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Clinical outcome in acute adhesive small bowel obstruction after surgical or conservative management

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Abstract

Introduction and Methods: Acute Small Bowel Obstruction is a surgical emergency that constitutes 20% of the surgical emergencies reported in the west. This present research was to study the clinical outcome in acute adhesive small bowel obstruction after surgical or conservative management. From July 2022 to June 2023, a Prospective Single Center Study was done among 60 patients admitted with an episode of adhesive small bowel obstruction in Government General Hospital, Ongole. The following data was collected using a structured questionnaire: age, demographic characteristics, socio economic status, patient's complaints and duration of complaints. A detailed general examination was done. Systemic examination and basic investigations were done.

Results: Forty-five patients were managed using surgical methods while fifteen of them were managed through conservative measures. The mean age of the patients in surgery group (n=45) is 50.2 years (S.D=11.78) [range= 28-75 years] while the mean age of the patients in the conservative group (n=15) is 50.73 years (S.D=11.11) [range=37-72 years]. The overall (N=60) mean age was 50.33 years (S.D=11.52) [range=28-75]. Majority of the patients were males (n=42, 70%) while others were females (n=18, 30%). The mean pain score among 60 patients was 4.85 (S.D=2.02) [range=1-10]. All of them had past history of previous surgery. On inspection, abdominal distension with guarding present in 45 of them (75%). CECT showed free fluid in 45 of the patients (75%). Among 60 patients, twenty-six of them were readmitted, of which, ten of them were surgically managed and 16 of them

were conservatively managed. The mean duration of hospital stay was 8.75 days (S.D=3.63). The hospital stay was higher in the conservative group with a mean of 14.53 days (S.D=2.29) ranging between 12-18 days while the surgery group had a lower duration of hospital stay of 6.82 days (S.D=0.89) ranging between 6-8 days.

Discussion and Conclusion: Patients with SBO who undergo surgery are at lower risk of recurrence. Patients with SBO who undergo surgery are at lower risk of repeated hospitalisations. The recurrence of symptoms is also lower in the patients who were treated surgically. Patients with three or more of the following criteria (pain duration C4 days, abdominal guarding, leukocyte C10 9 109/l, C-reactive protein C75 mg/l, free fluid C500 ml on CT scan, or reduced contrast enhancement on CT scan) should undergo prompt surgical intervention as it allows both obstruction removal and long-term reduction of recurrent SBO episodes. The decision to operate should also take into account the evolution of the clinical status and laboratory values, additional CT findings (e.g., Volvulus, transition zone, reduced contrast enhancement, small bowel feces sign), as well as the patient's general condition, comorbidities, and surgical history.

Keywords: Volvulus, Conservative Measures, Nasogastric Tube.

Introduction

Acute Small Bowel Obstruction is a surgical emergency that constitutes 20% of the surgical emergencies reported in the west. It is defined as the "functional or mechanical interruption of the normal passage of contents through the gastrointestinal tract". The obstruction may be due to reasons either within the wall or outside the wall or in the lumen. It may be either partial or complete. The characteristic sequel is the accumulation of gas and air in the intestine leading to the swelling of the bowel wall. This culminates in the collection of fluid in the lumen thereby stretching the intestinal wall and jeopardise the perfusion of the wall. The incidence of small bowel obstruction does not vary with gender and has known to occur around 64 years of age. In more than 75% of the reported cases, small bowel obstruction is induced by adhesions of previous surgeries. The procedures that correlate with small bowel obstruction are appendectomy, hysterectomy and colectomy. Other reasons include; Neoplasms (5-10%), Crohn's disease (7%), Hernia (2%), Radiation-induced enteritis (1%), History of foreign body ingestion prior obstruction of the small bowel, Irradiation, Prior inflammation of the small bowel.

Ellis et al in 1999 showed that single previous pelvic or abdominal surgery in 29,970 patients led to a readmission rate of 34.6% with 2.1 times more cases of adhesions in ten years. Other studies report spontaneous small bowel obstruction where no previous history of surgery was reported.

The small bowel obstruction is an emergency with a need for tactical measures to relieve obstruction. It involves evaluation clinically, conduct a battery of biological tests and imaging studies (CT being the preferred mode of imaging).

Conservative management is being followed in a number of patients that includes giving rest to the bowel, decompress using Nasogastric tube and provide resuscitation using fluids. Assessment at regular intervals is essential to ensure that the bowel is not undergoing ischemia. Any signs of underlying ischemia should be recognised early and must be addressed using surgical intervention. Urgent surgery is warranted in patients who show visible signs of clinical weariness or

who show signs of strangulation in CT imaging. A number of patients present with symptoms where both conservative measures and surgical options are viable. The decision here depends on the discretion of the surgeon. This emphasizes the importance of the role of the clinician in the management of small bowel obstruction that also poses a clinical challenge. The challenges are manifold. The conservative management may result in intra abdominal adhesions which may present with obstruction on a future date. Surgical management may also lead to newer adhesions as is the case with abdominal surgeries.

The risk of recurrence is lower in patients who were treated with surgery which was reported at 42% (Landercasper et al, 1993). Comparatively, the risk is augmented in conservative management. Another study highlighting the correlation between the risk and rate of recurrence reported that the risk of recurrence is positively correlated to the rate of recurrence (Fevang, 2004).

The small bowel obstruction may be due to functional reasons like the bowel wall or the splanchnic nerves dysfunction. It may also be due to mechanical barrier. Sometimes, the large bowel obstruction may mimic like small bowel obstruction which is referred to as "colonic pseudo-obstruction". This acute functional dilatation is known as a dynamic or paralytic ileus. The symptoms are similar only with the absence of mechanical obstruction. Mechanical obstruction may be luminal, mural or extramural.

They can also be classified as:

a) Proximal (high SBO)

b) Distal (low SBO)

c) Closed loop

d) Open–ended obstruction

In closed loop obstruction, the lumen is occluded on either side not allowing movement of contents in either direction while in open-ended obstruction, the contents can move in any one direction.

Partial obstruction is where few contents like liquids and gas may pass through the lumen whereas in complete obstruction, all contents are blocked. Simple obstruction doesn't compromise blood supply whereas in complicated obstruction, the blood flow is cut off and leads to the ischemia, infarction and perforation. A unique type of intestinal obstruction is intussusception which is due to the telescoping of a segment of a bowel into another. It is prone to happen anywhere distal to the gastric cardia. If the intussusception happens in the retrograde direction, it is known as enteric but can also present in the downward direction. The exact mechanism of colic and enterocolic of intussusception is not clearly known but a presence of an organic lesion, diseased bowel, adjacent area of the normal bowel might act as a starting point for intussusception.

