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COLONIC OBSTRUCTION

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The optimal management of large bowel obstruction remains controversial despite the extensive literature on the subject. Interpretation of this literature is complicated by the fact that the individual reports include heterogenous groups of patients, who have been treated in a variety of ways with little to indicate the rationale underlying the management decisions. Prospective gathered data are rare [24] and there has been only one, incomplete, randomized trial comparing primary bowel resection versus staged resection [53].

Definition

Bowel obstruction is defined as partial or complete obstruction of the small or large bowel that impedes the natural preogression of digestive processing [83].

Causes of Colonic Obstruction: (Table 1)

1. Malignant disease accounts for about 90% of all cases of colonic obstruction [92] and 85% of patients who undergo emergency colorectal surgery have obstruction from colorectal carcinoma [24; 17].
2. Colonic volvulus accounts for 10% to 15% of colonic obstructions and 1% to 4% of all cases of intestinal obstruction. In Eastern Europe and parts of Africa and Asia, volvulus accounts for 20% to 50% of all intestinal obstructions [6].
3. Diverticulosis is common in western populations. Obstruction accounts for about 10% to 15% of complications related to diverticulosis [9].
4. Intussusception, although generally recognized as a cause of intestinal obstruction in the pediatric population, about 5% of cases of intussusception occur in adults [28] .
5. "Pseudo-obstruction" is a term used when symptoms of obstruction are evident, but actual obstruction cannot be confirmed by the usual diagnostic methods [68].
6. Adhesions and hernias – the usual causes of small bowel obstructions – rarely cause obstruction of the colon. The incidence ranges from 0.5% to 8.3% [59].
7. Other causes of large bowel obstruction include Crohn's disease, Ulcerative colitis inflammatory processes, ischemic colitis, radiation colitis, feacal impaction, endometriosis, and foreign bodies.
8. Paralytic ileus secondary to injury, illness, or electrolyte abnormalities.
9. Causes of colon obstruction in neonates include meconium plug syndrome, aganglionic megacolon (Hirschsprung's disease), colon atresia, small left colon syndrome, neuronal colonic dysplasia, intestinal pseudo-obstuction, and the various presentations of imperforate anus.

Table (1): ***Causes of intestinal obstruction*** [83].

Extrinsic lesions	*Intrinsic Lesions*	*Intralumenal Objects*
Adhesions and congenital bands	Benign and malignant neoplasms	Meconium ileus
Hernias	Adenocarcinomas	Barium impaction
External hernias	Lymphomas, lymphosarcomas	Fecal impaction
Internal Hernias	Carcinoid tumours	Bezoars
Diaphragmatic hernias	Inflammatory conditions	Foreign bodies
Volvulous	Tuberculous enteritis, Schistosomiasis,	Parasitic infestation
Mid gut	Lymphogranuloma, actinmycosis Chron's disease	
Cecal	Strictures secondary to ischemia	
Sigmoid	Radiation injury	
Extrinsic masses	Diverticulitis, pelvic inflammatory disease	
Benign or malignant tumours	Intussusception	
Abscesses	Congenital defects	
Aneurysms	Intestinal atresia	
Hematomas	Malrotation/Volvulus	
Endometriosis	Meckel diverticulum	
Ovarian tumours	Hischsprung disease	

Classification of Bowel Obstruction (Table 2):

Table (2): ***Classification of bowel obstruction*** [83].

Classification	*Subtype of Obstruction*	*Definition*
Causes	Mechanical	Lumenof the bowel is physically obstructed with a mass or narrowed opening
	Non Mechanical (paralytic)	Peristalsis is halted in an area of the bowel producing a back up of bowel contents
		Single occurrence or periodic unrelated occurrences of bowel obstruction.
Onset	Acute	Usually characterized by rapid onset of symptoms
	Chronic	Repeated episodes of partial or complete bowel obstruction due to an ongoing risk factor
Extent	Partial	Bowel lumen partly open, and allowing some movement of bowel contents, but activity is slow or compromised.
	Complete	Total occlusion of the bowel lumen, causing complete back up of all bowel content proximal to obstructing mass or non-peristalsis section.
Effects on Bowel	Simple	When the lumen is obstructed, but the blood flow to the mesentery remains intact.
	Strangulated	An obstruction with compromised blood flow to the obstructed area.
	Closed loop	A section of bowel is trapped over itself and blocked on both ends, resisting both regurgitation and abnormal progression of the intestinal contents. (Common causes are volvulus , strangulated hernia and colonic obstruction with competent ileocaecal valve).

Pathophysiology

The pathophysiologic mechanisms of bowel obstruction can involve alterations in the bowel wall, neurologic, or vascular impairment of the bowel [83]. Irrespective of aetiology or acuteness of onset, the proximal bowel dilates and develops altered motility. Below the obstruction, the bowel exhibits normal peristalsis and absorption until it becomes empty, then it contracts and becomes immobile. Initially, proximal peristalsis is increased to overcome the obstruction, as intraintestinal pressure increases, the blood flow to the mucosa is affected more severely than flow to other intestinal tissue. If the obstruction is not relieved the bowel begins to dilate causing reduction in peristaltic strength, ultimately resulting in flaccidity and paralysis [30].

