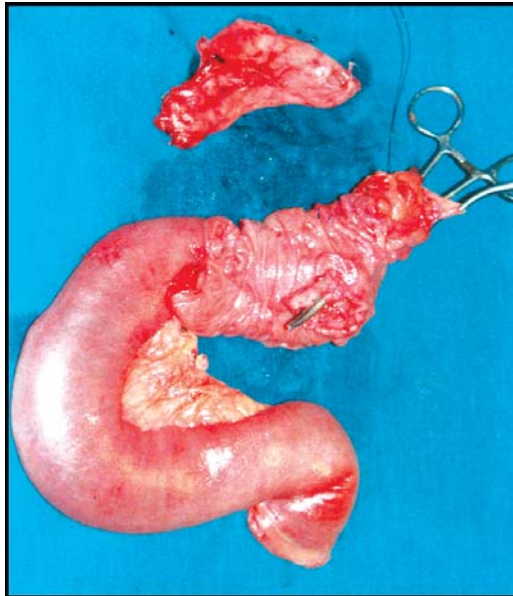


Figure 17.8: Dissection of uncinate process

Step 9: End to side pancreatojejunostomy gastrojejunostomy: Outer layer is made with 3/0 non-absorbable sutures and the inner layer (mucosa to mucosa) with 3/0 absorbable sutures, over a small stent fixed with absorbable suture, which will be shed in due course of time.

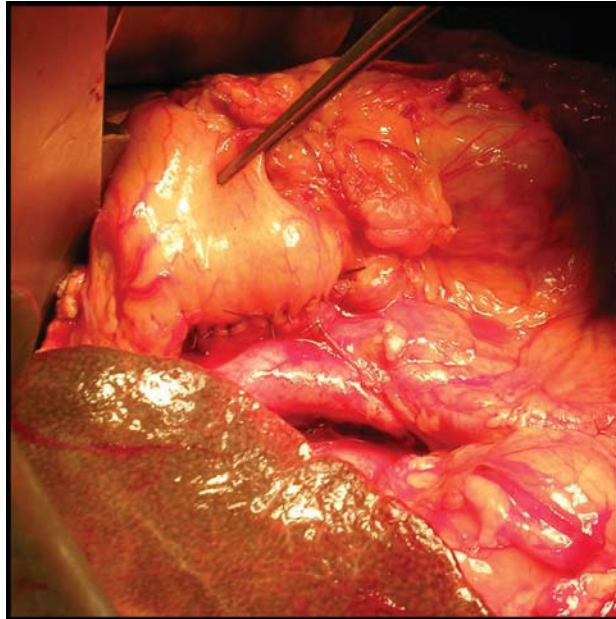


Figure 17.9: End to side pancreatojejunostomy gastrojejunostomy

Step 10: End to side hepaticojejunostomy: Outer layer is made with 3/0 non-absorbable sutures and the inner layer (mucosa to mucosa) with 3/0 absorbable sutures, over a long stent brought out through the jejunum and outside abdomen, connected to closed drainage.

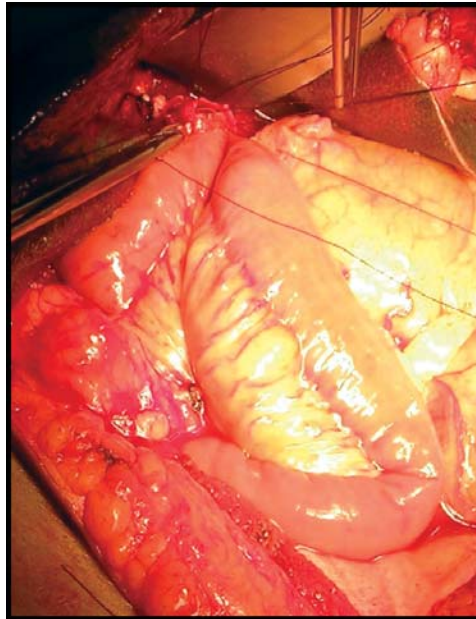


Figure 17.10: End to side hepaticojejunostomy

Step 11: End to side gastrojejunostomy or duodeno-jejunostomy (Pylorus preserving operation): This anastomosis lies about 20 cm distal to the hepaticojejunostomy. This is done by Hand sewn technique in four layers with outer layers (seromuscular) is made with 3/0 non absorbable sutures and the inner layer (mucosa to mucosa) with 3/0 absorbable sutures.