Depending on the process that initiates intussusception, it is classified as; a) Idiopathic b) Postoperative c) Intussusception due to an organic lesion Meckel's diverticulum may also invaginate into the ileum and then into the colon. Another condition is the volvulus which is the axially twisted portion of the gastrointestinal tract around the mesentery of the colon that may result in varying degrees of luminal obstruction and may lead to severe consequences like blood supply cut off, ischemia, infraction and perforation. Gall stone ileus is a mechanical obstruction due to the passage of gallstones through biliary-enteric fistula from the biliary system. The stones get impacted in the lumen of the bowel. When Meckel's Diverticulum gets incarcerated in an external hernia, it is called as Littre's hernia.

The present study aimed to compare the outcome of surgical and conservative managements of small bowel obstruction. The rates of recurrence, hospitalisations, duration of hospital stay and the number of patients who were operated post conservative management were compared.

Review of Literature

Intestine is a word derived from the Latin vulgate that denotes being “internal”. True to the name the intestines constitute most of the volume of the organs that are present internally. There are two parts to it: small and large.

The Small Intestine

The food released from the stomach releases into the small intestine as Chyme, where digestion takes place. The term small intestine is the longest part of the intestine (around 10 feet). It derives its name as small intestine from the size of the diameter of the lumen which is only 1 inch. It is not just the length but also a large number of mucosal folds largely increase the surface area of the small intestine which is essential for the meticulous process of digestion of food and absorption of nutrients.

Anatomy of the small intestine

Duodenum

The small intestine is coiled and comprises of three regions namely; duodenum, jejunum and ileum (proximal to distal). The proximal and the shortest region is the duodenum starting at the pyloric sphincter (10- inches). After the pyloric sphincter, the duodenum curves and enters the retroperitoneal space tracing a c-shape around the head of the pancreas. Then it ascends anteriorly and returns to the retroperitoneal cavity to continue as jejunum. The anatomical course of the duodenum leads to four parts;

a) Superior b) Descending c) Horizontal d) Ascending

There are few anatomically important portions in the duodenum. One such part is the place where there is a transition from anterior portion of the alimentary canal to the mid-region. This is marked by the presence of ampulla of Vater, also known as the hepatopancreatic ampulla. This region is the confluence of the bile duct and mainpancreatic duct that carry bile and pancreatic juices respectively. The opening of the hepatopancreatic ampulla is at the major duodenal papilla which is a tiny volcano shaped structure. It contains a sphincter that is responsible for regulating the flow of pancreatic juice and bile from the ampulla into the duodenum.

Jejunum

It is the next part of the small intestine that extends between ileum and duodenum. it is around 3-feet long and anatomically gets seamlessly extended as the ileum.

Ileum

The third and longest part of the small intestine that is around 6-feet in length is the ileum. It has an elaborate vascular structure to support the thick walls and the well-developed mucosal folds. Theileum continues into the caecum, the proximal portion of the large intestine which is demarcated by the ileocecal sphincter or valve. The mesentery holds the jejunum and Ileum to the posterior abdominal wall of the abdominal cavity. The large intestine forms a frame around these three portions of the small intestine.

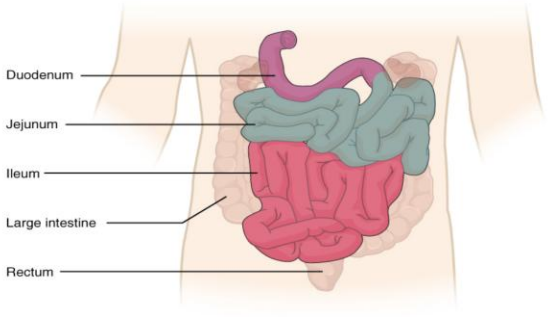

Image 1: Gross anatomy of the small intestine

Figure 1

Nerve and blood supply of the intestines

The extrinsic innervations of the small intestine is provided by the parasympathetic nerve fibers from the vagus nerve and the sympathetic nerve fibers from the thoracic splanchnic nerves. The main arterial supply comes from the superior mesenteric artery. They are accompanied by the veins that run with the arteries and drain into the superior mesenteric vein. The blood rich in nutrients is carried from the small intestine into the liver through the hepatic portal vein.

Histology

The walls of the small intestine is similar to the alimentary canal with different features of the mucosa and sub-mucosa which as well suited for absorption of the nutrients. The absorptive area contains close to 600-fold including villi, circular folds and micro villi. The majority of the absorption occurs in the proximal one-third of the small intestine, therefore, this arrangement is more existent in the proximal portion.

Circular folds

The mucosa and sub mucosa contain a deep ridge called plicacirculare which is a circular fold beginning from the proximal part of duodenum till the middle of ileum. These folds facilitate absorption of the nutrients. These folds structurally cause the fluid in the intestine swirl in these ridges which gives more time for absorption and mixing.

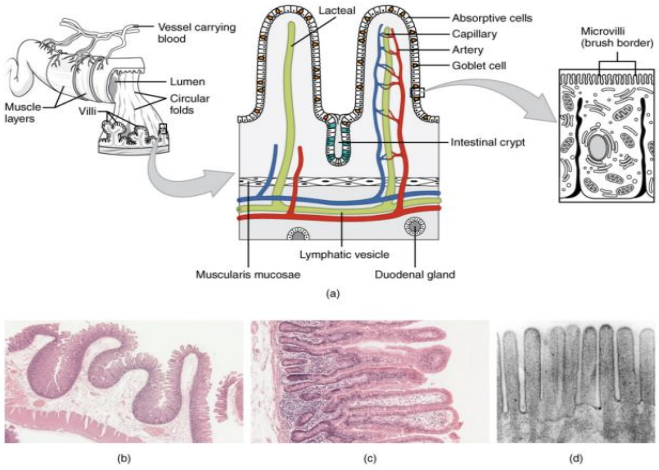

Figure 2

Villi

The circular folds are anatomically small hair-like projections (0.5-1 mm long) with high vascularity. This mucosa gives a furry texture that largely increases the surface area of the intestine (there are around 20-40 villi for every square millimeter). The villi are covered by the mucosal epithelium that is rich in absorptive cells. Every villus contains muscle, connective tissue and a capillary bed consisting of one arteriole and one venule. It also contains a lacteal, which is a lymphatic capillary. The carbohydrates and proteins are directly observed into the blood stream whereas the fat is absorbed through the lymphatics.

