

**THE RETROSPECTIVE STUDY OF SCORING IN
ACUTE INTESTINAL OBSTRUCTION -TIMING OF
SURGERY**

by

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**MASTER OF SURGERY in GENERAL SURGERY
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ABSTRACT

BACKGROUND AND OBJECTIVES

INTESTINAL obstruction is one of the most common abdominal problems faced by surgeons in routine practice whether caused by any bowel pathology of either the small or large bowel continues to be a major cause of morbidity and mortality.

The objectives are to study the:

- (1) various modes of presentation, various causes, importance of early recognition, diagnosis and management.
- (2) influence of various factors like age, sex, diet and socio-economic status in the pathogenesis of acute intestinal obstruction.
- (3) morbidity and mortality rates in acute intestinal obstruction.

METHODS

The materials for the clinical study of intestinal obstruction were collected from cases admitted to various surgical wards. 126 cases of intestinal obstruction have been studied. Patients belonged to the age groups ranging from 12 years to 85 years, paediatric age group is excluded from this study. The criteria for selection of cases was based on clinical history, physical findings, radiological and haematological investigations.

The study was divided into Clinical study, Investigations and Treatment. Postoperative follow up after the discharge of patients was done in majority of the patients upto six months. The results are tabulated stressing on following points age, sex, symptoms, examination findings, investigations, abnormalities, probable causative

factors, operative findings and operative procedure adopted and complications if any.

RESULTS

The study group consisted of 126 cases of acute intestinal obstruction in the adult. The common age group is 31-40 and 51-60 age group with 20% each in the total study. The commonest cause of intestinal obstruction in the adults in this study series was Adhesions (40%) followed by obstructed Hernia (30%). The clinical features of pain abdomen, vomiting, constipation were the main symptoms in this study. Tenderness, guarding, rigidity, rebound tenderness and shock are the cardinal feature of strangulated obstruction. The most common type of obstruction was due to postoperative adhesions or band arising from the previous surgeries. This constituted about 40% of the cases of the study group. The second most common type of intestinal obstruction was due to obstructed/strangulated external hernia. Salient features were pain in the groin lump, acute onset of swelling which is tender, irreducible and absence of cough impulse. Obstructed hernia constituted about 30% of the total cases studied. Volvulus of the sigmoid was 4% in this series.

Conservative measures included insertion of flatus tube but many of the cases were undergone laparotomy due to failure in the recovery of symptoms. Derotation and sigmoidopexy was done in one case and in one case where there was vascular compromise, resection and anastomosis was done. Malignancy of the large bowel was seen in 7 cases constituting 14% of cases. 65% of the cases diagnosed as malignancy were in the age group 35-75 years. Of these 2 cases were managed with Hartman's procedure. One case was managed with transverse loop colostomy and remaining cases were managed with resection and anastomosis. Most of the deaths occurred in malignancy.

Although pulmonary tuberculosis more prevalent in India due to advent use of antitubercular drugs incidence of abdominal

tuberculosis is becoming less. In our study incidence of ileocaecal tuberculosis was 4% and both were managed with resection and anastomosis. In the present study intussusception causing intestinal obstruction was 6%. One case was managed with simple reduction and the remaining two were undergone resection and anastomosis. One case of mesenteric ischaemia was present in our study. The case was managed with resection and anastomosis but patient died due to septicemia.

The complication in this study was 18%. Overall mortality of this study was 14%. The result obtained from this study was comparable to various other studies. Malignancy and mesenteric ischaemia had more mortality outcomes than simple obstruction caused by postoperative adhesions. The poor outcome of the disease were due to late presentation to the hospital which had high incidence of bowel damage with associated faecal contamination of the peritoneum. The mortality in the postoperative period was mainly due to faecal peritonitis, bronchopneumonia and respiratory tract infection.

INTERPRETATION AND CONCLUSION

Acute intestinal obstruction remains an important surgical emergency in the surgical field. Success in the treatment of acute intestinal obstruction depends largely upon early diagnosis skilful management and treating the pathological effects of the obstruction just as much as the cause itself. Erect abdomen X-ray is valuable investigation in the diagnosis of acute intestinal obstruction. Postoperative adhesions are the common cause to produce intestinal obstruction. Clinical radiological and operative findings put together can diagnose the intestinal obstruction. Mortality is still significantly high in acute intestinal obstruction. So the pattern of scoring criteria remains important to take case immediately for surgery or treat conservatively. Definitive scoring is missing in most standard books. The study includes rising pulse rate, abdomen girth chart, elevated wbc count, multiple air fluid more than 6, nasogastric

fecal content with a score of 2 to each of them.more than 7 needs surgery.

SYNOPSIS

- a) INTRODUCTION
- b) DEFINITION
- c) REVIEW OF LITERATURE
 - 1) Historical Review
 - 2) Embryology and Histology
 - 3) Anatomy
 - 4) Physiology
 - 5) Pathology of bowel obstruction
 - 6) Classification
 - 7) Symptoms
 - 8) Investigation
 - 9) Treatment
- d) METHODOLOGY
- e) RESULTS
- f) MASTER CHART
- g) DISCUSSION
- h) CONCLUSION
- i) SUMMARY
- j) BIBLIOGRAPHY
- k) PROFORMA

INTRODUCTION

The purpose of this dissertation is to discuss briefly the available literature on intestinal obstruction. It is one of the most common intra-abdominal problems seen by the general surgeons in their practice. They account for 15% - 20% of surgical admissions.

Manifestation of bowel obstruction may range from slight abdominal discomfort to hypovolemic or septic shock requiring an urgent operation. The morbidity of acute intestinal obstruction is gradually reducing with better understanding of anatomy, physiology, pathology, lab investigation and surgical newer techniques.

The main objective for this dissertation is to study the

- 1) various modes of presentation various causes importance of early recognition diagnosis and management.
- 2) influence of various factors like age, sex, diet and socio-economic status.
- 3) The timing of surgery for acute intestinal obstruction.
- 4) Morbidity and mortality rates in bowel obstruction.

DEFINITION

Acute intestinal obstruction or ileus may be defined as the condition where there is some interference with the onward movement of intestinal contents.