The distension proximal to an obstruction is produced by two factors:

- Gas – regardless the level of obstruction-, there is a significant overgrowth of both aerobic and anaerobic organisms resulting in considerable gas production [96]. Following the reabsorption of oxygen and carbon dioxide, the majority is made up of nitrogen (90%) and hydrogen sulphide. In colonic obstruction, the normal gastrointestinal flora produces methane, leading to retained abdominal gas, distention, and increased serum ammonia levels .
- Fluid – this is made up of the various digestive juices. Following obstruction, fluid accumulates within the bowel wall and any excess is secreted into the lumen, while absorption from the gut is retarded [29]. Dehydration and electrolyte loss are therefore due to reduced oral intake, defective intestinal absorption, losses due to vomiting and sequestration in the bowel wall.

Bowel perforation occurs when the pressure proximal to the obstruction exceeds the capacitance of the bowel all. The function of the ileocaecal valve is important. When the valve is competent (thus preventing reflux back into the ileum), a closed-loop obstruction develops. Because of a correlation between tension in the colon wall and the diameter of the bowel based on La Place's law, the caecum dilates prone to perforate, especially when it reaches a diameter of 10 to 12 cm. Initially the serosa splits between the taeniae, and patchy sites of hemorrhage and perforation appear. Progressive peritoneal contamination then occurs. Perforation may also occur in a more distal segment, usually just proximal to an obstructing lesion [35].

Strangulation

Strangulation occurs due to, external compression (hernia orifices/adhesions/bands), Interruption of mesenteric blood flow (volvulous, intussusception), closed loop obstruction, or primary obstruction of the intestinal circulation (mesenteric infarction)

The venous return is compromised first before the arterial supply unless primary obstruction is present Once the arterial supply is impaired, haemorrhagic infarction occurs. As the viability of the bowel wall is compromised there is marked translocation and systemic exposure to aerobic and anaerobic organisms with their associated toxins [35].

Clinical Features

Examining the patient with untreated LBO may reveal signs of dehydration or septicaemia, a distended abdomen, altered bowel sounds, an abdominal mass, or signs of peritonism. An abdominal mass may be caused by a tumour, acute diverticulitis, or gross caecal dilatation. An abdomen without bowel sounds and with minimal tenderness and pain suggests pseudo-obstruction. Ascites and hepatomegaly in a patients with previously resected colorectal cancer suggests carcinomatosis. The rectum tends to feel empty and capacious; rarely, a rectal tumor is palpable or a rectal shelf suggesting carcinomatosis. Traces of blood suggest a possible tumor or bowel ischemia. Detecting strangulation and perforation is largely based on clinical symptoms and signs. High fever, persistent techycardia, or peritoneal signs strongly suggest strangulation or perforation and warrant urgent laparotomy [74].

Vomiting may be late in appearance or even absent in large bowel obstruction, depending to some extent on the competence of the ileocaecal valve Feculent vomiting rarely occurs and, when it does, is due to proliferation of bacteria in the stagnant intraluminal fluids proximal to the obstruction.

Laboratory Studies

Studies are directed at evaluating the dehydration and electrolyte imbalance that may occur as a consequence of large bowel obstruction and at ruling out ileus as a diagnosis. Complete blood count, routine serum chemistries and urine specific gravity should be evaluated. Suggestion of an abnormal anion gap also should prompt an arterial blood gas measurement and/or a serum lactate level measurement. A decreased haematocrit level, particularly with evidence of chronic iron-deficiency anemia, may suggest chronic lower gastrointestinal bleeding, particularly due to colon cancer. A stool guaiac test also should be prformed, for similar reasons. Althoughbowel obstruction, or even constipation, may mildly elevate the WBC count, substantial leukocytosis should prompt reconsideration of the diagnosis suggesting ischemia, perforation or ileus, secondary to an intra-abdominal or extra-abdominal infection or another process.

Imaging Studies

Plain Film

Abdominal radiographs confirm a clinical diagnosis of large bowel obstruction but may not be accurate in detecting the site or cause of the obstruction. It has a sensitivity and specificity of 84%, 72% respectively. A flat and upright abdominal radiograph may demonstrates dilation of the small and/ or large bowel and air fluid levels. An upright chest x-ray generally is ordered simultaneously to determine whether free air is present, which would suggest perforation of a hollow viscus and ileus rather than organic obstruction. A dilated colon without air in the rectum is more consistent with obstruction. The presence of air in the rectum is consistent with ileus, or partial obstruction. This finding can be misleading, particularly if the patient has undergone rectal examinations or enemas [99].

Contrast Studies

Contrast enema has been and continues to be the recommended radiological examination of choice for evaluating patients with colonic obstruction. Its sensitivity and specificity in diagnosing colonic obstruction is 80% and 100% respectively [62]. Contrast enema is used to differentiate between ileus, pseudo-obstruction and mechanical obstruction. In those patients thought clinically to have mechanical obstruction, over 10% in fact have pseudo-obstruction and in patients who have clinical pseudo-obstruction a similar proportion 10%, are found on imaging to have an obstructing carcinoma [92] . It also helps to localize the site of obstruction which allows planning for the operative strategy.