Microvilli

The smaller sub division of the villi is the microvilli that are approximately 1micro meter in diameter. They are surface extensions of the plasma membrane of the epithelial cells of the mucosa that are cylindrical and apical. Each cell contains a microfilament that supports the microvillus. Microscopically, the micro villus gives a brush border appearance. The surface of the membranes contains the digestive enzymes that aid in the absorption of the nutrients. The microvilli of the intestine largely

increase the surface area for absorption. Intestinal Glands The mucosa between the villi is lined by deep pockets that give way to crypts of Lieberkühn which are tubular interstitial glands. These crypts produce the intestinal juice which isalkalinein nature mixed with water and mucus. When the small intestinegets distended due to food or chyme, these glands release these fluids to aid absorption. The submucosa contains Brunner's glands which are mucus-secreting duodenal glands. The fluid is rich in bicarbonates and alkaline in nature that acts as a buffer for the acidic chyme from the stomach. The small intestine mucosa contains a number of cells with different functions. The following table enumerates the role of the different cells of the intestinal mucosa.

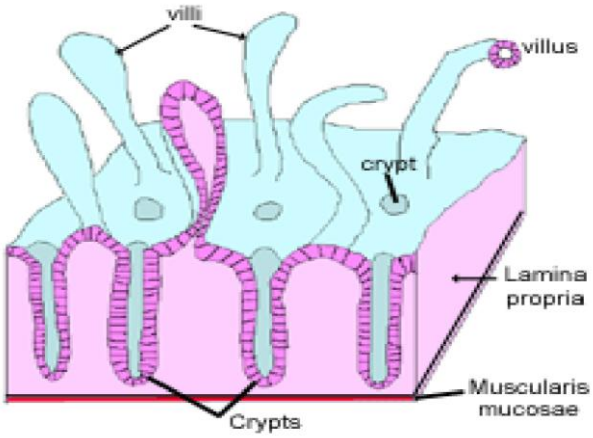

Figure 3

Intestinal MALT

The small intestine mucosa contains MALT in the lamina propria. The small aggregations of these MALT is called as Peyer's patches which are present in the distal ileum which serves to prevent the entry of bacteria from the gut into the blood circulation. The Peyer's patches correspond to the strength of the immune system thereby are present more in young people than the elderly.

Mechanical Digestion in the Small Intestine

The digestion in the small intestine is different from the stomach. The intestinal smooth muscles cause both peristalsis and segmentation. The peristalsis is called as migrating motility complexes. The main function in the stomach is mixing and pushing the chyme into the small intestine whereas in the small intestine, the function is to mix the contents well and break down the food into simpler forms and aid in absorption. Therefore, the segmentation pushes the food back and forth into the segments to help in mixing and enables more contact with the intestinal mucosal wall that enables increased absorption. The rate of segmentation decreases as it descents distally [segmentation rate is 12 times per minute in duodenum whereas in the ileum, it is only 8 times per minute].

After the mixing, breaking and absorption of the chyme, the segmentation is slowly replaced by the motility. This is orchestrated by the hormone motilin that initiates the migrating motor complex and causes peristalsis. These complexes are progressive in nature. The first complex starts from the proximal part of the duodenum and pushes the chyme downstream.

Then the next complex starts further down and pushes the chyme further ahead. These are continued till the first batch of chyme reaches the distal ileum taking up to two hours and starts all over again. As the food from the small intestine reaches the ileum, the sphincter that regulates the movement of food from the proximal part of the intestine relaxes to allow the passage of food. This is called as ileocecal sphincter which is usually in the contracted state. When the food enters the stomach, the gastroileal reflex increases the ileal segmentation through a nervous mechanism. Then it releases the hormone gastrin relaxes the sphincter.

Once the residue passes, the sphincter closes to avoid backflow of the intestinal contents. Thus, by the end of 3 to 5 hours, the chyme is completely converted into a residue and sent to the large intestine.

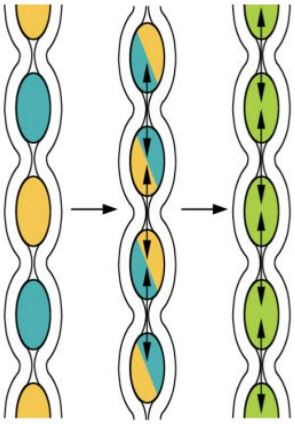

Figure 4

Chemical Digestion in the Small Intestine

The three main constituents of the food: carbohydrates, fats and proteins get digested in different ways. The carbohydrates and proteins are partially broken down in the stomach whereas the lipids are largely unbroken and reach the small intestine intact. The majority of the digestion here therefore focusses on lipids using intestinal and pancreatic juices. The digestion of lipids is enabled by bile and enzyme pancreatic lipase. The main function of the intestinal juice is to mix with pancreatic juices and provide an adequate medium. Osmosis also facilitates the absorption of water. In addition to the enzymes in the juices, the luminal surfaces also contain enzymes in the microvilli that helps indigestion.

In order to have a concerted and optimal functioning of the small intestine, the food must be slowly released from the stomach into the small intestine or else large volumes may lead to loss of fluid loss into the lumen and thereby lead to low blood volumes. Also, the difference in the ph levels between the two parts of the alimentary tract may require rapid adjustment to ensure absorption.

Small bowel Obstruction

The obstruction of the small intestine is known as the small bowel obstruction. They are caused by scar tissue, hernia or cancer.

They may lead to bands of scar called adhesions post a surgical procedure. Sometimes, the bowel gets entrapped in the adhesions leading to obstruction. If the obstruction compromises the blood supply, it may lead to life-threatening situation. Based on the symptomatology, it can be either simple or strangulated or partial or complete. Not all the cases present with the classical symptoms of nausea, vomiting and abdominal pain and constipation. The abdominal pain associated with the small bowel obstruction is described as crampy and intermittent. The symptoms require immediate attention, failure of which may lead to ischemia, perforation and increased abdominal pain. This explains why early identification and surgical intervention is very important in the management of small bowel obstruction. Other studies show that failure to pass flatus and/or fetus and vomiting to be the most common presenting symptoms. On examination, the abdomen is distended with a predominant distension. Abdominal pain continues to be present in a majority of the patients.