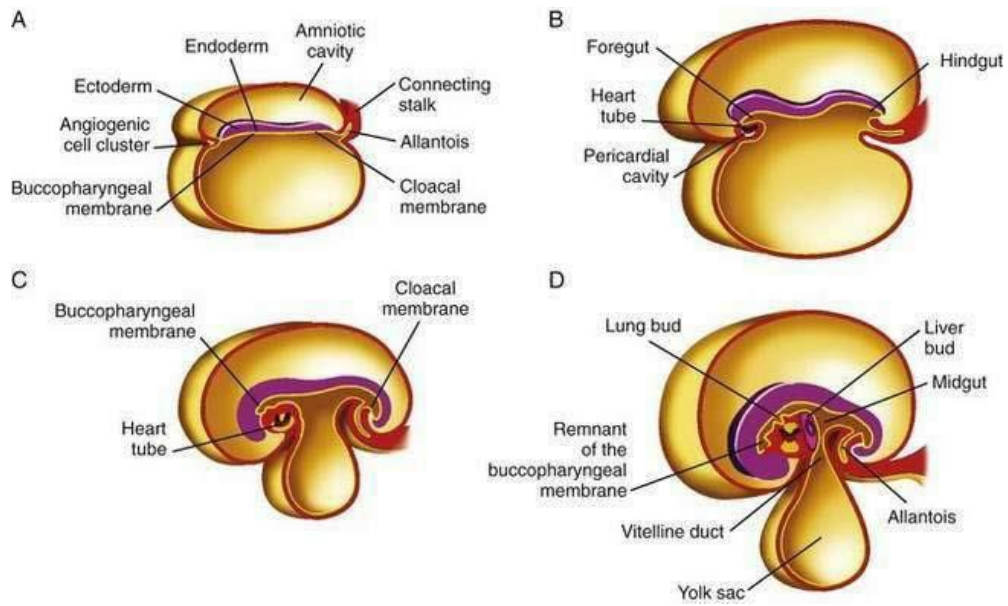
REVIEW OF LITERATURE

EMBRYOLOGY AND HISTOLOGY

The embryo begins the third week of development as a bilaminar germ disk. During week three, in a process called gastrulation, this disk becomes a trilaminar disk. The surface facing the yolk sac becomes the definitive endoderm; the surface facing the amniotic sac becomes the ectoderm. The middle layer is called mesoderm. The long axis and left-right axis of the embryo also are established at this time. The oral opening is marked by the buccopharyngeal membrane; the future openings of the urogenital and the digestive tracts become identifiable as the cloacal membrane. At four weeks of gestation, the alimentary tract is divided into three parts: foregut, midgut, and hindgut.

The endoderm forms the intestinal tube, which communicates only with the yolk sac. Narrowing of the communication of the yolk sac with the endoderm forms the vitelline duct. With folding of the embryo during the fourth week of development, the mesodermal layer splits. The portion that adheres to endoderm forms the visceral peritoneum, whereas the part that adheres to ectoderm forms the parietal peritoneum. The space between the two layers becomes the peritoneal cavity.

MOLECULAR REGULATION OF INTESTINAL MORPHOGENESIS



The induction of endoderm appears to be governed by nodal or transforming growth factor- β signaling.¹⁵ Specification is initiated by transcription factors expressed in the different regions of the intestinal tube. Thus, PDX1 specifies the duodenum, CDXC the small intestine, and CDXA the large intestine and rectum.¹⁶ Differentiation of the gastrointestinal tract depends on the interaction between the endoderm and mesoderm through the Hox code. Signaling from the mesoderm to endoderm is regulated by the Hox genes that encode homeodomain-containing transcription factors. Induction of the Hox code in the mesoderm results from expression of Shh through the endoderm of the midgut and hindgut. Shh is a signaling molecule that acts as a morphogen or form-producing substance in a variety of organ systems. When prompted by this code, the mesoderm instructs the endoderm to form the various components of the midgut and hindgut regions, for example, the small bowel, cecum, colon, and cloaca as indicated by animal studies, Hox genes contribute to the subdivision of the intestine, and formation of the ileocecal valve that separates the small and the large

intestine. Shh also plays a crucial role in the development of the hindgut.

The primitive gut results from incorporation of the endoderm-lined yolk sac cavity into the embryo, following embryonal cephalocaudal and lateral folding. The primitive gut is composed of a blind-ended tube in the cephalic and caudal portions of the embryo, which is the progenitor of the foregut and hindgut; the midgut is connected to the yolk sac by the vitelline duct. The endoderm gives rise to the epithelial lining of the gastrointestinal tract; muscle, connective tissue, and peritoneum originate from the splanchnic mesoderm. During the ninth week of development, the epithelium begins to differentiate from the endoderm with villus formation and differentiation of epithelial cell types. Organogenesis is complete by 12 weeks of gestation.

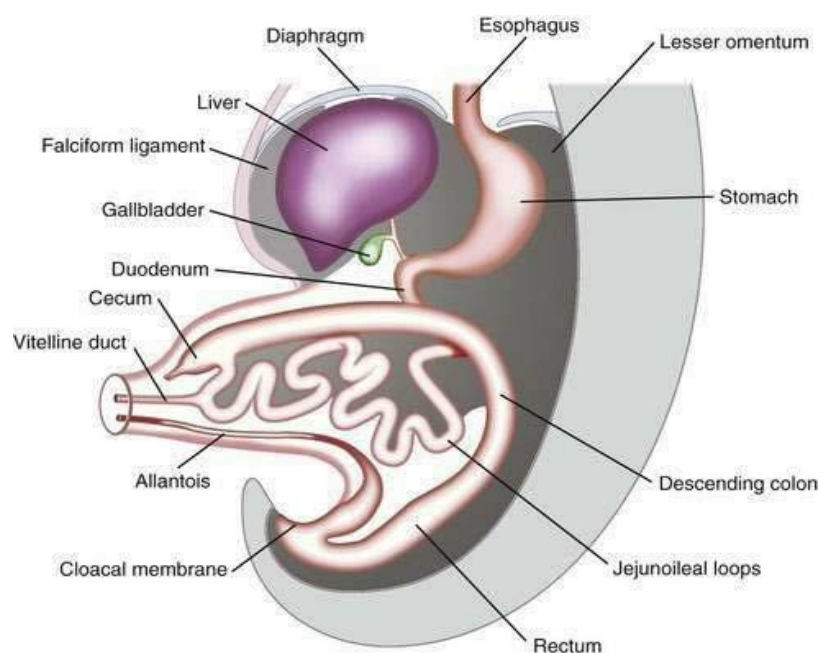
Initially the foregut, midgut, and hindgut are in broad contact with the mesenchyma of the posterior abdominal wall. The intraembryonic cavity is in open communication with the extraembryonic cavity. Subsequently the intraembryonic cavity loses its wide connection with the extraembryonic cavity. By week five of embryonic development, splanchnic mesoderm layers are fused in the midline and form a double-layered membrane, the dorsal mesentery, between the right and left halves of the body cavity. The mesoderm surrounds the intestinal tube and suspends it from the posterior body wall, allowing it to hang into the body cavity. The caudal portions of the foregut, the midgut, and most of the hindgut thus are suspended from the abdominal wall by the dorsal mesentery extending from the duodenum to the cloaca. The dorsal mesentery forms the mesoduodenum in the duodenum, the dorsal mesocolon in the region of the colon, and the mesentery proper in the region of the jejunum and ileum.