CT scan

Although CT role is growing for evaluating patients with small bowel obstruction [61], its role in large bowel obstruction is appears to be limited. It has gained ground in the diagnosis of intussusception [13,57] and diverticular disease although the distinction between perforated carcinoma and diverticulitis is problematic [8]. It has a sensitivity and specificity of 96% and 93% respectively. CT evaluation is also limited in partial colonic obstruction. In these cases, where there is no proximal dilatation to delineate the obstructing lesion. CT is much more difficult to interpret without proper colon cleansing and use of air insufflation. In cases where the differential diagnosis is confusing, CT provides more intra-abdominal information than could otherwise be obtained through colonoscopy or contrast enemas [31].

Endoscopy

Flexible endoscopy preceded by rectal enema may be useful in evaluating left sided colonic obstruction; including the anatomic location and pathology of the lesion. Although colonoscopy may be useful in patients with partial colonic obstruction it has little role in the initial evaluation of patients with complete colonic obstruction. The insufflation of air or even carbon dioxide through the endoscope into the obstructed bowel may exacerbate colonic distention and precipitate perforation. Because the caecum is not reached in such cases, the endoscopist must be alert to the possibility of incorrectly identifying anatomic landmarks and the location of the obstruction. An abdominal roentgenogram with the tip of the endoscope at the site of the obstruction may be helpful in identifying and documenting the location of the large bowel obstruction. Right-sided colonic obstruction is more difficult to evaluate without first administering an oral bowel preparation, which is contraindicated in the setting of bowel obstruction.

Specific Causes and Treatment For Large bowel obstruction

Colorectal Cancer

About 8 to 29% of patients with colorectal cancer present with obstructive symptoms [82]. Eighty-five percent of patients undergoing emergency colorectal surgery have obstruction form colorectal carcinoma [24] Approximately. three-quarters of all malignant large bowel obstructions are situated in the left colon at or distal to the splenic flexure [85]. Nearly half of splenic flexure lesions present with obstruction, while less than one tenth of all rectal carcinomas present in this manner [54,102]. At other sites in the colon, the risk of a lesion causing obstruction is similar at about 20% [70]. Patients who require emergent management of obstructing colorectal cancer have a worse prognosis than those who undergo elective operations [12].

The symptoms of malignant colonic obstruction are insidious in onset, with a median duration of 3 months, and 25% of patients have symptoms for 6 to 24 months [16]. The presence of blood in the stool, particularly when combined with obstructive symptoms, is highly suggestive of a neoplasm, as is the presence of weakness, weight loss, and anorexia.

Resuscitation

Resuscitation involves correction of fluid and electrolyte imbalance,nasogastric decompression to temporarily treat the obstruction and prevent vomiting and aspiration. Medical care is directed primarily at supporting the patient and treating any comorbid illnesses. Antibiotic prophylaxis against anaerobic bacteria and gram negative spectrum should be initiated [96] together with thromboembolic prophylaxis in high risk patients. Preoperative stomas marking, for both colostomy and ileostomy, are required. Once the patient has been resuscitated and prophylactic therapies have been instituted, the ideal is for a planned operation to be performed during daylight hours by seniour surgical and anaesthetic staff [15].

Treatment of obstruction of the right side

The concept of resection and primary anastomosis now is accepted by virtually all surgeons for treating carcinoma of the right and transverse colon proximal to the spelenic flexure [56]. The incidence of anastomotic leak was 10% compared to 6% for patients without obstruction (not significant) [70]. The only exception for primary anastomosis is the patient who is severely ill or who has an established, generalized peritonitis resulting from perforation because an anastomosis may increase mortality. Ileostomy with exteriorization of the proximal end of the colon is safer in this circumstance [70].

Treatment of obstruction of the left side

In the literature, the surgical techniques recommended for the treatment of colon cancer presenting as an

emergency are highly divergent. The decision must be made on a case to case basis, by choosing the best therapeutic option in each case.

I. Resection and immediate anastomosis

Conceptually, the ideal management of malignant large bowel obstruction would be to remove the tumour and restore bowel continuity at a single operation. This approach has, in the past, been discarded because of a mortality rate form anastomotic leakage of up to 50% [42]. Segmental resections involve anastomosis of unprepared, dilated and edematous bowel, and the traditional teaching is that this is to court disaster [41]. However, recent data indicate that more acceptable results can be achieved. To minimize these risks, early reports of successful resection and immediate anastomosis employed per-operative bowel preparation by on-table lavage [20]. These maneuvers undoubtedly add about 30-40 minutes in the length of the operation and may, in fact be unnecessary [1].

Although many surgeons are reassured if the bowel is emptied of faeces prior to anastomosis, the importance of bowel preparation has been challenged. While experimental data indicate that anastomotic leakage is increased by feacal loading [87], the clinical data are conflicting with some authorities finding a correlation between leakage and faecal loading [41] while others do not [81]. In recent series good results have been obtained by simple decompression of flatus and extrusion of solid faeces into a bowl [26], or even by ignoring the faecal load entirely [43] or by the use of intraluminal bypass tubes [38].

The combined mortality rate from 15 recent series gathered by Carty and Ravichandran 1997 was only 9% with an anastomotic leakage rate of 6% However, other authors reported an overall, statistically significant, mortality for one stage surgery with primary anastomosis to range between 23% to 50% [24; 82]. Therefore this option must still be exercised with caution.