1. Following are the signs and symptoms of small bowel obstruction:
2. Nausea and vomiting in 60-80% of the cases with the vomitus being bilious in nature.
3. Constipation and absence of flatus in 80-90% of the cases which is typically present later.
4. Abdominal distension in 60% of the patients
5. Fever and tachycardia, when strangulation sets in The risk factors that correlate with small bowel obstruction are

a) Previous abdominal or pelvic surgery
b) Previous radiation therapy
c) Ovarian or colonic malignancy
d) Inflammatory bowel disease

Successful management of small bowel obstruction depends on the etiology, pathophysiology, imaging methods, clinical soundness and good technical skills.

Definition, etiology and classification

It is the failure of progression of contents of the intestine through the small bowel. Depending on the nature, location, severity and etiology, different terms are assigned to describe the bowel obstruction. The following list enumerates the classification of the small bowel obstruction based on etiology and location Adynamic ileus: commonest causes:

- Generalized peritonitis, e.g. perforated viscous
- Acute Pancreatitis
- Electrolyte abnormalities.
- Postoperative ileus

Serious intra-abdominal infection:

- Acute diverticulitis
- Acute appendicitis
- Pelvic inflammatory disease

Mechanical SBO:

Luminal

Gallstone ileus: 1–2% of mechanical obstructions and 25% of obstructions in elderly,Neoplasm, Bezoar.

Mural

- Meckel's diverticulum: mechanism of obstruction:
- Volvulus (twist around mesodiverticular or omphalomesenteric band)
- Intussusception (initiated by inverted diverticulum)
- Stenosis from adjacent ileal ulcer *Crohn's disease*: mechanism of obstruction:
- Fibrous stricture
- Acute inflammation/ phlegmon /abscess

Neoplasm

Leiomyoma is the commonest benign tumor, and carcinoid or adenocarcinoma is the commonest malignant tumors.

Mechanism of obstruction

- Luminal

Mural: intussusceptions

Intussusception

- Organic lesion: 85–90% o Neoplasm: malignant 19–46%
- Meckel's diverticulum o Traumatic hematoma
- Idiopathic, 3.8–12.5%
- Postoperative, 2.5–4% of early postoperative bowel obstruction

Vovulus:

- 1.7–5.7%
- Primary (in a virgin abdomen): 10–30%
- Secondary (tension band): 70–90%
- *Radiation enteritis*, 0.5–5%: mechanism of obstruction:
- Stricture
- Adhesion
- Hematoma

Strictures

- Non-steroidal anti-inflammatory drugs
- Potassium

Extramural

Adhesion: 50–70%

- Phlegmon/abscess
- Neoplasm: metastatic disease, 4–10% of SBO
- External hernia: Littre's hernia, incarcerated Meckel's diverticulum in external hernia

Etiology of acute small bowel obstruction

The small bowel obstruction may be due to functional reasons like the bowel wall or the splanchnic nerves dysfunction. It may also be due to mechanical barrier. Sometimes, the large bowel obstruction may mimic like small bowel obstruction which is referred to as "colonic pseudo obstruction". This acute functional dilatation is known as adynamic or paralytic ileus. The symptoms are similar only with the absence of mechanical obstruction. Mechanical obstruction may be luminal, mural or extramural.

They can also be classified as

a) Proximal (high SBO)
b) Distal (low SBO)
c) Closed loop
d) Open–ended obstruction

In closed loop obstruction, the lumen is occluded on either side not allowing movement of contents in either direction while in open-ended obstruction, the contents can move in any one direction.

Partial obstruction is where few contents like liquids and gas may pass through the lumen whereas in complete obstruction, all contents are blocked. Simple obstruction doesn't compromise blood supply whereas in complicated obstruction, the blood flow is cut off and leads to the ischemia, infarction and perforation. A unique type of intestinal obstruction is intussusception which is due to the telescoping of a segment of a bowel into another. It is prone to happen anywhere distal to the gastric cardia. If the intussusception happens in the retrograde direction, it is known as enteric but can also present in the downward direction. The exact mechanism of colic and enterocolic of intussusception is not clearly known but a presence of an organic lesion, diseased bowel, adjacent area of the normal bowel might act as a starting point for intussusception.

Depending on the process that initiates intussusception, it is classified as

a) Idiopathic b) Postoperative c) Intussusception due to an organic lesion

Meckel's diverticulum may also invaginate into the ileum and then into the colon. Another condition is the volvulus which is the axially Twisted portion of the gastrointestinal tract around the mesentery of the colon that may result in varying degrees of luminal obstruction and may lead to severe consequences like blood supply cut off, ischemia, infraction and perforation. Gall stone ileus is a mechanical obstruction due to the passage of gallstones through biliary-enteric fistula from the biliary system. The stones getimpacted in the lumen of the bowel. When Meckel's Diverticulum gets incarcerated in an external hernia, it is called as Littre's hernia.

Pathophysiology of small bowel obstruction

Any etiological agent causes a similar type of pathologic and physiologic consequences. The manifestations may differ between different degrees of obstruction. The obstruction leads to elevation of the frequency of the migrating motor complexes proximal to the point of obstruction. These contractions lead to severe abdominal cramps. These contractions help to propel the contents of the lumen forward. When the contents are not emptied, they accumulate leading to abdominal distension which leads to retrograde giant contractions manifesting as vomiting. In adynamic ileus migratory motor complexes (MMC) (contractions initiated in the stomach and proximal SB almost simultaneously and propagate distally to clear the intestine of secretions and debris) and fed contractions (intermittent and irregular contractions that provide mixing and slow

distalpropulsion) are inhibited. The increased intraluminal pressure jeopardizes the blood supply through the mesenteric veins and completely stops when the pressure equals systolic pressure. This leads to a decrease in the blood flow through the capillaries in the mucosa, leading to rupture and hemorrhagic infiltration. Any twist to the vessels leads to their occlusion and resulting anoxia of the intestinal epithelium and subsequent necrosis. Continued necrosis may lead to perforation. The necrosis may be due to pressure or ischemia. When the obstruction is simple, the proximal part of the intestine in the obstruction is edematous and heavy leading to cyanosis. Further, it may progress to serosal tears.

One of the acute physiologic and pathologic response to small bowel obstruction is the depletion in the volume and electrolyte disturbances. Intestinal contents are locked up in the lumen and the fluid is accumulated in the luminal area leading to volume depletion.