SPECIFIC STRUCTURES AND SYSTEMS

Duodenum

The duodenum originates from the terminal portion of the foregut and cephalic part of the midgut. With rotation of the stomach, the duodenum becomes C-shaped and rotates to the right; the fourth portion becomes fixed in the left upper abdominal cavity. The mesoduodenum fuses with the adjacent peritoneum; both layers disappear, and the duodenum becomes fixed in its retroperitoneal location. The lumen of the duodenum is obliterated during the second month of development by proliferation of its cells; this phenomenon is shortly followed by recanalization. Because the foregut is supplied by the celiac artery and the midgut by the superior mesenteric artery, the duodenum is supplied by both arteries and therefore is relatively protected from ischemic injury.

Midgut

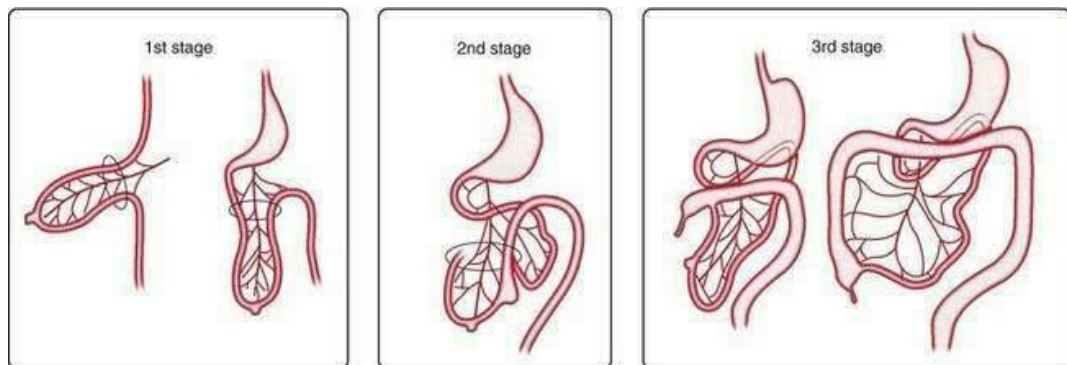


In a 5-week embryo, the midgut is suspended from the dorsal abdominal wall by a short mesentery and communicates with the yolk sac by way of the vitelline duct. The midgut gives rise to the duodenum distal to the ampulla, to the entire small bowel, and to the cecum, appendix, ascending colon, and the proximal two thirds of the transverse colon. The midgut rapidly elongates with formation of the primary intestinal loop. The cephalic portion of this loop, which communicates with the yolk sac by the narrow vitelline duct, gives rise to the distal portion of the duodenum, the jejunum, and a portion of the ileum; the distal ileum, cecum, appendix, ascending colon, and proximal two thirds of the transverse colon originate from the caudal limb. During week 6 of embryonic development, the primary intestinal loop enters the umbilical cord (physiologic umbilical herniation) and by week 10 it re-enters the abdominal cavity. The proximal portion of the jejunum is the first portion of the intestine to re-enter the abdominal cavity and becomes located on the left side; the subsequent loop that re-enters the abdominal cavity locates to the right. The cecal bud is the last segment to re-enter the abdominal cavity. The cecum originates as a small dilatation of the caudal limb of the primary intestinal loop by approximately 6 weeks of development. Initially it lies in the right upper quadrant; then it descends to the right iliac fossa, placing the ascending colon and hepatic flexure in the right side of the abdominal cavity. The appendix originates from the distal end of the cecal bud. Because the appendix develops during descent of the colon, its final position frequently is retrocecal or retrocolonic.

The primary intestinal loop rotates counterclockwise for approximately 270 degrees around an axis formed by the superior mesenteric artery. This rotation

occurs in three stages : the first stage occurs between six and eight weeks (90 degrees), the second stage is at nine weeks (180 degrees), and the third stage is at 12 weeks of gestation (270 degrees). Elongation of the bowel continues, and the jejunum and ileum form a number of coiled loops within the peritoneal cavity.

Mesentery



When the caudal limb of the primitive intestine moves to the right side of the abdominal cavity, the dorsal mesentery twists around the origin of the superior mesenteric artery. After the ascending and the descending portions of the colon reach their final destinations, their mesenteries fuse with the peritoneum of the posterior abdominal wall, and they become retroperitoneal organs. The appendix, cecum, and descending colon retain their free mesentery.

The transverse mesocolon fuses with the posterior wall of the greater omentum. The mesentery of the jejunum and ileum at first is in continuity with the ascending mesocolon; after the ascending colon becomes retroperitoneal, the mesentery only extends from the duodenum to the ileocecal junction.

Hindgut

The distal third of the transverse colon, the descending colon and sigmoid, the rectum, and the upper part of the anal canal originate from the hindgut. Initially the urinary, genital, and rectal tracts empty into a common channel, the cloaca. They become separated by the caudal descent of the urorectal septum into an anterior urogenital sinus and a posterior intestinal canal. The lateral fold of the cloaca moves to the midline, and the caudal extension of the urorectal septum develops into the perineal body. In a man, the lateral genital ridges coalesce to form the urethra and scrotum; in a woman, no fusion occurs, and the labia minora and majora evolve. The cloaca is lined by endoderm and covered anteriorly by ectoderm. The most distal portion of the hindgut enters into the posterior region of the cloaca, the primitive anorectal canal. The boundary between the endoderm and the ectoderm forms the cloacal membrane. This membrane ruptures by the seventh week of embryonic development, creating the anal opening for the hindgut. This portion is obliterated by the ectoderm but recanalizes by week nine. Thus, the distal portion of the anal canal originates from the ectoderm and is supplied by the inferior rectal artery; the proximal portion of the anal canal originates from the endoderm and is supplied by the superior rectal artery. The pectinate line is situated at the junction of the endoderm and the ectoderm.

Arterial System

Vascular endothelial growth factor (VEGF)-A and its receptors, VEGFR-1 and VEGFR-2, are important for endothelial cell proliferation, migration, and sprouting. Angiopoietins and their receptors, Tie1 and Tie2, play a role in remodeling and maturation of the developing vasculature. Mutation in Tie2 has been reported in vascular dysmorphogenesis.

Arteries of the dorsal mesentery, originating from fusion of the vitelline arteries, give rise to the celiac, superior mesenteric, and inferior mesenteric arteries. Their branches supply the foregut, midgut, and hindgut, respectively.