An alternative strategy for avoiding a stoma in patients with large bowel obstruction is to extend the conventional wisdom of resection and anastomosisi of right sided lesions to the left with performance of a subtotal colectomy. It has several theoretical attraction [7]. Clearly, in the presence of caecal perforation or infarction, subtotal/total colectomy is the treatment of choice. Second, the dilated, unprepared proximal bowel is removed and this constitutes in effect a surgical bowel preparation [49]. An anastomosis between ileum and undilated distal colon can then be constructed. This may be preferable to the colo-colic anastomosis that follows a segmental resection since the leak rate of ileo-colic anastomosis 10% has been reported to be lower than that for colo-colic anastomosis 18% [70]. Third, synchronous lesions appear to be more common in patients presenting with obstruction and is around 7.1% [17]. Many of these lesions are removed by subtotal colectoy and subsequent screening for metachronous lesions is facilitated. The operative mortality rate and clinical anastomotic leak for subtotal colectomy are 7% and 1% respectively [17].

There are, however, several disadvantages of subtotal colectomy. The first is frequency of defaecation and the risk of faecal incontinence, especially in elderly patients [15]. Diarrhea is often a problem in the early postoperative period and usually settles to 1-5 motions per day. The frequency of defecation is higher after ileo-rectal than for ileo-sigmoid anastomosis [5]. The use of a J-pouch ileorectal anastomosis for patients having total colectomies with partial removal of the upper rectum, showed a successful outcome in terms of mortality, morbidity and function over a short- term follow up [21]. Secondly, subtotal colectomy is a major operation that can take over 200 minutes to perform [37]. Finally, removing a major part of the colon is the sacrifice of its, largely undetermined contribution to nutrition [63].

Role of defunctioning stomas

There is no consensus on the value of proximal defunctioning colostomy, ileostomy or caecostomy. Although diversion is known not to reduce the incidence of dehiscence [41] it is considered as management if an anastomotic leak occurs.

Conceptually similar defunctioning, but without the inconvenience of a stoma, can be achieved using an intraluminal bypass tube. These soft latex tubes are secured to the inside of the bowel proximal to the anastomosis and carry the faecal stream past the anastomosis. This technique has been used with good effect in small series [47].

II. Resection and delayed anastonsosis

The advantages of this approach include immediate resection of the obstruction, the relative safety of avoiding an anastomosis with its attendant risk of failure, and more rapid convalescence with a shorter hospital stay. A randomized trial comparing patients who underwent emergency colostomy versus resection without primary anastomosis did not show any differences in the mortality rate for the two groups [53]. The disadvantages are the complication rate associated with the primary operation in which stump dehiscence or retraction of the distal stoma causes complications in up to 10% of patients [91]. The mortality rate of Hartmann's procedure is 19% [17]. Secondly, the reanastomosis, with a morbidity of about 30% and anastomotic leak rate of about 10 % [65] and a mortality of 2-3%. Only 70% of patients have gastrointestinal continuity restored however resection without primary anastomosis is a good option for patients

with risk factors that preclude a primary anastomosis as perforated left colon cancer, poor nutritional status, or immuno-suppression.

III. Decompression and delayed resection (Three staged procedure)

Between 70% and 80% of patients having transverse colostomy undergo tumour resection during the first hospitalization [36]. The overall mortality rate is 21%. Sixteen percent for the decompression phase and an additional 5% for those who underwent resection [18]. When the cumulative morbidity and mortality rates of the three stages are taken into account, an initial loop colostomy does not offer any survival advantage and has the distinct disadvantage and prolonged hospital stay, which is at least twice as long as in those patients treated by one of the alternative options [1] and exposure of the patient to repeated operation [53]. This procedure should be considered in special circumstance, such as when the patient is unstable during surgery or when the surgical team is relatively inexperienced which may compromise performance of an adequate cancer resection in the presence of obstruction [36].

Recent Techniques

Recently attention has focused on decompressing the colon before surgery. This permits the conversion of a patient with large bowel obstruction to a more elective situation. Originally, some of these techniques were used for palliation in non-curative cases. These techniques include laser ablation of the tumor center [27;48], endoscopic stent insertion [23,97,79], balloon dilatation [93], and transluminal tube decompression [38,72,55]. Although these techniques hold promise, the available data are small. Also, no long term survival data are available. (Table 3) shows the results of the different series.

(Table 3): ***Results of Different Series for colonic decompression***

Technique	*Study*	*Number of patients (successful/number of attempts*	*Complications of deflation technique*	*Mortality (including deflation and resection*
Deflation with transluminal tube	Horiuchi et al 2001	9/9	None	0%
	Rattan et al 1989	6/9	None	0%
	Lelcuk et al 1986	3/4	None	0%
Balloon dilation with or without laser	Stone& Bloom 1989	3/3	None	0%
Laser	Kiefhaber et al 1986	54/57	Perforation (2)	3.7%
	Eckhauser & Mansour 1992	29/29	Perforation (1)	3.4%
Stent Placement	Saida et al 1996	12/15	Perforation (2) Dislocation (1)	0%
	Tejero et al 1997	35/38	None	2.6%
	Dauphine et al 2002	22/26	Migration (1)	0%

Palliative Treatment

Resection is the best treatment for disseminated cancer [58]. Although there is much controversy of the impact of resection on survival in patients with disseminated disease, some authors have found a benefit for resection in these patients [63]. In cases were resection is not an option as in most recurrent cases, proximal diversion, internal bypass or endoscopic techniques should be considered [23].

