Complications (Fig. 29.30)
1. Intestinal obstruction
2. Pericolic abscess: Pain is present in the tumour site and may radiate to back, leg or hip as in caecal perforations. It is due to irritation of the psoas muscles or due to irritation of femoral nerve.
   - Diagnosis is confirmed by ultrasound/CT scan.
   - Percutaneous aspiration, followed by elective resection is the best treatment.
3. Faecal fistula (Fig. 29.31)
   - Pericolic abscess when it is incised or drained to the exterior may result in faecal fistula if there is malignancy.
   - Carcinoma caecum may result in appendicitis and appendicectomy may invariably result in faecal fistula.
4. Internal fistula: Colovesical, colocolic, coloenteric are not uncommon complications of malignancies. They are managed by resection. However, preoperative assessment of fistulae by investigations should be done.

PEARLS OF WISDOM
Involvement of local structures is not a contraindication for radical resection.

Investigations (Fig. 29.32)
1. Complete blood picture—demonstrates low Hb%
2. Occult blood in stools

PEARLS OF WISDOM
Occult blood in the stools may be the finding which gives a ‘clue’ in many cases of anaemia for evaluation.

3. Double contrast barium enema may show irregular filling defect—intrinsic, persistent. It may also show an apple core deformity (Figs 29.33 and 29.34 and Key Box 29.10).

**KEY BOX 29.10**

BARIUM ENEMA
- Gives good anatomic and topographic information.
- Can detect associated diverticular disease.
- Small ulcerative lesions can also be diagnosed.

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**Fig. 29.32:** Carcinoma colon—investigations

**Routine tests/general fitness**
1. Complete blood count
   - Hb%: Low indicating anaemia
   - TC, DC: If it is high, it indicates perforation, pericolic abscess
   - ESR: May be increased
2. Stool: Occult blood positive
3. Liver function tests, renal function tests and blood sugar estimation
4. Cardiac ECHO/ECG for fitness before surgery

**Diagnostic tests**
1. Ultrasound: Simple, baseline noninvasive investigation
   - Can pick up "colon mass"
   - Can detect liver metastases
   - Can demonstrate ascites, para-colic nodes
2. CT scan
   - Objective, more precise about mass, infiltration to vascular pedicles, lymph nodes, urters
3. Colonoscopy
   - Invasive but diagnostic and Gold standard investigation
   - Biopsy should be taken for final confirmation

**Fig. 29.33:** Barium enema showing apple core deformity

**Fig. 29.34:** Intrinsic, irregular, persistent filling defect

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**Fig. 29.31:** Carcinoma colon perforated—pericolic abscess which on draining resulted in faecal fistula
Figs 29.35A and B: Colonoscopy shows growth and biopsy is being taken (Courtesy: Dr Filipe Alvaes, Consultant, Medical Gastroenterologist, KMC, Manipal)

4. **Flexible sigmoidoscopy**: 60 cm of colon can be visualised. It is an outpatient procedure. It is indicated in rectal bleeding. An enema is given before the procedure.

5. **Colonoscopy** is done to take a biopsy from growth and also to rule out synchronous malignancy as seen in 5% of the cases (more than one malignancy at the time of diagnosis). If biopsy cannot be taken, as in obstruction, brush cytology can be taken (Fig. 29.35).
   - Small risk of perforation is present and it is an invasive procedure.
   - Virtual colonoscopy can pick up polyp of 6 mm size also, but biopsy cannot be taken.

6. **Ultrasound**: It is the baseline investigation to be done first. It can detect colonic mass
   - It can detect hydronephrosis, liver metastasis, ascites, para-aortic nodes.
   - Ultrasound guided biopsy is possible in limited cases.
   - Definitely it cannot pick up early mucosal or lesions which have penetrated up to muscularis mucosa or serosa.