Vomiting further causes volume depletion and electrolyte disturbances. The electrolyte disturbance depends on the level of obstruction. Proximal obstruction may lead to accumulation of water in the lumen along with sodium and potassium. Edema of the intestine may cause further sequestration of the contents of the intestine. The protein rich exudate may get accumulated in the peritoneal cavity. As obstruction progresses, the collection of fluid inthe peritoneum changes from a clear fluid to a bloody dark exudate. The bacterial flora also undergoes changes as the disease progresses. The fecal type of bacteria increase in the proximal part of the obstruction whereas the distal portion see a drastic change in the bacterial flora. The breakdown of the fluid flora leads to feculent fluid. Finally, when the bowel is strangulated, there is loss of blood in the infracted bowel, tissue death, translocation of the bacteria and the toxic substances and result in perforation.

Mechanism of Adhesive Obstruction

The fibrinolytic system plays a major role in the healing of the peritoneal wounds and when this system is disrupted, it leads to adhesion formation. The system is balanced by a number of activators and inhibitors. The disruption in this balance leads to the formation of adhesions.

The major activators of this system are:

- Tissue plasminogen activator (tPA) (most important and accounts for 95% of the plasmin generated)
- Urokinase-like plasminogen activator (uPA), A complex interaction of multiple biochemical factors orchestrate the formation of adhesions through a series of inflammation, repair of tissues, angiogenesis and innervation. Surgical trauma is causative in the formation of adhesions which may be due to cutting, abrasion, ischemia, desiccation and coagulation.

Whatever may be the source of injury, the mechanism remains the same. The injury leads to bleeding andelevated permeability of the vascular system leading to leakages from the injured places. A parallel inflammatory response happens that occurs post-operatively promoting the release of pro-inflammatory cytokines, infiltration of inflammatory cells and

activation of the complement and coagulation cascades.

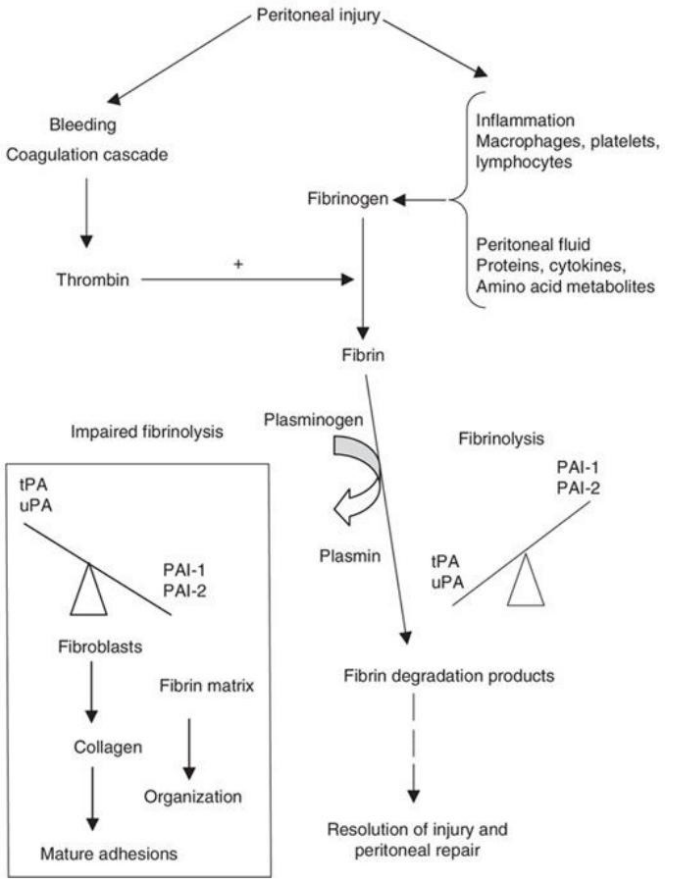

Figure 5

Diagnosis of acute small bowel obstruction

The diagnosis of acute small bowel obstruction is straight forward and simple. The clinical features coupled with plain radiograph of the abdomen may point to the diagnosis of small bowel obstruction. In few cases, CT scan and ultrasound may be required. After establishing the diagnosis, the location, Etiology and severity are assessed. The mainstay of diagnosis is to find out if the obstruction is simple or complicated. The past history of the patient may sometimes point to the Etiology of small bowel obstruction. But when the clinical picture is confusing, the following can be; a) Meckel's diverticulum b) Gall stone ileus c) Neoplasms

The four cardinal symptoms may be present; 1) Pain (colicky) 2) Vomiting 3) Obstipation 4) Distension Pronounced vomiting is present in high SBO. The contents of the vomit may be bile and improperly ingested food. When the SBO is low, the vomit is feculent. In patients with gall stone ileus, tumbling SBO is seen. The tumbling nature corresponds to the impaction of stone, release and re-obstruction. In 20-56%, biliary symptoms may be present. Intussusception may present with intermittent partial bowel obstructive symptoms.

Strangulation and gangrene may not always be clinically evident. Strangulation may be indicated by pain or localized abdominal tenderness, fever, leucocytosis and tachycardia. When these four cardinal signs are not present, the obstruction may be simple. Any simple obstruction showing these classical findings may lead to a diagnosis of strangulation.

Radiological Findings

One of the most simple and valuable diagnostic tests is the plain x-ray. The accuracy being up to 50-60%. Up to 20-30% of the times, the findings are not conclusive while rest of the cases, the x-rays may be normal. In high SBO, late obstruction and closed loop obstruction, the typical signs of air fluid levels may be absent in the dilated intestine proximal to the obstruction. Plain x-rays do not always help in diagnosis of low-grade obstruction. The following figure shows the findings of the x-ray in small bowel obstruction.

Figure 6

In some clinical conditions, intraluminal contrast studies are done: enteroclysis, barium enema and small bowel follow-through in the following conditions; a) When the clinical features are confusing b) Plain x-ray is inconclusive c) Non-operative management doesn't elicit adequate response This test is especially required in conservative management

a) postoperative or adynamic ileus, partial SBO, malignant SBO (carcinomatosis, intraabdominal recurrent or metastatic cancer) b) Radiation enteritis, recurrent adhesive SBO, and SBO in Crohn's disease. Small bowel follow-through (SBFT) differentiates adynamic ileus from mechanical SBO.

In adynamic ileus, the oral contrast moves towards the colon in four to six hours whereas in mechanical small bowel obstruction, the contrast shows signs of dilatation and stops at the site of obstruction within an hour. The carcinomatosis shows multiple sites of obstruction with pooling of contrasts. In gall stone ileus, the contrast shows a filling defect whereas a beak-like point of obstructionsuggests intussusception. Small bowel enema (enteroclysis) is the infusion of barium that aids in observing the mucosal pattern, motility and distensibility of the bowel loops closely. This is better than the small bowel follow-through and is helpful in the diagnosis of tumors, intussusception, strictures, radiation enteritis and Crohn's disease.