Venous System

Vitelline veins give rise to a periduodenal plexus that develops into a single vessel, the portal vein. The superior mesenteric vein originates from the right vitelline vein that receives blood from the primitive intestinal loop. The left vitelline vein disappears. The umbilical veins become connected to the hepatic sinusoids after which the right umbilical vein disappears and the left umbilical vein joins the inferior vena cava; ultimately the umbilical vein is obliterated and forms the ligamentum teres. The cardinal veins are involved with forming the inferior vena cava as is the proximal portion of the right vitelline vein.

ANATOMY

The word intestine is derived from a Latin root meaning “internal,” and indeed, the two organs together nearly fill the interior of the abdominal cavity. In addition, called the small and large bowel, or colloquially the “guts,” they constitute the greatest mass and length of the alimentary canal and, with the exception of ingestion, perform all digestive system functions.

The Small Intestine

Chyme released from the stomach enters the small intestine, which is the primary digestive organ in the body. Not only is this where most digestion occurs, it is also where practically all absorption occurs. The longest part of the alimentary canal, the small intestine is about 3.05 meters (10 feet) long in a living person (but about twice as long in a cadaver due to the loss of muscle tone). Since this

makes it about five times longer than the large intestine, you might wonder why it is called “small.” In fact, its name derives from its relatively smaller diameter of only about 2.54 cm (1 in), compared with 7.62 cm (3 in) for the large intestine. As we’ll see shortly, in addition to its length, the folds and projections of the lining of the small intestine work to give it an enormous surface area, which is approximately 200 m², more than 100 times the surface area of your skin. This large surface area is necessary for complex processes of digestion and absorption that occur within it.

Structure

The coiled tube of the small intestine is subdivided into three regions. From proximal (at the stomach) to distal, these are the duodenum, jejunum, and ileum

The shortest region is the 25.4-cm (10-in) duodenum, which begins at the pyloric sphincter. Just past the pyloric sphincter, it bends posteriorly behind the peritoneum, becoming retroperitoneal, and then makes a C-shaped curve around the head of the pancreas before ascending anteriorly again to return to the peritoneal cavity and join the jejunum. The duodenum can therefore be subdivided into four segments: the superior, descending, horizontal, and ascending duodenum.

Of particular interest is the hepatopancreatic ampulla (ampulla of Vater). Located in the duodenal wall, the ampulla marks the transition from the anterior portion of the alimentary canal to the mid-region, and is where the bile duct (through which bile passes from the liver) and the main pancreatic duct (through which pancreatic juice passes from the pancreas) join. This ampulla opens into the duodenum at a tiny volcano-shaped structure called the major duodenal papilla. The hepatopancreatic sphincter (sphincter of Oddi) regulates the flow of both bile and pancreatic juice from the ampulla into the duodenum.

The three regions of the small intestine are the duodenum, jejunum, and ileum. The jejunum is about 0.9 meters (3 feet) long (in life) and runs from the duodenum to the ileum. Jejunum means “empty” in Latin and supposedly was so named by the ancient Greeks who noticed it was always empty at death. No clear demarcation exists between the jejunum and the final segment of the small intestine, the ileum.

The ileum is the longest part of the small intestine, measuring about 1.8 meters (6 feet) in length. It is thicker, more vascular, and has more developed mucosal folds than the jejunum. The ileum joins the cecum, the first portion of the large intestine, at the ileocecal sphincter (or valve). The jejunum and ileum are tethered to the posterior abdominal wall by the mesentery. The large intestine frames these three parts of the small intestine.

Parasympathetic nerve fibers from the vagus nerve and sympathetic nerve fibers from the thoracic splanchnic nerve provide extrinsic innervation to the small intestine. The superior mesenteric artery is its main arterial supply. Veins run parallel to the arteries and drain into the superior mesenteric vein. Nutrient-rich blood from the small intestine is then carried to the liver via the hepatic portal vein.

The Large Intestine

The large intestine is the terminal part of the alimentary canal. The primary function of this organ is to finish absorption of nutrients and water, synthesize certain vitamins, form feces, and eliminate feces from the body.

Structure

The large intestine runs from the appendix to the anus. It frames the small intestine on three sides. Despite its being about one-half as long as the small intestine, it is called large because it is

more than twice the diameter of the small intestine, about 3 inches.

Subdivision

The large intestine is subdivided into four main regions: the cecum, the colon, the rectum, and the anus. The ileocecal valve, located at the opening between the ileum and the large intestine, controls the flow of chyme from the small intestine to the large intestine.

Cecum

The first part of the large intestine is the cecum, a sac-like structure that is suspended inferior to the ileocecal valve. It is about 6 cm (2.4 in) long, receives the contents of the ileum, and continues the absorption of water and salts. The appendix (or vermiform appendix) is a winding tube that attaches to the cecum. Although the 7.6-cm (3-in) long appendix contains lymphoid tissue, suggesting an immunologic function, this organ is generally considered vestigial. However, at least one recent report postulates a survival advantage conferred by the appendix: In diarrheal illness, the appendix may serve as a bacterial reservoir to repopulate the enteric bacteria for those surviving the initial phases of the illness. Moreover, its twisted anatomy provides a haven for the accumulation and multiplication of enteric bacteria. The mesoappendix, the mesentery of the appendix, tethers it to the mesentery of the ileum.

Colon

The cecum blends seamlessly with the colon. Upon entering the colon, the food residue first travels up the ascending colon on the right side of the abdomen. At the inferior surface of the liver, the colon bends to form the right colic flexure (hepatic flexure) and becomes the transverse colon. The region defined as hindgut begins with the last third of the transverse colon and continues on. Food residue passing through the transverse colon travels across to the left side of the abdomen, where the colon angles sharply immediately

inferior to the spleen, at the left colic flexure (splenic flexure). From there, food residue passes through the descending colon, which runs down the left side of the posterior abdominal wall. After entering the pelvis inferiorly, it becomes the s-shaped sigmoid colon, which extends medially to the midline. The ascending and descending colon, and the rectum are located in the retroperitoneum. The transverse and sigmoid colon are tethered to the posterior abdominal wall by the mesocolon.

Rectum

Food residue leaving the sigmoid colon enters the rectum in the pelvis, near the third sacral vertebra. The final 20.3 cm (8 in) of the alimentary canal, the rectum extends anterior to the sacrum and coccyx. Even though rectum is Latin for “straight,” this structure follows the curved contour of the sacrum and has three lateral bends that create a trio of internal transverse folds called the rectal valves. These valves help separate the feces from gas to prevent the simultaneous passage of feces and gas.