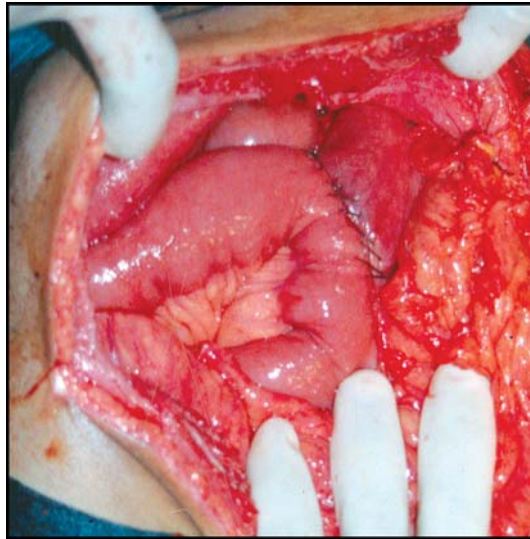


Figure 17.11: End to side gastrojejunostomy or duodeno-jejunostomy (Pylorus preserving operation)

Step 12: Final appearance of reconstruction

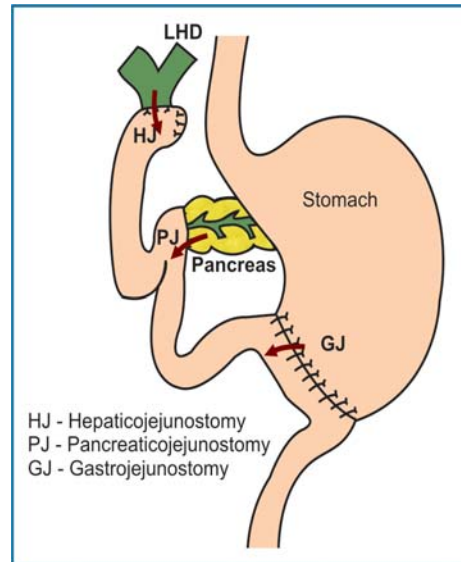


Figure 17.12: Final appearance of reconstruction

Step 13: Wound closure: The wound is closed in layers with drains near the anastomoses.

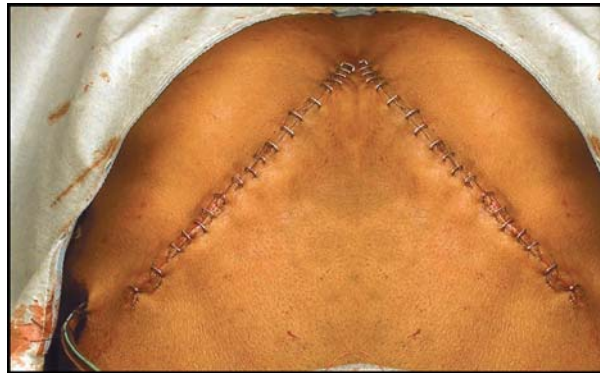
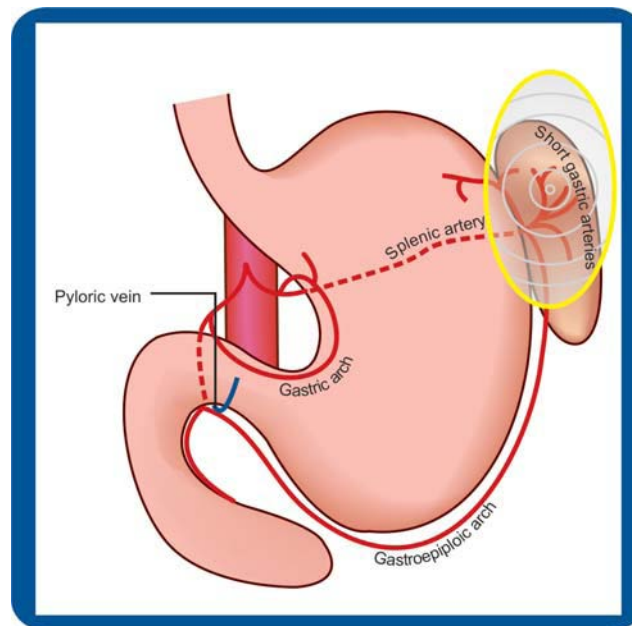


Figure 17.13: Wound closure

Splenectomy



Step 1: Position: Supine



Figure 18.1: Supine position

Step 2: Incision: Long midline or left subcostal incision.



Figure 18.2: Left subcostal incision

Step 3: Deepening the incision: After incising the skin and the subcutaneous planes, the anterior rectus sheath, rectus abdominis muscle, posterior rectus sheath and the peritoneum are incised in the same line with cutting diathermy, and the abdominal cavity entered.



Figure 18.3: Deepening the incision

Step 4: Mobilization of spleen: The surgeon should pass his left hand over the convex surface of the spleen and it is pulled towards the midline, and the posterior leaf of the lienorenal ligament is incised with scissors.