An appearance of a "stretched spring" with intervening thick rings against fine rings nearby shows vascular compromise in the diagnosis of intussusception. Enteroclysis may point to the nature of the intussusception; whether it is benign or malignant. Benign is longer and permanent while malignant is short and transient. In radiation enteritis, there is a combination of thickened valvulaeconniventes mucosal folds measuring greater than 2 mm, mural thickening (wall thickness greater than 2 mm when adjacent bowel loops are parallel for at least 4 cm under compression). Some of the following findings may be found; a) Single or multiple stenosis of different lengths b) stenosis at site or origin of sinus or fistula c) adhesions (as evidenced by constant angulation of bowel loops and relative fixity within the pelvis).

The barium will be pooled in the form of barium-filled with matting loops of the terminal ileum. The individual loops or mucosal folds are not clearly seen. Whereas in Crohn's disease, a combination of features are seen: sinuses, stenoses, fistulae, discrete fissure ulcers, thickened valculaeconniventes, skip lesions, cobble stoning and asymmetrical involvement. Barium enema is not really sensitive for the diagnosis of small bowel obstruction. Distal SBO mimics like large bowel obstruction. Gastrografin or Barium is used in LBO for differentiating mechanical obstruction from pseudo-obstruction, confirm the presence of intussusception, volvulus and also find out the site of obstruction (Stage C).

Ultrasonography

It is an important diagnostic tool for evaluating acute abdomen. It can be used for the following; a) Gallstone ileus b) Intussusception c) Pelvic disease, d) Gallbladder disease e) Aid in the exclusion of SBO

Ultrasound shows the diseased gall bladder, gas in the gall bladder and/or bile ducts in gallstone ileus. There can also be fluid in the bowels which points to the stone in the intestine. The presence or absence of stones in the gall bladder acts as an important feature for planning management. In intussusception, target sign will be present which a mass with a sonolucent rim around it is predominantly. This sonolucense is mainly due to the

edema of the bowel and a very significant hyper echoic center (due to the compressed center of intussusception). Ultrasound is very efficient is differentiating mechanical SBO from the paralytic ileus by the presence of peristalsis in the former. The location of the obstruction can be determined using ultrasound. When no apparent cause can be established, the obstruction is attributed to adhesions.

Computed Tomography (CT scan)

It is currently emerging as a useful tool in the treatment protocol of the bowel obstruction1. Following are the features of CT scan in SBO; a) Confirmation of the diagnosis b) Differentiate between mechanical and functional obstruction c) Find out the cause and site of the obstruction d) Differentiate between simple and complicated SBO CT scan helps in making early decisions about the management of SBO and prevent unnecessary delay. False positives in CT scan may lead to difficulties in interpreting. In around 18% of the cases, it is difficult to identify the location and identify the obstruction.

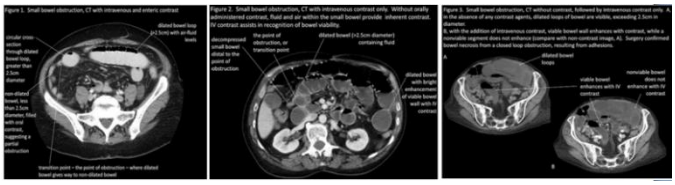

Figure 7

Treatment of acute small bowel

Obstruction

Successful management depends on the following three steps:

1. Resuscitation
2. Investigation
3. Definitive therapy

The initial management of small bowel obstruction focusses on aggressive intravenous therapy and correcting electrolyte imbalances. The fluid resuscitation may be monitored using a Foley's catheter, Central Venous Catheter and Swan Ganz catheter. Blood tests are used to find out:

a. Electrolyteimbalances
b. Leucocyte count
c. Liver function
d. Amylase levels
e. Acidosis
f. Anemia
g. Bleeding tendency

There are no studies that say that long intestinal tube is better than nasogastric tubes for decompression in small bowel obstruction. Plain x-rays are taken initially and if required, contrast studies are done. The CT scan is becoming an increasingly reliable tool. But a repeated clinical examination of the patient is very essential for management. When there is incarceration of external hernia, emergent surgery is required after relying on clinical and radiological diagnosis (if it shows strangulation, perforation and gangrene).

If not indicated, conservative management with continuous monitoring can be used as a mode of treatment and a concrete decision be taken later on. The following figures show the treatment strategies of the acute small bowel obstruction.

The management of adhesive small bowel obstruction using oral water-soluble contrast

Gastrografin transit time may allow for the selection of appropriate patients for non-operative management. Some studies have shown when the contrast does not reach the colon after a designated time it indicates complete intestinal obstruction that is unlikely to resolve with conservative treatment. When the contrast does reach the large bowel, it indicates partial obstruction and

patients are likely to respond to conservative treatment.

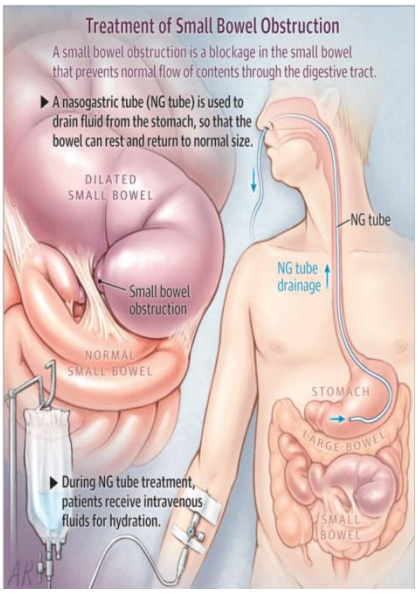

Figure 8

Other studies have suggested that the administration of water-soluble contrast is therapeutic in resolving the obstruction.

The appearance of water-soluble contrast in the colon on an abdominal X ray within 24 hours of its administration predicts resolution of an adhesive small bowel obstruction with a pooled sensitivity of 0.97, specificity of 0.96. The area under the curve of the summary ROC curve is 0.98. Six randomized studies dealing with the therapeutic role of gastrografin were included in the review, water soluble contrast did not reduce the need for surgical intervention (OR 0.81, p = 0.3). Meta analysis of four of the included studies showed that water soluble contrast did reduce hospital stay compared with placebo (WMD= 1.83) P<0.001.

Materials and Methods

Aim of the study: To study the clinical outcome in acute adhesive small bowel obstruction after surgical or conservative management

Objectives: 1. To frame the criteria for surgical management of adhesive small bowel obstruction 2. To evaluate the recurrent abdominal symptoms in surgical and conservative management of adhesive small bowel obstruction.