7. **CT scan in carcinoma colon**
   - Other than a biopsy, it has all the advantages and it is the investigation of choice after colonoscopy.
   - Anatomical location of the tumour, involvement of serosa
   - Infiltration of local adjacent structures like ureter (right side)—preoperative stenting is required in such cases.
   - Metastasis in the liver, ascites, para-aortic nodes.
   - Other associated diseases specially in elderly such as aortic aneurysm, gall stones, hiatus hernia, etc.
   - 90% and 95% sensitivity and specificity in detecting liver lesions greater than 1 cm.

8. **Carcino-embryonic antigen (CEA)** (Key Box 29.11).
   - It is a foetal glycoprotein, not present in normal human beings (minute quantities). It is present in the cell membranes of many tissues including colorectal cancer.
   - It is present in the last trimester in the foetus.
   - It has a prognostic rather than a diagnostic value. After treatment of the primary, CEA level should come back to normal. If it is increased, it suggests either recurrent tumour or secondaries in the liver.

**Prognostic factors of carcinoma colon**
- **Spread**: If it is limited to mucosa and there are no nodes, 5-year survival is 90–100%.
- **Age**: Younger patients have poor prognosis.
- **Grade**: Poorly differentiated tumours have worse prognosis.
- **Obstruction and perforation**: Poor prognosis due to dissemination of malignant cells.
- **Blood transfusion**: Perioperative blood transfusion has poor prognosis.

**Pearls of wisdom**

Blood transfusion increases number of suppressor T-lymphocytes thus causing immunosuppression. Hence, follow bloodless surgery or autologous blood transfusion.

**Preoperative preparation**

1. Mechanical bowel preparation is necessary to reduce the bacterial load in the colon. This reduces incidence of anastomotic leakage.
   - Whole gut irrigation by oral polyethylene glycol is found to be superior than enemas. It is the method of choice today. It is mixed with 2 litres of water and is given 12 hours before surgery.
2. **Antibiotics:** Oral antibiotics neomycin/metronidazole or neomycin/erythromycin are given in the afternoon and evening before surgery. They act locally and are given mainly to decrease wound infection.

   Intravenous antibiotics such as ciprofloxacin and metronidazole or 3rd generation cephalosporins such as ceftriaxone is given one hour before the surgery. The target bacteria are *E. coli* and *Bacillus fragilis*.

3. **Improvement of general condition** by correcting albumin levels and if necessary, TPN will definitely decrease the incidence of anastomotic leakage.

4. A **fat-free diet, low residue diet** is prescribed two to three days before surgery.

5. **Prophylactic fractionated heparin** enoxaparin or dalteparin is given subcutaneously, to prevent deep vein thrombosis. Otherwise subcutaneous heparin is given.

### Principles of surgery

Colonic surgery is a very common problem encountered in the practice or institution. Every surgeon should be aware of the basic principles of colonic surgery and technique of anastomosis. I have grouped them together under the heading of ten commandments so as to understand better.

### Surgery

Over a period of years, radical resections for carcinoma of colon have become less radical pertaining to the extent of bowel resection. For example: One need not remove terminal 30 cm of ileum for carcinoma caecum today. Only 6–8 cm of ileum removal is sufficient in a right hemicolecotony.

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**Different types of surgery**

1. **Carcinoma right colon including caecum:** If it is operable, the treatment is right radical hemicolecotony. Structures removed in this operation are (Fig. 29.36 and Key Box 29.12).
   - Terminal 6–8 cm of ileum
   - Caecum, appendix and ascending colon
   - One-third of transverse colon
   - Fat, fascia, lymphatics and lymph nodes like ileocolic nodes, periolic nodes, nodes at the origin of SMA.
   - If the growth is fixed to posterior abdominal wall, common iliac vessels, palliative ileo-transverse anastomosis is done (ileo-transverse colostomy).

2. **Carcinoma transverse colon—‘V’ resection.** The area supplied by middle colic artery is removed followed by end to end anastomosis. The patient may need removal of entire transverse colon depending upon lesion.
   - When lesion is at hepatic flexure or in the transverse colon, extended right hemicolecotony should be done.