Anal Canal

Finally, food residue reaches the last part of the large intestine, the anal canal, which is located in the perineum, completely outside of the abdominopelvic cavity. This 3.8–5 cm (1.5–2 in) long structure opens to the exterior of the body at the anus. The anal canal includes two sphincters. The internal anal sphincter is made of smooth muscle, and its contractions are involuntary. The external anal sphincter is made of skeletal muscle, which is under voluntary control. Except when defecating, both usually remain closed.

PHYSIOLOGY

The human body has several levels of organization: cells, tissues, organs, and organ systems. Working together, human organ systems supply the body’s cells with essential

biological materials they need to function, as well as facilitating the elimination of wastes. They also work in a coordinated fashion to maintain temperature, pH, and other conditions at optimal levels to support cellular processes. The digestive system has three main functions: digestion of food, absorption of nutrients, and elimination of solid food waste. The organs of digestive system include those that make up the gastrointestinal (GI) tract (e.g., esophagus, stomach, and small and large intestines) and accessory organs (e.g., liver, gall bladder, and pancreas).

The small and large intestines form a major part of the GI tract. Located in the abdomen, they are the major site of digestion and absorption of nutrients from ingested food . The small intestine consists of three sections: duodenum, jejunum, and ileum . The duodenum is the first and the shortest segment of small intestine. It receives partially digested foods from stomach and pancreatic secretions containing digestive enzymes; it plays important roles in digesting foods. The jejunum lies in the midsection of intestine, connecting the duodenum and ileum. It contains circular folds and villi to increase surface area for absorbing small nutrient particles that were enzymatically digested in the duodenum. The absorbed nutrients then enter liver through the enterohepatic circulation. The ileum is the third part of small intestine and contains villi similar to those in jejunum. The ileum absorbs vitamin B12, bile acids, and other remaining nutrients not absorbed by jejunum . Villi are absent in caecum and large intestine (colon).

The cross-sectional structure of small intestine contains four layers: mucosa, submucosa, muscular layer, and adventitia. The mucosa consists of epithelial cells, which secrete mucus as a thick protective fluid. The main functions of the mucosa are to absorb and transport nutrients, keep the tissues moist, and protect the body from pathogens and foreign particles. The submucosa is a relatively thin, collagen-rich extracellular matrix, which supports the mucosa and joins it to the muscular layer. The muscular layer consists

of muscle tissue; it is responsible for gut movement such as peristalsis. The adventitia is a smooth tissue membrane consisting of two layers of mesothelium, a visceral membrane and a parietal layer. The adventitia secretes serous fluid.

The small intestine consists of four layers: mucosa, submucosa, muscle layer, and adventitia. The intestinal epithelium is lined with a single layer of polarized cells, among which the major types include enterocytes, goblet cells, Paneth cells, stem cells, and others.

The Properties and Functions of Intestinal Epithelial Cells (IECs)

IECs exist as a layer of cells that line the luminal surface of intestinal epithelium. IECs are continuously replaced every 4-5 days through a process of renewal and migration. New IECs are produced by stem cells located in crypts at the base of the intestinal glands. These stem cells give rise to progenitors that differentiate into mature IECs types as they (except Paneth cells) migrate up the crypt-villus axis [5]. The aged IECs undergo apoptosis and are shed off into intestinal lumen. Several cell types are present in the intestinal epithelium, including enterocytes, Paneth cells, goblet cells, and neuroendocrine cells

Enterocytes are the major cell type in intestinal epithelium. They are simple columnar epithelial cells and play important roles in nutrient absorption (e.g., ions, water, sugar, peptides, and lipids) and in secreting immunoglobulins. Goblet cells comprise around 10% of all IECs. Goblet cells secrete mucus, which lubricates the passage of food through the intestines and protects the intestinal wall from digestive enzymes. Paneth cells are only found in small intestine, particularly in the ileum . Paneth cells synthesize and secrete antimicrobial peptides and proteins. It was reported that Paneth cells can directly sense enteric bacteria via cell-autonomous MyD88-dependent toll-like receptor (TLR) activation, triggering expression of

multiple antimicrobial factors . Paneth cells are long-lived cells; they migrate downwards to the base of crypts after differentiating from stem cells. Neuroendocrine cells can release intestinal hormones or peptides into bloodstream upon stimulation, to activate nervous responses. Neuroendocrine cells are also known to act as chemoreceptors, initiating digestive actions, detecting harmful substances, and initiating protective responses .

Other cell types reported include exocrine cells and endocrine cells. Exocrine cells are located in the mucosa of small intestine; they secrete mucus, peptidase, sucrose, maltase, lactase, lipase, and enteropeptidase . Endocrine cells secrete cholecystokinin and secretin. Their secretions are primarily regulated by chyme: the larger the amount of chyme present, the greater the secretions.

The Absorption of Amino Acids in the Intestine

According to the National Academies of Sciences Engineering Medicine, the Dietary Reference Intake is 0.8 grams of protein per kilogram of body weight. Most of these proteins cannot be absorbed by human body in their predigested state and must be converted into amino acids prior to absorption. Digestion describes the process by which complex dietary substances are converted into simple forms that can be absorbed by the body. Protein digestion starts in stomach and finishes in the intestine. Three enzymes are important for protein digestion: pepsin, trypsin, and chymotrypsin. The acidic environment in stomach denatures proteins and makes them available for proteolytic digestion. Pepsin is the major proteolytic enzyme in stomach, where it converts large proteins into smaller peptides. The partially digested peptides enter small intestine, where they are further degraded by activated trypsin and chymotrypsin. Trypsin and chymotrypsin are secreted by pancreas as inactive forms and converted into active forms when secreted into small intestine. Proteins digestion can be further enhanced by proteases, such as aminopeptidase N. Aminopeptidases can digest proteins from the amino terminus and form

single amino acids or di- and tripeptides.

Absorption of amino acids is mainly carried out by IECs through active transport. These IECs are highly polarized, with the apical plasma membrane facing the intestinal lumen. Because there are different types of transporters localized in either apical or basolateral membranes, IECs can transport substances in one direction across the epithelium. There are more than 7 types of amino acid transporters in the apical surface of IECs. One type is Na⁺/amino acid transport system; it transports amino acids from the intestinal lumen into cells. At least 5 amino acid transporters are present at the serosal (basolateral) surface, which can transport amino acids out of the cells and into interstitial fluid. The amino acids can then enter blood vessels for circulation. The undigested and unabsorbed substances enter the large intestine.

Amino acids can be transported into IECs by transporters (e.g., sodium coupled neutral amino transporter 2) at the luminal plasma membrane and out of IECs by transporters at the serosal side (and then into blood vessels for circulation). Amino acids regulate a wide range of IECs' properties and functions through diverse signaling pathways. In this article, we focus on discussing the roles of amino acids (especially glutamine and arginine) on the proliferation, barrier function, and immunity responses of IECs.