Colonic Volvulus

Colonic volvulus is an axial twist of the colon around its mesentery. Its incidence is 76.2% at the sigmoid, 21.7% at the caecum and 1.9% at the transverse colon and 0.2% at the splenic flexure [6]. The clinical presentation is the same to that of other types of large bowel obstruction; however, unlike a slowly progressive neoplasm, volvulus tends to present with an abrupt onset [34]. The cause of volvulus is unclear; however, a long sigmoid loop and narrow mesenteric attachment is essential for sigmoid volvulus.

Sigmoid volvulus

The diagnosis should be sought in the case of any institutionalized patient with an acute abdomen. In approximately 80% of cases, the diagnosis can be confirmed by a plain-film radiograph of the abdomen which shows a "bent inner tube" picture. If necessary, a barium enema can reveal the pathognomonic twisted

"bird's beak" or "ace of spades" deformity and sometimes a barium enema is successful for decompression when the rectal tube is not [31]. If the diagnosis is in doubt, a CT scan can also be helpful, demonstrating specific findings that can be pathognomonic such as the mesocolon "whirl sign" and in some cases indicating gangrene. High WBC counts and marked polymorphonuclear predominance with many immature forms strongly suggest that strangulation is present.

Management

Initial treatment consists of the stabilizing maneuvers previously discussed. The principal strategy for treating sigmoid volvulus is early non operative decompression by proctoscope, sigmoidoscope or colonoscope and rectal tube, followed by elective surgery [6]. The success rate of decompression is 55% to 75% [80]. Recurrence of sigmoid volvulus after decompression has been reported to be up to 90% and a mortality of 2% Surgery is usually done after decompression and orthograde bowel preparation. If the colon is viable, then a variety of surgical options are available which includes, detorsion with colopexy, sigmoid resection with primary anastomosis and mesosigmoidoplasty. The particular benefit of mesosigmoidoplasty is that no anastomosis is performed, and hence can be done in bowel that has not been decompressed or prepared preoperatively In patients with megacolon because the recurrence rate after resection and primary anastomosis in 82%, subtotal colectomy with ileorectal anastomosis should be done [64].

Failure of tube decompression, or suspected strangulation, demands immediate operative reduction. If the sigmoid is not viable resection is required followed by Hartmanns procedure which has a mortality of 12.5% compared to 33.3% when resection and primary anastomosis was done.

Caecal Volvulus

Volvulus of the caecum occurs commonly in persons 25 to 35 years of age. Unlike in sigmoid volvulus, severe chronic constipation is not an underlying factor, and there is no association with psychiatric or neurologic diseases. Hypofixation, presumably congenital, of the caecum, proximal ascending colon, and terminal ileum to the posterior abdominal wall is a prerequisite for caecal volvulus. Rotation of the hypermobile caecum, usually 360 degrees around the mesenteric pedicle of the ileocaecal artery, produces a closed-loop obstruction. This rotation is often precipitated by distal colonic obstruction from neoplasm, inflammation, or other causes.

There is a relatively high incidence of previous abdominal surgery in patients with caecal volvulus, the surgery possibly having disturbed the fixation of the caecum to the posterior wall. The clinical manifestations are essentially those of an acute small bowel obstruction. There is an acute onset of severe, colicky abdominal pain, followed by nausea and vomiting. The abdomen is diffusely tender and greatly distended [74].

A plain-film abdominal radiograph is usually diagnostic showing the characteristic "coffee bean" [32] deformity. Caecal volvulus can be confirmed with a contrast enema. Colonoscopy can be diagnostic for caecal volvulus, can exclude colonic ischemia, and may be therapeutic [2].

If bowel is viable, the mortality is 10% to 15% [71]. The approach to patients with caecal volvulus and viable colon is to perform resection with primary anastomosis [3]. Although caecostomy combined with caecopexy has 7% mortality compared to 21% mortality for resection and primary anastomosis, caecostomy has a higher morbidity than resection with primary anastomosis [67]. Nonviable colon is associated with an overall mortality of 40%. The mortality was 28% if primary anastomosis was avoided and an end ileostomy was done [3].

Diverticular disease

The incidence of large bowel obstruction in patients presenting with complicated diverticular disease is 10%-15% [100]. It is caused by either a pericolic abscess that causes obstruction by compression and spasm, this group is best treated by intravenous antibiotics, bowel rest, percutaneous drainage followed by subsequent resection and primary anastomosis. Obstruction may also be caused by repeated attacks of diverticulitis that result into fibrous stricture. Clinically this condition is difficult to differentiate from malignancy [75] and hence a cancer type resection is often required. Operative principles are the same as previously described for colonic cancer.

Intususception

Intussusception usually occurs in children aged 3 months to 5 years. Adult intussusception is uncommon, the large intestine accounting for about 20% [28]. It is usually due to a lesion that serves as a lead point for the invagination, which is usually malignant [71].

Unlike in children, intestinal bleeding is present in adults only 20% of the time and an abdominal mass is almost never felt [28]. Because of its nonspecific symptoms, adult intussusception is often not diagnosed until surgery is performed.

CT scan of the abdomen is the diagnostic test of choice for adult intussusception. Barium enemas are also accurate but, unlike in children, the reduction that may accompany barium enema is usually not desired before surgery because of the risk of a seeding from a malignant lead point. Plain-film abdominal radiographs usually show

nonspecific bowel obstruction.