Study design: Prospective Single Center Study

Place of study: Government General Hospital, Ongole

Study period: July 2022 to June 2023

Study population & Sampling Methodology: All patients admitted with an episode of adhesive small bowel obstruction in Government General Hospital, Ongole.

This study includes 60 patients who are with episode of adhesive small bowel obstruction.

Inclusion criteria: All patients with an episode of adhesive small bowel obstruction irrespective of age and sex.

Exclusion criteria: 1. Large bowel obstruction 2. incarcerated abdominal wall hernia 3. Early post-operative SBO [within 1 month] 4. Inflammatory bowel disease 5. Radiation induced intestinal fibrosis 6. Peritoneal carcinomatosis.

Methodology: The material for the study was taken from the cases admitted in the surgical ward of the Department of General Surgery, Government General Hospital, Ongole, who presented with episode of adhesive small bowel obstruction The following data was collected using a structured questionnaire: age, demographic characteristics, socio economic status, patient's complaints and duration of complaints. A detailed general examination was done. Systemic examination and basic investigations were done. The following data was extracted from the patient's history, clinical examination, operative notes and during follow up:

1. Patient selection
2. Abdominal pain and history of guarding

3. Laboratory findings
4. Free fluid/reduced contrast enhancement in CT scan
5. Previous history of surgery
6. Operative / non-operative
7. Duration of stay in the hospital.
8. Recurrent abdominal symptoms during subsequent follow-up.

The decision for operative/non operative was decided based on history of abdominal pain/guarding and lab investigations/CECT abdomen findings Patient selected for non-operative management was given iv antibiotics, nasogastric tube, analgesics, oral contrast agent and followed up for recurrent abdominal symptoms Patient who are selected for operative procedures were subjected to emergency laparotomy with adhesiolysis with or without resection anastomosis of bowel and followed up for recurrent abdominal symptoms.

Follow up : Patients were followed every three months in first year, then every six months next year, then annually.

Investigations: The study requires the following investigations to be conducted on patient's a. TLC b. CRP c. CECT ABDOMEN /PELVIS

Statistical Analysis: Data were analyzed according to history, clinical examination and investigation. Data were entered in excel sheet and analyzed using SPSS v23. Frequencies and percentage analysis were done. Cross tabulation and Chi-square analyses were done to find the relationship and association between various variables.

Images from the surgical procedure done

Figure 9

Results: A prospective single centre study to evaluate the clinical outcome in acute adhesive small bowel obstruction after surgical or conservative management among 60 patients who are with episode of adhesive small bowel obstruction revealed the following results. Forty-five patients were managed using surgical methods while fifteen of them were managed through conservative measures.

The mean age of the patients in surgery group (n=45) is 50.2 years (S.D=11.78) [range= 28-75 years] while the mean age of the patients in the conservative group (n=15) is 50.73 years (S.D=11.11) [range=37-72 years]. The overall (N=60) mean age was 50.33 years (S.D=11.52) [range=28-75]. Majority of the patients were males (n=42, 70%) while others were females (n=18, 30%). The mean pain score among 60 patients was 4.85 (S.D=2.02) [range=1-10]. All of them had past history of previous surgery.

On inspection, abdominal distension with guarding present in 45 of them (75%). CECT showed free fluid in 45 of the patients (75%). Among 60 patients, twenty-six of them were readmitted, of which, ten of them were surgically managed and 16 of them were conservatively managed.

The mean duration of hospital stay was 8.75 days (S.D=3.63). The hospital stay was higher in the conservative group with a mean of 14.53 days (S.D=2.29) ranging between 12-18 days while the

surgery group had a lower duration of hospital stay of 6.82 days (S.D=0.89) ranging between 6-8 days.

Distribution of patients: Out of 60 patients, 45 of them were surgically managed while of them conservatively managed.

Age of the participants: The following figure and tables show the age distribution of the participants. The mean age of the patients in surgery group (n=45) is 50.2 years (S.D=11.78) [range= 28-75 years] while the mean age of the patients in the conservative group (n=15) is 50.73 years (S.D=11.11) [range=37-72 years]. The overall (N=60) mean age was 50.33 years (S.D=11.52) [range=28-75].

	Mean	S.D.	Range
Conservative (n=15)	50.73 Years	11.11	37-72
Surgery (n=45)	50.2 Years	11.78	28-75

Table 1: Age of the participants in surgery group

Gender of the participants: The following figure and tables show the gender distribution of the participants. Majority of the patients were males (n=42, 70%) while others were females (n=18, 30%)

	Male (n, %)	Female (n, %)
Conservative (n=15)	7 (46.7%)	8 (53.3%)
Surgery (n=45)	35 (77.8%)	10 (22.2%)

Table 2: Gender of the participants

Duration of Abdominal Pain: The following tables show the duration of abdominal pain among the conservative and surgery group. The mean duration of pain was higher in the surgery group.

	Mean	S.D.	Range
Conservative (n=15)	2.2 days	0.86	1-3 days
Surgery (n=45)	5.7 days	1.43	4-10

Table 3: Duration of abdominal pain

Pulse rate of the participants

	Mean	S.D.	Range
Conservative (n=15)	87.29/min	22.73	74-140/min
Surgery (n=45)	98.27/ min	13.82	74-140/min

Table 4: Pulse rate of the participants

TC	Mean	S.D.	Range
Conservative(n=15)	7120	1592	4800-11500
Surgery(n=45)	15400	1999.38	11200-21000

CRP	Mean	S.D.	Range
Conservative(n=15)	49.07	9.37	37-67
Surgery(n=45)	86.489	5.8	77-97

Table 5: Laboratory findings of the participants

Duration of hospital stay: The following tables and figures show the duration of hospital stay in the two groups. The hospital stay was higher in the conservative group with a mean of 14.53 days (S.D=2.29) ranging between 12-18 days while the surgery group had a lower duration of hospital stay of 6.82 days (S.D=0.89) ranging between 6-8 days.

	Mean	S.D.	Range
Conservative (n=15)	14.53 days	2.29	12-18
Surgery (n=45)	6.82 days	0.89	6-8

Table 6: Duration of hospital stay

History of Previous Abdominal Surgery: The following tables show the history of previous surgery in the two groups.