Amino Acids Regulate the Proliferation and Differentiation of IECs

The maintenance and growth of intestine is driven by the amount of luminal nutrients. High nutrient content causes increases in the cell number, villus length, and crypt depth. In addition, the type of nutrients appears to contribute to alterations in the morphology and functions of IECs. A recent study found that L-glutamine enhanced intestinal enterocytes growth via activation of mammalian target of rapamycin (mTOR) signaling pathway, independently of AMP-activated kinase (AMPK). High-protein diet was found to upregulate the expression of genes related to cell proliferation and chemical barrier

function in rat colon. This study demonstrated that high-protein diet increased the amount of undigested peptides entering the large intestine, modified the gut microbiota composition, and increased protein fermentation by bacteria, resulting in the production of numerous amino acid derived metabolites.

It was also found that treatment with amino acid solution (1.0 g/L threonine, 1.2 g/L valine, 1.1 g/L serine, 0.2 g/L tyrosine, and 1.6 g/L tryptophan) increased the IECs proliferation rate in mice exposed to radiation. The treatment increased the proliferation markers (e.g., Ki-67, p-Erk, p-Akt, and PCNA) and stem cells markers (Lgr5+), decreased apoptosis markers (e.g., cleaved caspase-3), and increased protein levels of sodium–hydrogen exchanger 3 (NHE3) and sodium-dependent glucose transporters (SGLT1) in the brush border membrane. Mice treated with this amino acid solution displayed decreased paracellular permeability (tightening of the mucosal barrier), increased Na⁺ absorption, and improved survival when exposed to lethal dose of total-body irradiation. The results demonstrated that the better absorption of electrolytes and nutrients could be, at least partially, attributed to an increased villus height induced by amino acid solution, and that the extracellular signal-regulated kinase (ERK) pathway in IECs was activated by the amino acid solution.

Oral supplementation of L-glutamine (0.5%) to weaning piglets was found to increase the villus height and crypt depth, reduce oxidative stress, increase the proliferative rates of IECs, and lower the apoptotic rate of IECs. In cultured intestinal porcine epithelial cells (IPEC-1), L-arginine stimulated the proliferation rate and attenuated the lipopolysaccharide- (LPS-) induced cell death. In mechanistic study, the authors found that L-arginine treatment increased relative protein levels of phosphorylated mTOR and phosphorylated ribosomal protein S6 kinase-1 and decreased relative protein levels of TLR4 and phosphorylated nuclear factor kappa-light-chain-enhancer of activated B cells (NF- κ B) in LPS-treated IPEC-1 cells.

Amino Acids Regulate the Intestinal Epithelial Barrier Functions

IECs are tightly bound together in a monolayer by intercellular junctional complexes. These cell-cell connections allow the epithelium to form a barrier which separates the extracellular fluid at the luminal side of the cell from fluid at the serosal side and also prevents microbial invasion of interstitial tissues. Tight junctions are a primary determinant of intestinal epithelial barrier properties and functions. Tight junctions prevent the direct diffusion of small molecules from intestinal lumen into the interstitial spaces and then into the blood vessels. Disruption of tight junction structures by specific protein mutations or by aberrant signaling can be both the cause and effect of diseases.

In recent years, studies have established the important roles of glutamine in regulating the functions of tight junction proteins. In human Caco-2 cells, a classic model for studying gut barrier function, it was found that glutamine deprivation or inhibition of glutamine synthetase significantly decreased the transepithelial resistance and reduced the expression of tight junction proteins. Glutamine addition rescued the phenotype of barrier dysfunction. In another study, the authors found that glutamine deprivation upregulated the phosphatidylinositol 3-kinase (PI3-K)/Akt pathway and reduced the expression of a tight junction protein claudin-1, consequently breaking down the barrier function (with decreased transepithelial electrical resistance and increased permeability). Other junctional proteins such as ZO-1, occludin, and claudins have been reported as essential effectors of perijunctional actomyosin ring-mediated tight junction regulation. In a piglet weaning-related gastrointestinal infection model, glutamine supplementation (4.4%, w/w) has been found to preserve the intestinal epithelial barrier function in the distal ileum of piglets during infection. Upon exposure to *E. coli*, the expression levels of claudin-1 and occludin were reduced in control-fed animals but not in glutamine-supplemented piglets. The study showed that glutamine

supplementation was beneficial in mitigating the severity of infection, probably by reducing the mucosal cytokine responses and by preserving the intestinal barrier function . Oral glutamine supplementation in an intestinal ischemia-reperfusion (IR) injury rats had significant increases in jejunal and ileal bowel and mucosal weight and villus height and crypt depth compared to IR-nontreated rats. Supplementation with glutamate (2%) demonstrated positive effects on the growth performance of pigs fed with mold-contaminated feed, ameliorated the imbalanced antioxidant system, and reduced the mycotoxins-caused abnormalities in intestinal structure [34]. Deficiency in dietary glutamine has been reported to impair cell signaling and result in intestinal atrophy in both piglets and infants.

L-Arginine supplementation at a dose of 0.5% or 1% in weaned pigs was found to protect and enhance the intestinal mucosal immune function and maintain intestinal barrier integrity after *E. coli* LPS challenge. In an inflammatory bowel disease (IBD) mouse model, L-arginine supplementation suppressed the dextran sulfate sodium- (DSS-) induced intestinal mucosal injury and improved IBD clinical parameters (e.g., survival and body weight loss). Dietary L-arginine supplementation also reduced the methotrexate-induced intestinal mucosal injury and improved intestinal recovery following injury in rats. In feeding of L-arginine has been reported to improve the development and barrier functions of small intestine of posthatch broilers, which was attributed to the activation of the mTOR pathway.

Amino Acids Regulate the Intestinal Immunity

IECs play important roles in protecting the human body from microbial infections. The intestines contain the largest number of immune cells in the body and are continually exposed to a wide range of antigens and potential immune stimuli. IECs can sense and respond to microbial stimulations to reinforce their barrier function and to participate in the coordination of appropriate immune responses, ranging from tolerance to antipathogen immunity. Because

IECs function as a barrier between the intestinal microbiota and the host, they are important to the maintenance of the symbiotic relationship between gut microbiota and the host by constructing mucosal barriers, secreting immunological mediators, and delivering bacterial antigens. Inflammasome expressed by IEC plays important roles in mucosal immune defense and inflammation. Dysfunction of intestinal epithelium can cause diseases, and some diseases cause the abnormalities in intestinal epithelium, which could worsen the complications. The majority of immunological processes occurs in the mucosa. Peyer's patches are important components of the gut-associated lymphoid tissue (GALT) in the small intestine. The B cells usually dominate in the germinal centers of follicles and T cells scatter between follicles. The B cells in GALT play central roles in the intestinal immune responses. Abnormalities in B cell functions can cause the development of autoimmunity. B-1 cells produce most of the circulating natural antibodies. They can differentiate into immunoglobulin M- (IgM-) or IgA-secreting cells and affect tissue homeostasis and the maintenance of a symbiotic mucosal microbiota through BCR dependent and independent means. The absence of IgA-producing B-1 cells in the intestines might increase the risk of food allergies. Regulatory T cells (Tregs) are a subpopulation of T cells. They function to suppress dysregulated immune responses of other immune cells to maintain intestinal homeostasis. Tregs have been suggested to play important roles in other physiological and pathophysiological processes, including the pathogenesis of IBD, controlling gut microbial diversity, and promoting intestinal tissue remodeling/repair in response to damage.