Enema or insufflation techniques are contraindicated when there is evidence of peritonitis, perforation, sepsis, or shock. Patients with these problems require prompt surgical intervention. Primary resection is the best treatment for large bowel intususception because of the risk of malignancy.

Inflammatory bowel disease (IBD)

IBD may give rise to large bowel obstruction if fibrosis or carcinoma develops. Development of a fibrous stricture is more suggestive of Crohn's disease because the disease is transmural, whereas carcinoma is more common in ulcerative colitis. The majority of malignant stricture developed in patients with disease for 20 years or longer. Giant pseudopolyposis causing acute LBO is rare and has been reported in ulcerative colitis [89] and Crohn's disease [2]. Endoscopy may be helpful to differentiate between a benign and malignant stricture. If cancer can not be excluded a cancer type resection is required. If it is a benign stricture, resection is still likely to be done or balloon dilatation [46]

Ischemia

Colonic ischemia may occur as a result of atheroma of the mesenteric vessels, emboli, low-output states, or an iatrogenic cause, such as aortic surgery or therapeutic embolization. Ten percent to 15% of cases of colonic ischemia result in a stricture, but only a fraction of these result in LBO. Conventional treatment is resection, which may need to be extensive so that the blood supply to the remaining bowel is adequate. Principles of resection with primary anastomosis versus staged procedures are similar to what has already been discussed in the cancer section. For added safety, any left-sided primary anastomosis should be covered by a proximal stoma.

Radiation Stricture

In the abdomen and pelvis, the small bowel is the most critical dose-limiting structure. Radiation injury to the rectum causes a stricture in 21% of patients. However, the stricture onset is slow and large bowel obstruction is relatively uncommon. The pathologic process in chronic radiation injury is "endarteritis obliterans" and results in chronic ischemia. Evaluating the entire gastrointestinal tract prior to surgery is critical. Such evaluation allows assessment of the extent of radiation damage to both the large and small intestine and permits detection of recurrent tumor. Contrast studies, CT scans, and endoscopy are usually necessary. Skin incisions and stomas should be made away from irradiated skin [4]. Primary resection is the treatment of choice, however, if a radiation reaction is severe enough to result in a stricture, it is technically impossible to do a resection because of involvement of all pelvic structures. A stoma, either a colostomy or an ileosotomy, is the procedure of choice [59].

Acute colonic pseudo obstruction

The pathogenesis of acute pseudo-obstruction (Ogilvi syndrome) is not known. An imbalance in autonomic nervous activity is thought to be the major factor. Possible cause of this condition include cardiovascular, post-traumatic [66], postoperative [90], inflammatory [19] respiratory [101], metabolic, neurological and pharmacologic disorders [14]. Clinical features of Ogilvie's syndrome are abdominal pain (83%), constipation (51%), diarrhea (41%), fever (37%), and abdominal distension (100%). Because mechanical obstruction and pseudo-obstruction can have similar clinical features, a water soluble contrast enema or colonoscopy is recommended for all patients.

In general, management is conservative, involving bowel rest, intravenous fluid administration, gentle enemas, correction of the underlying cause, and regular clinical and radiological assessment. A significant percentage of patients do not improve with the above conservative treatment yet do not require urgent laparotomy. The therapeutic options here include colonoscopic decompression, pharmacologic manipulations, elective caecostomy, either open or percutaneous, and decompressive blow,-hole colostomy [59].

Colonoscopy is used with a success rate from 73% to 91% and a recurrence rate of 11% to 18%. Most recurrences were treated successfully with a second colonoscopy [10]. Pharmacologic manipulations involve administering guanethidine an adrenergic blocker, neostigmine a parasympathomimetic, or erythromycin a motilin agonist [11]. Intravenous guanethidine and neostigmine showed good results in which it deflated 8 out of 12 patients with Ogilvie's syndrome within 5 minutes [40].

Those who develop peritoneal irritation or free air require urgent laparotomy. Perforation carries a mortality of 46% to 75% [52] and should be actively prevented by careful assessment and treatment. The risk of perforation correlates poorly with the absolute caecal diameter. The mean caecal diameter for perforation is 15 cm. Perforation and the duration of distension correlated well. The mean duration for perforation is 6 days [44].

Obstruction by Colonic Adhesions

Obstruction of the colon is rarely caused by adhesions. The incidence ranges from 0.5% to 8.3%. The signs and symptoms of adhesional large bowel obstruction are similar to those of acute or intermittent small-bowel obstruction. Simple lysis of adhesions is usually sufficient; however, one should always look for another cause [59].

Faecal Impaction

The traditional treatment of faecal impaction consists of digital manipulation, enema instillation, or disimpaction under anesthesia. Even though these methods are usually successful, in certain circumstances laparotomy is required to avert or treat the complications of faecal impaction such as stercoral perforation [50].

Endoimetriosis

Colon and rectal endometriosis is relatively rare. When neoplasm cannot be ruled out as a cause, segmental resection is recommended.