3. **Carcinoma left colon—left radical hemicolecotony.**
   - Left half of the transverse colon and descending colon are removed followed by anastomosis of transverse colon to sigmoid colon—This is the area supplied by left colic artery (Fig. 29.37).

#### KEY BOX 29.12

**STRUCTURES THAT CAN GET INJURED DURING RIGHT HEMICOLECTOMY**

- Duodenum
- Ureter
- Gonadal vessels

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1 Removal of a foot of ileum is not necessary unless it has a doubtful vascularity after ligation of pedicles.
4. Carcinoma sigmoid colon—radical sigmoid colectomy followed by anastomosis of descending colon to the rectum (colectomy). Or in a few cases, left hemicolec-lectomy may have to be done.

5. Left-sided colonic tumours with intestinal obstruction—an emergency temporary transverse colostomy is done to divert the faecal matter to relieve intestinal obstruction (for more details on colostomy see page 785). Resection is not done because many patients are elderly with comorbid illness such as diabetes, hypertension, cardiac illness.

   • General condition of the patient is poor with gross abdominal distension and dehydration.
   • Left colon is loaded with faecal matter. Hence, high chances of anastomotic leakage and faecal peritonitis are present.
   • After 2 weeks, laparotomy is done once again. The primary tumour is resected and end-to-end anastomosis done.
   • This is followed by closure of the colostomy 8 weeks later—three-stage operation.
   • Single-stage resection can also be done provided, thorough colonic irrigation through appendicular stump (after appendicectomy), is given and it should be successful in clearing the entire colon. This is the concept of on-table irrigation and lavage.

ON-TABLE IRRIGATION AND LAVAGE (Fig. 29.38)

Indication
In cases of left-sided colonic obstructions—classical example being carcinoma rectosigmoid with obstruction.

Procedure
• Resection is done first. Clamps are applied to both ends.
• Appendicectomy is done and purse string suture applied but not tied.
• Through the appendicular stump lumen, a 30 Fr Foley catheter is passed into colon.

Fig. 29.38: ‘On-table’ irrigation through appendicular stump

- The position of the catheter is checked to be lying safely in the cecum and its balloon is inflated. A purse string suture, previously applied to the appendix base is tied.
- Saline is irrigated at a rate of 50 to 100 ml per hour speed. Proximal clamp is opened into a container (kidney tray).
- It takes about an hour or so for the whole gut irrigation.
- This is done till the returning fluid is clear.

Advantage
- It avoids a stoma, decreases stay in the hospital and thus less expensive.

Caecostomy tube

Once anastomosis is completed, Foley catheter is brought out through an opening in the abdominal wall and connected to a bag. It is sutured to the inside of the parietes by vicryl sutures and kept open.

Tube removal

Tube is removed after 7–10 days provided there is no leak from the stoma line.

ENHANCED RECOVERY PROGRAMME

These are the various changes in the management of these patients over conventional methods. A few are given below which will help the patient recover fast and get discharged—no quality compromise:

- Nasogastric tube is not required unless operating on obstructed colons. Evidence is that the sutures/staplers are good enough to prevent the leaks.
- Improve the nutrition preoperatively by increased intake of carbohydrates—oral or TPN.
- Laparoscopy has the definite advantage of small incisions, less pain, easy breathing and less respiratory complications.
- Early mobilization, early feeds, early recovery and early removal of catheters.
- Epidural catheters to relieve pain.
- Few diagrammatic representation of the colectomies are shown in the next page (Figs 29.39 to 29.44).
SURGERIES IN A CASE OF CARCINOMA COLON (Figs 29.39 to 29.44 and Table 29.4)

Figs 29.39A and B: Right hemicolectomy followed by end-to-end ileocolic anastomosis

Figs 29.40A and B: Palliative ileotransverse anastomosis in inoperable case

Figs 29.41A and B: Extended right hemicolectomy—growth in the hepatic flexure

Figs 29.42A and B: Transverse colectomy followed by colorectal anastomosis

Figs 29.43A and B: Left hemicolectomy for growth in the splenic flexure

Figs 29.44A and B: Resection of rectosigmoid growth followed by colorectal anastomosis

Figs 29.39 to 29.44: All figures are contributed by Ms Vidushi, MBBS student, KMC, Manipal
**POSTOPERATIVE CHEMOTHERAPY**

1. pT1-2N0M0 do not require any adjuvant treatment, such patients can be kept on follow-up with routine 3 monthly CEA and annual CECT thorax/abdomen/pelvis.