History of Previous Surgery (Surgery Group)	Frequency	Percent
Appendicectomy	6	13.3
Emergency Laparotomy for Perforation	1	2.2
Hysterectomy	3	6.7
Laparotomy - obstruction	9	19.8
Laparotomy - adhesiolysis	2	4.4
Laparotomy - perforation	8	17.6
Laparotomy - tumour excision	6	13.3
LSCS	4	8.9
Umbilical hernia repair	6	13.3
Total	45	100.0

Table 7: History of Previous Surgery (Surgery Group)

History of Previous Surgery (Conservative Group)	Frequency	Percent
Appendicectomy	1	6.7
Hysterectomy	5	33.3
Laparotomy - obstruction	2	13.3
Laparotomy - perforation	2	13.3
Laparotomy- adhesiolysis	1	6.7
LSCS	4	26.7
Total	15	100.0

Table 8: History of Previous Surgery (Conservative Group)

CECT Findings: The findings from CECT showed free fluid in the patients of the both groups.

Plain X-ray and USG: All the patients showed MAF-SB.

Palpation: The patients in the surgery group showed guarding on palpation.

Readmission: Out of 45 patients in the surgery group, 16 (35.2%) of them were readmitted between 10 to 24 months compared to conservative group; 10 (67%) of them were readmitted between 6 to 14 months.

Readmission Management: The following table shows the readmission management among the two groups. Out of 10 patients in the conservative group, eight of them were managed surgically. In the surgery group, only two of them were managed operatively.

	Conservative	Surgery
Conservative (n=10)	2	8
Surgery (n=16)	14	2

Table 9: Readmission management

Discussion

A prospective single centre study to evaluate the clinical outcome in acute adhesive small bowel obstruction after surgical or conservative management among 60 patients who are with episode of adhesive small bowel obstruction revealed the following results. Forty-five patients were managed using surgical methods while fifteen of them were managed through conservative measures. The mean age of the patients in surgery group (n=45) is 50.2 years (S.D=11.78) [range= 28-75 years] while the mean age of the patients in the conservative group (n=15) is 50.73 years (S.D=11.11) [range=37-72 years]. The overall (N=60) mean age was 50.33 years (S.D=11.52) [range=28-75]. Majority of the patients were males (n=42, 70%) while others were females (n=18, 30%). The mean pain score among 60 patients was 4.85 (S.D=2.02) [range=1-10]. All of them had past history of previous surgery. On inspection, all of them had abdominal distension with guarding present in 45 of them (75%). CECT showed free fluid in 45 of the patients (75%). Among 60 patients, twenty-six of them were readmitted, of which, ten of them were surgically managed and 16 of them were conservatively managed. The mean duration of hospital stay was 8.75 days (S.D=3.63).

The hospital stay was higher in the conservative group with a mean of 14.53 days (S.D=2.29) ranging between 12-18 days while the surgery group had a lower duration of hospital stay of 6.82 days (S.D=0.89) ranging between 6-8 days.

The present study compared the outcomes of treatment between conservative and surgical management of the patients with acute small bowel obstruction. The patients treated with surgery require lesser rehospitalization and less likely to suffer from the everyday symptoms at home. Surgery for small bowel obstruction does not necessarily reduce the recurrence of small bowel obstruction.

The results from the study are similar to that of Landercasper et al where a rehospitalization rates were statistically significant ($p< 0.005$) and different between conservative (38%) and surgical management groups (21%)14. The study reported operation rates of a new episode of small bowel obstruction of 17% in conservative compared to 10% in surgical management groups with p-value Landercasper et al reported a larger rate of recurrence may be attributed to the inclusion of patients by malignancy and inflammatory bowel disease. Fevang et all said that surgery reduces the rate of recurrence with a relative risk of 0.55, 95% CI, 0.35-0.8615. The study also concluded that risk of managing operatively for a new case of small bowel obstruction is the same irrespective of the initial management choice with a relative risk of 0.79; 95%CI, 0.39-1.59. The results from this study related to the morbidity of the patients with small bowel obstruction is in concert with previous studies. The post-operative mortality is not consistent in the studies as different factors attributed to the mortality rates. The present study is similar to the previous studies. The modality of treatment has no effect on the mortality rate of the patients. The recurrence of symptoms was higher in the patients who were treated conservatively. This warrants an important clinical decision whether to manage conservatively or operatively.

Considering the risk-benefit analysis, the benefits of surgical management are higher with better relief of symptoms and lower recurrence rates. But with advanced age and other comorbidities, surgical management poses a question whether it is as effective

than conservative management. This calls for the customization of treatment based on sound clinical decision based on the various parameters like the general condition of the patient, clinical signs and symptoms, etc. The decision can be arrived by combining the severity score of SBO21 and the APACHE II scores that indicate the medical condition of the patient.

Surgical management is known to decrease the morbidity of the patient. But no specific studies show the difference between early surgical management and surgery after 24-hours. Considering this, any patient with SBO can be conservatively managed within the first 24 hours and can be decided to operate after observation for 24 hours. When there are no signs of severity, conservative management can be attempted. When there is no recovery within 24 hours, an oral water-soluble contrast test can be done and taken up for surgery28.

Conclusion

A prospective single centre study to evaluate the clinical outcome in acute adhesive small bowel obstruction after surgical or conservative management among 60 patients who are with episode of adhesive small bowel obstruction revealed the following results. Forty-five patients were managed using surgical methods while fifteen of them were managed through conservative measures. Following conclusions were drawn; 1) Patients with SBO who undergo surgery are at lower risk of recurrence 2) Patients with SBO who undergo surgery are at lower risk of repeated hospitalizations. 3) The recurrence of symptoms are also lower in the patients who were treated surgically 4) Based on the above findings, following recommendations can be made;a) patients with three or more of the following criteria (pain duration ≥4 days, abdominal guarding, leukocyte ≥10x 109 /l, C-reactive protein ≥75 mg/l, free fluid ≥500 ml on CT scan, or reduced contrast enhancement on CT scan) should undergo prompt surgical intervention as it allows both obstruction removal and long-term reduction of recurrent SBO episodes.

b) The decision to operate should also take into account the evolution of the clinical status and laboratory values, additional CT findings (e.g., volvulus, transition zone, reduced contrast enhancement), as well as the patient's general condition, comorbidities, and surgical history.

Limitations: The study had the following limitations; Selection bias: as the patients were selected by the investigator and assigned to the groups. A randomized control trial would have been a better design for studies like this.

But this again has the disadvantage of unethically exposing the patient to surgical procedures where a conservative management would have been enough and vice versa. Also, all the decisions need to done rapidly to ensure the safety of the patient than considering the effectiveness of the design. The patients who were managed conservatively had lower severity scores which may have affected the comparison between the two groups

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