Adequate nutrition is essential to the development and maintenance of the immune system. Extensive studies have shed light on the homeostatic regulation of amino acids in intestinal immunity. It was found that glutamine reduced the proinflammatory IL-6 and IL-8 production in intestinal biopsies, and enhanced anti-inflammatory IL-10 level in the gut. IL-10 is mainly produced by leukocytes (e.g., T cells and B cells) and also by epithelial cells. IL-10

plays important roles in the maintenance of intestinal mucosal homeostasis and in the suppression of proinflammatory responses of innate and adaptive immune cells. Oka and colleagues found that compared to the regulatory B cells (Bregs) from healthy controls, Bregs from patients with Crohn's disease had impaired IL-10 production and that Bregs-depleted mice developed more severe intestinal inflammation compared to the controls. The results suggested that a decrease or loss of Bregs function exacerbated intestinal inflammation. The IL-10-producing regulatory B10 cells have been shown to inhibit the DSS-induced intestinal inflammation/injury in a colitis mouse model.

Amino acids have been shown to affect the development, maturation, and functions of B cells and T cells in the intestine. The deficiency of arginine has been shown to impair early B cell maturation in F/A-2^{+/+} transgenic mice, leading to drastically reduced B cell numbers in small intestine and decreased serum IgM levels [50]. Studies using amino acid transporter ASCT2-deficient mice (Slc1a5^{-/-} mice) demonstrated that ASCT2 plays important role in the development of the T helper 1 (Th1) and Th17 responses and in the regulation of CD4 T helper cell function. It was found that, due to a reduction in glutamine import, the mTORC1 signaling in T cells was reduced and the proinflammatory CD4⁺ T cell responses were attenuated. Cobbold and colleagues found that depletion of the essential amino acid(s) inhibited the activation and proliferation of T cells and mTOR signaling in dendritic cells. Glutamine has been found to be required for T cell activation. Depletion of glutamine blocked the proliferation and cytokine secretion of T cells. And, the T cell activation induced glutamine uptake and metabolism regulated by ERK/MAPK signaling. Ikeda and colleagues found that branched-chain amino acids (BCAA, e.g., isoleucine) regulated the maintenance of Tregs through Slc3a2-dependent metabolic reprogramming. Mice fed a reduced BCAA diet had reduced Foxp3⁺ Tregs numbers and Foxp3⁺ Tregs in mice on a reduced leucine diet showed defective proliferation. Oral supplementation of L-arginine has been shown to

improve the intestinal immune function and reduce bacterial and endotoxin translocation in experimental severe acute pancreatitis rats. The treatment increased CD3⁺ and CD4⁺ T-lymphocyte numbers and CD4⁺/CD8⁺ ratio in intestinal mucosal lamina propria.

These findings may help understand the beneficial effect of glutamine on reducing morbidity and gut permeability in patients with multiorgan system trauma. In a rat model of puncture-style brain trauma, glutamine administration reduced the gut damage and decreased intestinal NF- κ B activity and intestinal proinflammatory cytokines expression. Oral and parenteral feeding studies have demonstrated that, in addition to the total protein intake, the availability of specific dietary amino acids (particularly glutamine, glutamate, and arginine) is also essential to optimizing the immune functions of intestine. Deficiencies in amino acids such as tryptophan, arginine, glutamine, and cysteine can reduce immune cells activation. These amino acids have been shown to play unique roles in maintaining the integrity, growth, and function of the intestine, in normalizing inflammatory cytokines secretion, in improving T-lymphocyte numbers, specific T cell functions, and the secretion of IgA. In a 2,4,6-trinitro-benzene sulphonic (TNBS) acid-induced ulceration rat model, compared to rats fed with control-diet, the rats fed with glycine showed mild ulceration and localized inflammatory cells in the mucosa and the submucosal area, decreased colonic myelo-peroxidase activities (70%), and decreased TNBS-induced IL-1 β and TNF- α mRNA.

Studies in mice have demonstrated that dietary amino acids stimulation regulates the homeostasis of macrophages in the small intestine. For instance, when mice were given total parenteral nutrition, which deprived the animals of enteral nutrients, there was a significant decrease in IL-10-producing macrophages (e.g., F4/80⁺CD11b⁺ macrophages) in small intestine, whereas the IL-10-producing CD4⁺ T cells remained unchanged. The production of IL-10 in small intestine is dependent on both diet and microbiota. These data demonstrated a strong association between amino acid deprivation and

the impaired replenishment of intestinal immunity function; a prolonged protein (amino acids) deficiency impairs critical immune functions.

L-arginine has been shown to be involved in protein synthesis and in the regulation of many essential cellular functions including immune response, hormone secretion, and wound healing. L-arginine (0.5%) supplementation in pigs increased the numbers of IgA-secreting cells and CD8⁺ and CD4⁺ T cells in ileum. In human Caco-2 cells, L-arginine was found to ameliorate intestinal inflammation through attenuating Interleukin-1 β - (IL-1 β -) induced NF- κ B activation. L-arginine and its metabolite ornithine promote colonic epithelial wound repair by enhancing cell proliferation and collagen deposition through activation of mTOR signaling pathway. Dietary glycine and L-glutamine supplementation has been shown to protect the colonic wall of irradiated rats.