Colonic obstruction in the pediatric group

Colon Atresia

Colon atresia as an isolated entity, unassociated with imperforate anus or cloacal exstrophy, is relatively uncommon. Failure to pass meconium in the first 24 hours of life, abdominal distention, and bilious vomiting are the usual clinical manifestations. Infants with colon atresia are usually full term and rarely have associated anomalies. Erect and recumbent abdominal radiographs demonstrate dilated intestine with air-fluid levels. The atretic loop often has a soap-bubble appearance because of the admixture of meconium and air. The diagnosis is confirmed by barium enema examination, which demonstrates a blind-ending distal end of a microcolon and dilated air-filled loops of proximal intestine. Most cases occur in the transverse colon. The sigmoid colon is the second most common site of colon atresia. Colon atresia is treated with a preliminary colostomy in the newborn period and subsequent closure with anastomosis at age 3 to 6 months. Other reports concerning colon atresia recommend primary anastomosis for right-sided lesions and a temporary colostomy for atresia affecting the sigmoid colon [73].

Meconium P1ug Syndrome

The exact cause is unknown and is thought to be related to some factor or factors that dehydrate the meconium. Meconium plug syndrome is unrelated to meconium ileus and in most cases is not a sequela of cystic fibrosis. Although an occasional infant with meconium plug syndrome has a positive sweat chloride determination consistent with cystic fibrosis, most do not [77]. Infants typically present with significant abdominal distention and failure to pass meconium in the first 24 hours of life. Plain abdominal radiographs demonstrate many loops of distended bowel with air-fluid levels. Barium enema study shows a microcolon extending up to the descending or transverse colon, at which point the colon becomes dilated and copious intraluminal material *(thick meconiurn plug)* is observed. The barium enema study is often both diagnostic and therapeutic. After the contrast material is instilled, large pieces of inspissated meconium plugs are passed, and the obstruction is completely relieved. Occasionally, a second enema, usually using gastrografin, is required to effect complete evacuation of the thickened meconium. If any signs of obstruction recur, aganglionic megacolon must be considered as the cause of these symptoms. Five percent of patients with Hirschsprung's disease present with a clinical picture of meconium plug syndrome in the neonatal period [69].

Aganglionic Megacolon (Hirschsprung's Disease)

Aganglionic megacolon is a neurogenic form of intestinal obstruction characterized by an absence of ganglion cells in the myenteric (Auerbach) and submucosal (Meissner) plexus. The absence of parasympathetic innervation causes a failure of relaxation of the internal anal sphincter. Aganglionosis begins at the anorectal line and in 80% of cases involves the rectosigmoid area. The disease process may extend proximal to the splenic flexure in 10% of cases, and the entire colon and distal ileum or more proximal small bowel may be involved in 10% of cases [73]. Relatively rare cases of total aganglionosis of the entire gastrointestinal tract have also been reported. Hirschsprung's disease has a definite family history. If the first infant in a family had rectosigmoid involvement, the risk that a second child will be born with Hirschsprung's disease is approximately 6%. An abnormal locus on the tenth chromosome has been identified in some families and is associated with the ret-oncogene. Eighty percent of affected infants are boys; in cases of total colonic aganglionosis, 35% are girls.

Most infants with Hirschsprung's disease are symptomatic at birth. More than 95% present with delayed passage of meconium in the first 24 hours of life. Almost all babies with aganglionosis are full-term babies, more than 95%, with an average birth weight greater than 3 kg. Abdominal distention and bilious vomiting are other presenting findings. Abdominal distention is often severe; obvious dilated loops of bowel are visible on the abdominal wall as intestinal patterning. In some instances, 10 to 15% of cases, the infants may have severe diarrhea alternating with constipation. This diarrhea is known as the *enterocolitis of Hirschsprung's disease* and is associated with colonic ulceration and an increased morbidity and mortality. Erect and recumbent abdominal radiographs demonstrate many dilated loops of bowel.

A barium enema is performed in each suspected case of aganglionic megacolon. This contrast study usually demonstrates that the colon is slightly dilated; however, in many newborns, no definitive cutoff point indicates the transition zone where the narrow distal aganglionic rectum or rectosigmoid meets the obstructed dilated normal proximal colon containing ganglion cells. It may take 3 to 6 weeks for the transition zone to become apparent in some

cases. Unlike healthy newborns, who evacuate the contrast from a barium enema in 10 to 18 hours, infants with Hirschsprung's disease retain the barium for 24 to 48 hours. This observation emphasizes the importance of obtaining a delayed, more than 24 hours, follow-up abdominal radiograph. A transition zone may be seen more clearly on the delayed radiograph. In older babies, the transition zone is usually appreciated on the initial barium study. The barium enema may look entirely normal in babies with short segment disease affecting only the rectum and demonstrates a comma-shaped rectosigmoid, flattened flexures, and occasionally a microcolon in instances of total colonic aganglionosis [73].

The diagnosis of Hirschsprung's disease is confirmed by obtaining a rectal biopsy. A submucosal suction biopsy is adequate in more than 90% of cases. Ganglion cells are either identified or absent in the Meissner submucosal plexus. This determination must be done with permanent stains and is usually not amenable to frozen section techniques. In more urgent circumstances, a definitive diagnosis requires a full-thickness operative rectal biopsy that can be evaluated for the presence or absence of ganglion cells in Auerbach myenteric plexus by frozen section technique. If no ganglion cells are seen on at least 10 sections, the diagnosis of Hirschsprung's disease is confirmed. Acetytcholinesterase staining is also a useful diagnostic tool. Increased staining of neurofibrils is characteristic of Hirschsprung's disease. Anorectal manometry may be a useful diagnostic adjunct. This technique measures the anorectal intraluminal pressure with a balloon probe connected to a pressure transducer and polygraph recorder. In infants with Hirschsprung's disease, this study usually demonstrates an absent rectoanal inhibitory reflex, a finding indicating a lack of relaxation of the internal sphincter that is characteristic of aganglionosis.