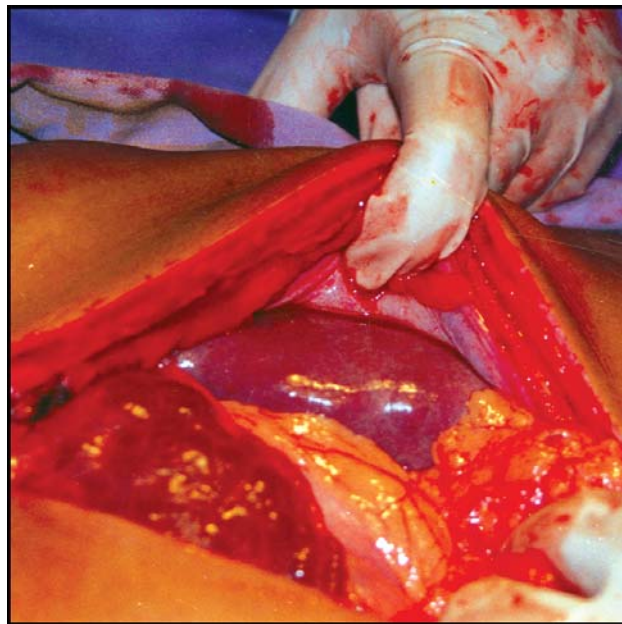


Figure 18.4: Mobilization of spleen

Step 5: Division of short gastric vessels: The short gastric vessels are divided between ligatures.

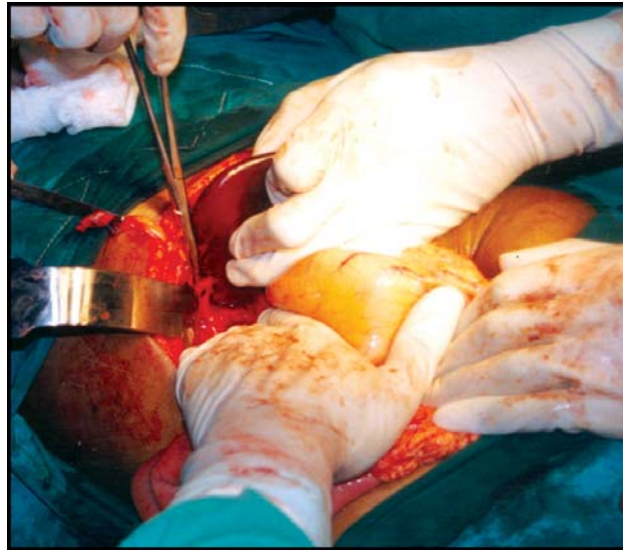


Figure 18.5: Division of short gastric vessels

Step 6: Division of gastrosplenic ligament: The gastro-splenic ligament is divided.



Figure 18.6: Division of gastrosplenic ligament

Step 7: Separation of spleen: The spleen is separated from all its attachments.

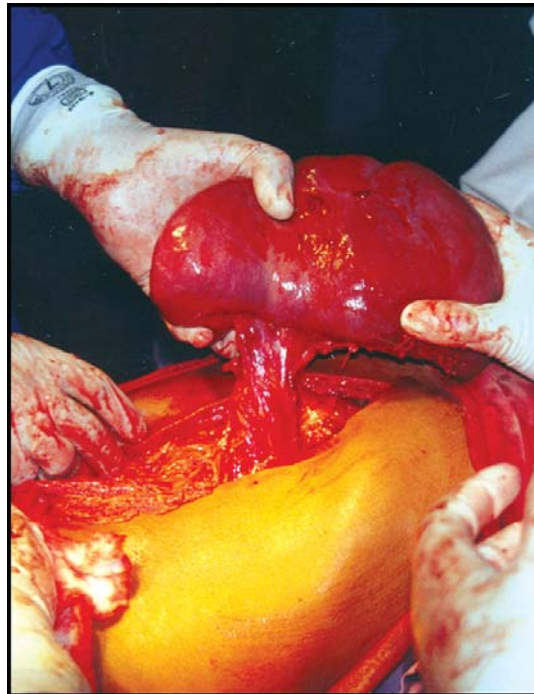


Figure 18.7: Separation of spleen

Step 8: Division of splenic vessels: The spleen is turned forwards and the splenic vessels (artery first) are divided at the hilum between ligatures.



Figure 18.8: Division of splenic vessels

Step 9: Wound closure: Wound closed in layers with a large bore drain in the left subphrenic space if necessary.



Figure 18.9: Wound closure

Excised spleen

Figure 18.10: Excised spleen

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