2. pT3N0M0 or node positive disease requires adjuvant treatment in the form of concurrent chemoradiotherapy and chemotherapy. 2 cycles of FOLFOX (5-FU + Leucovorin + Oxaliplatin) → Concurrent 5-FU/Leucovorin and radiation → 2 more cycles of FOLFOX.

Oral Capecitabine can be used in place of IV 5-FU.

3. It is preferable to add Oxaliplatin in the chemotherapy regimen if nodes are positive for metastatic disease. In older population (>65–70 years), it might offer less benefit.

4. Oxalaptins have been shown to downsize liver metastasis. Chief complications of Oxalaptins is peripheral neuropathy.

   - Indications for chemotherapy has been given in Key Box 29.13.

**KEY BOX 29.13**

**INDICATIONS FOR CHEMOTHERAPY**

- All node positive patients
- In node negative patients if
  - T4 lesions are involving free mesothelial surface
  - Major microscopic vein involvement
  - Signet cell carcinoma
  - High preoperative CEA
  - Aneuploidy on flow cytometry
  - Microsatellite instability

**Postoperative radiotherapy**

Adenocarcinoma colon does not respond well to radiation. Routinely it is not given. Surgery remains the gold standard for carcinoma colon. Soft tissue infiltration into psoas muscle or abdominal wall or inoperable recurrent tumours are indications for radiotherapy.

**Metastatic disease without obstruction**

Patients with isolated liver/lung secondaries should also undergo treatment with a radical approach as even in these cases with resection of the primary and adequate liver/lung resection, a good disease control can be achieved.

1. A typical course of neo-adjuvant therapy comprises concurrent 5-FU/Capecitabine and radiation in cases of large lesions abutting the abdominal wall or down into the pelvis. A dose of 45–50 Gy is used to treat the pelvis including the growth and the draining lymphatic regions followed by 5 Gy boost to the tumour itself.

2. Following neo-adjuvant therapy, patient should be re-evaluated using CT/MRI for possibility of resection.

3. Surgery is usually considered after 6–8 weeks following neo-adjuvant therapy as the maximal response to the treatment may take up to 2 months.

4. Further adjuvant treatment is to be given following surgery depending upon the histopathological report.

**Management of liver metastasis**

- CT scan and PET scan are done to evaluate local/systemic disease. Provided there is no systemic spread, liver secondaries have to be treated aggressively. Pattern of recurrence in colonic carcinomas is more commonly distant, that is the tend to recur more commonly at distant sites such as liver and lungs. As a result, systemic treatment is more necessary.

- Liver directed therapies such as hepatic arterial chemotherapy infusion/embolisation, radiofrequency-ablation radiotherapy should be used in treatment of isolated liver metastasis.

- Indications for liver resection is given in Key Box 29.14.
**KEY BOX 29.14**

**INDICATION FOR RESECTION OF LIVER METASTASIS**

- Solitary metastasis or metastasis confined to one lobe.
- < 3 metastasis in both lobes
- Absence of extrahepatic disease

**Novel agents in colorectal cancers**

1. **Bevacizumab**—anti-VEGF (vascular endothelial growth factor) monoclonal antibody. It has anti-angiogenesis property thereby controlling the tumour growth.
2. **Cetuximab** anti-EGFR (epidermal growth factor), monoclonal antibody.

**Follow-up (Key Box 29.15)**

Most of the colonic cases are curable if diagnosed and treated early. Also metachronous lesion can occur in the rest of the colon. Hence, certain tests are necessary during follow-up.