Early reports strongly discouraged performing primary one-stage pull-through procedures in newborns and infants because of an increased rate of morbidity and mortality [84; 95]. This caused pediatric surgeons in most centers to perform an initial colostomy and to delay definitive repair until 3 to 12 months. The dogma of this multistage approach has been challenged, in terms of both outcomes and cost excellent results after a primary pull-through procedure in newborns using either the Soave procedure or the Duhamel technique by an open or laparoscopic procedure [33]. In instances of uncertainty, surgeon preference, or increased distension of the bowel, a temporary decompressing colostomy at least 10 cm proximal to the transition zone is the procedure of choice. This site is evaluated at the time of operation for the presence of ganglion cells on frozen section, to avoid placing the stoma in obstructed aganglionic bowel [86,45,22, 39, 88].

If no ganglion cells are present in the sigmoid colon, a biopsy is obtained in the transverse colon and then more proximally into the right colon and small bowel if necessary. Although some surgeons suggest a biopsy of the appendix to confirm total colonic aganglionosis, others indicate that the appendix should not be examined by biopsy because this location is not always reliable for identifying definitive ganglion cells. The biopsy process continues proximally into the small intestine until ganglion cells are identified. If a colostomy is performed, a definitive pull-through procedure using the Soave, modified Duhamel, or Swenson procedure may be accomplished when the infant is 3 to 9 months old. The type of procedure is the pediatric surgeon’s choice. All these operations are acceptable procedures, but the Soave and Duhamel procedures are the most popular.

The survival of babies with Hirschsprung's disease has improved significantly since 1990. Overall, survival is achieved in more than 90% of cases. Long-term follow-up is important. Most patients, more than 96%, are continent, but soiling is a problem in 2 to 3% of patients; rarely (in 1%), incontinence is observed. Some patients, 10 to 20%, may have constipation, but this can usually be improved with a high-fiber diet and stool softeners. Most children with postoperative symptoms improve with age [73]. In some children with persistent obstructive symptoms, coexisting intestinal neuronal dysplasia may be a factor.

Anorectal Anomalies

Anorectal anomalies can be classified as low, intermediate, or high, according to whether the rectal atresia has descended below the puborectalis sling, is at the level of the puborectalis, or remains above that level [25] (Table 4).

Table (4) : ***Wingspread Classification of Anorectal Anomalies.***

Level	*Female*	*Male*
High	Anorectal agenesis with rectovaginal fistula	Anorectal agenesis with rectoprostatitis, urethral fistula
	Rectal atresia	Rectal atresia
Intermediate	Rectovestibular fistula	Rectobulbar urethral fistula
	Rectovaginal fistula	
	Anal agenesis without fistula	Anal agenesis without fistula
Low	Anovestibular fistula	Anocutaneous fistula
	Anocutaneous fistula	Anal stenosis
	Anal stenosis	
	Cloacal malformations	
	Rare malformations	Rare malformations

Anal atresia refers to an inappropriate ascent of the proctodeum, resulting in a thin, veil-like membrane covering the normal anal canal and residing within the normal sphincter. Simply puncturing the skin membrane, which is often seen bulging with meconium, resolves this problem. Anal dilatations avoid the need for any extensive surgical procedures. Eighty-five to 90% of infants with imperforate anus and rectal atresia have an associated fistulous tract originating from the rectal segment. In males, the fistulous tract usually extends to the perineum or as a rectourethral fistula to the verumontanum of the urethra.

Anal atresia with a perineal fistula can be treated definitively in the neonatal period with a *cutback perineal Y-V anoplasty*. Male infants with rectal atresia and a fistula to the urethra are best managed with a diverting sigmoid colostomy in the neonatal period, with a subsequent posterior sagittal anorectoplasty (as advocated by Pena) performed between 6 and 12 months of age [25]. In girls, various anomalies are observed. Anal atresia with a rectoperineal fistula can be repaired as in males. Rectal atresia with a rectofourchette fistula can be treated by transplantation of the fistula to a site within the circular fibers of the external sphincter [98]. An optional method involves gently dilating the fistula on a daily basis to maintain evacuation of feces and then performing a transplant anoplasty at age 3 to 6 months when the tissues are firmer. Transplantation of the fistula allows preservation of the perineal body and an improved perineal appearance. Separation of the rectal and vaginal openings by the perineal body reduces the risk of urinary tract infection and vaginal soiling. If the tissues seem fragile at the time of the repair, a backup colostomy to divert the fecal stream may facilitate healing and may avoid breakdown of the repair.

Alternatively, a colostomy can be performed in the neonatal period, by using the posterior sagittal technique of Pena to repair the fourchette fistula. Girls with intermediate or high rectal atresia and rectovaginal fistula or a cloaca require a colostomy in the neonatal period [60].

Infants with imperforate anus have a high rate of associated anomalies in other systems. A careful systems review involving the gastrointestinal tract (looking for esophageal atresia, duodenal atresia), cardiovascular system, musculoskeletal system, genitourinary tract, and central nervous system should be carried out early to delineate these problems and to initiate treatment before other anomalies adversely affect the child's overall condition and outcome.

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