**Treatment of recurrent or metastatic cancer**

- Recurrence or metastasis is suspected during follow-up by abnormal values of investigation.
- Recurrent tumour should be resected *en bloc*—it may amount to a more radical procedure including resection of duodenum, liver, kidney (Figs 29.45 and 29.46).
- Metastasis in the liver (Key Box 29.14).

**KEY BOX 29.15**

**FOLLOW-UP OF COLORECTAL CANCER**

<table>
<thead>
<tr>
<th>Tests</th>
<th>Duration</th>
<th>In years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Haemo-occult</td>
<td>Once in 3-6 months</td>
<td>3</td>
</tr>
<tr>
<td>2. Colonoscopy</td>
<td>6 months after surgery, later once in a year</td>
<td>3</td>
</tr>
<tr>
<td>3. Alkaline phosphatase</td>
<td>Once in 3-6 months for 3 years</td>
<td>3</td>
</tr>
<tr>
<td>4. CEA</td>
<td>Once in 6 months</td>
<td>3</td>
</tr>
<tr>
<td>5. Chest X-ray</td>
<td>Yearly</td>
<td></td>
</tr>
</tbody>
</table>

**CHEMOPREVENTION OF COLORECTAL CANCER**

1. **Folic acid**: It is an important vitamin with many functions. In the absence of folic acid, hypomethylation can occur. As a result of this overexpression of proto-oncogenes such as K-ras and c-Myc can occur. Deficiency of folic acid causes imbalances in the nucleotide pool leading to DNA break and mutation. Thus folic acid supplementation should be given in adenoma specially when baseline levels of folic acid is low.

2. **Dietary fibres**: Fibres decrease the transit time, they dilute the carcinogens and are used to prevent development of cancer. Cellulose, hemicelluloses and pectin are a few examples. Fibres also produce short chain in fatty acids causing fermentation by faecal flora. Thus colonic pH becomes more acidic which in turn inhibits carcinogenesis.

3. **Aspirin, calcium, and sulindac** also have been used to prevent cancer developing in an adenoma.

**COLON SCREENING**

- Large bowel is the 4th most common site for cancer after lung, stomach and breast.
- More common in North America, North Europe and Australia. Lowest rates in Africa, India.
- 75% of CRC develop in people with no known risk factors apart from older age.

Figs 29.45 and 29.46: A colorectal cancer patient who was operated 3 years back for carcinoma caecum presented with recurrence in the abdominal wall. He underwent excision of the tumour. He did not have any other site of metastasis. Postoperative radiotherapy was given.
Forensic Medicine and Toxicology

1. Forensic examination of Injury and Wounds
   - Identification of Bite mark
   - Entry wound & exit wound
   - Cause of death from wound
   - Various cause of generous cheat
   - Various cause of generous cheat, sight, cause in detail
   - Features of entry wound of Rifle Bullet

2. Exam. of Blood & Seminal Stain
   - Blood group
   - Use of Blood group in disputed Paternity
   - Various test to confirm semen
   - Test of blood grouping in blood stain
   - Screening test of Blood Stain
   - Test of Blood grouping in blood stain
   - Test of Blood grouping in blood stain

3. Rape
   - Evidence of Rape
   - Various test to confirm semen
   - Paternity
   - Various test for human blood
   - Screening test of Blood Stain
   - Rape method of Preservative semen in Rape
   - Sowing baby in exchange

Notes of Dr. Ravindra Goswami (IAS-2015, AIR-153)
Poisoning


Classify Agri poison


2007

Classify OP poisoning + Sign, Sym + mg of Acute OP

S, S, mnx of parathion poisoning (2007) Class of Insecticide

Aluminium phosphide poisoning - precipte, S, S, mnx

2013

S, S, mnx of Chronic lead poisoning (2013) Carbol poisoning

2014

Sedative overdose = 1990 General Principles

2009

of mnx of Barbiturate / Sign, Symptom

Poisoning

2009

Drugs of Abuse, Intoxication poisoning death due to any of Abuse

2013

Drugs of Abuse + Implication on Health