Although prolonged protein deficiency can impair critical immune functions, short-term protein restriction has been shown to enhance immunity to pathogens and regulate inflammation. The integrated stress response (ISR) is a coordinated cellular program that allows eukaryotic cells to sense and respond to stress-induced signals, including nutrient deprivation (e.g., amino acid starvation) and endoplasmic reticulum stress. General control nonderepressible 2 (GCN2) is an ISR sensor that can sense amino acid depletion. A recent study revealed that acute amino acid starvation (using 2% protein diet or leucine-deficient diet) suppressed intestinal inflammation and ameliorated disease severity in a DSS-induced mouse colitis model through a GCN2-dependent mechanism. The authors demonstrated that amino acid starvation activated ISR and GCN2 suppressed intestinal inflammation and Th17 responses through a mechanism dependent on autophagy, a decrease in oxidative stress, and reductions of inflammasome activation and IL-1 β production. In a previous study, Sundrud and colleagues found that selective amino acid deprivation inhibited Th17 cell differentiation and that a small molecule

halofuginone selectively inhibited Th17 differentiation by activating the amino acid starvation response pathway. The authors also found that halofuginone suppressed the Th17-associated autoimmune inflammation in two experimental autoimmune encephalomyelitis mouse models. These findings illustrate the ability of T cells to sense amino acids levels in local environment, rather than using the amino acid solely as a fuel source, reveal a mechanism coupling the amino acid sensing with intestinal inflammation via GCN2, and potentially help identify novel targets for therapeutic intervention of IBD and other inflammatory diseases.

In addition to providing the monomer units for proteins syntheses, amino acids participate in diverse cellular functions. Extensive studies have demonstrated that (1) amino acids play important roles in maintaining IECs growth, structure, homeostasis, and functions; (2) amino acids regulate the intestinal epithelial barrier structure and functions; (3) amino acids regulate the intestinal immunity functions; and (4) amino acids supplementation has the potential to ameliorate the abnormalities/phenotypes associated with dysfunctional IECs, through restoring the properties (and functions) of IECs . These findings help further our understanding of the important roles of amino acids in the homeostasis of IECs and in maintaining the physiology of intestine, digestive system, and human body and could potentially help identify novel targets and reagents for therapeutic interventions of diseases associated with dysfunctional IECs

PATHOLOGY

A great deal of work has been done attempting to make a satisfactory classification, when one is reminded of the fact, that a recent classification mentions eighty distinct causes, we are content to accept the general classification.

I- Dynamic or Paralytic, for example due to

- 1- General or local infective peritonitis.
- 2- Manipulating intestine.
- 3- Blows.
- 4- Embolism of superior mesenteric artery.
- 5- Spasm as in chronic lead poisoning.

II- Mechanical;-

1- mechanical

Hernia

Bands

Appendix

Meckels diverticulum

Slits

Angulation.

2- Obturation

Tumors in intestine itself.

Cicatrices.

Foreign bodies.

Fecal impaction.

Intussusception.

Volvulus

Tumors outside intestine

Exudate

Various other causes might be mentioned but they would all fall under one of the two main divisions, dynamic or mechanical. The most important of these various kinds we will discuss.

MORBID ANATOMY.

It will be necessary for us to discuss this under two divisions, Acute and Chronic.

Chronic- Here the condition below the point of obstruction is seen to be that the coils of intestine are empty, contracted and color more or less grayish. Remnants of intestinal contents as hard fecal masses are retained here due to the bowel being unable to carry them onward.

Above the point of obstruction first thing noticed is an accumulation of intestinal contents above the constricted portion causing dilatation which seeks higher and higher levels. In the small intestine these contents are almost invariably fluid and gas while if the obstruction is in the large bowel, the contents may be more or less solid. The fluid portion under ordinary circumstances does not decompose in the small intestine, but here we have the same changes taking place that occurs normally in the large intestine; that is gas being produced.

In the chronic obstruction, however, this does not cause as much trouble owing to the fact that gas can escape by a partial obstruction much longer than the, the solids and liquids. As long as the circulation is not seriously disturbed, the intestinal mucosa is again able to absorb most of the gas formed.

Hypertrophy of the intestinal wall takes place here also as a result of the obstruction and distention and then the bowel trying to overcome this. This hypertrophy affects chiefly the muscularis.

The mucosa and serosa are both usually thinned. The mucosa is altered by the chemical and inflammatory changes going on after continuing to such an extent as to cause ulceration.

Acute - Below the obstruction the bowel is empty and collapsed as in the chronic type. Above the obstruction, however it is quite different; here, we notice that the bowel wall is much thinned and no compensatory hypertrophy occurs; also the distention is much more marked due to the poor circulation, the bowels being unable to absorb the gas from the mucosa and also no gas being able to pass the total obstruction.

The distention is aided materially by paralysis of the nervous mechanism and complete venous stasis so that finally no absorption of the gases occurs.

The appearance of the bowel above the obstruction is quite important, it first shows a marked hyperemia followed later by venous stasis, hence the coil is first deep red, later purplish and may finally terminate in gangrene. Micro organisms often times escape rapidly through the intestinal wall and cause great injury to the same without any lesion of the mesenteric vessels. This was demonstrated by Rocker with experiments on dogs. He injected fluid and air in the bowel after ligating it at two points and found that a marked venous stasis was produced even tho the mesentery was intact.

Kocher also contends that the condition of the bowel above the point of strangulation is very much altered and therefore suggests resecting the bowel high above the constriction as quantities of fluid are poured into the intestine from hyper secretion,

inflammatory exudation and hemorrhage. With fermentation and venous stasis the epithelium may become destroyed; ulcer may occur and eventually may terminate in perforation and peritonitis.

As a result of Rockers experiments he wishes to impress the fact upon our minds of the importance of instituting proper drainage above the point of obstruction on account of danger already induced on the bowel at this point approaching the gangrenous state.

SYMPTOMS.

The classical symptoms usually given for this condition are pain, nausea and vomiting, constipation, distention, prostration and collapse.

There are numerous other less important symptoms which we will discuss under the various types of obstruction.

Pain- This symptom may vary greatly, depending on the various etiological conditions. In the more acute types the pain comes on suddenly and exceedingly severe and is more or less general over the whole abdomen, especially the lesions affecting the small intestines as the nervous mechanism cannot be localized. Later on the pains may cease for a time and then return, but differ in that they are of a colicky character due to increased peristalsis. Still later the colicky pain may change to a pain described as stabbing in character which is due to the beginning peritonitis occasioned by the escape of micro organisms through the intestinal wall. The pain is very much increased in cases where strangulation occurs from any cause and these are the cases that pass through the typical cycle of symptoms rapidly and soon reach the stage of collapse with early death.

These are the cases too which show early distention due to the interference with the circulation. With the chronic type of obstruction pain is not so prominent a symptom but is more or less gradual in onset and is more the sensation of discomfort unless the obstruction suddenly becomes acute then the pain takes on the intense

colicky character. In this type when the acute obstruction does occur the patient often times is able to locate the point of obstruction due to the rapid distention and intense pains being more or less localized. Visible peristalsis is quite often noticed in the chronic types and should be looked for as they are of considerable value in diagnosis of this class of cases.

Vomiting:- This condition or rather nausea its forerunner may come on almost with the pain or even before especially in the very very acute cases and may be a reflex affair. At first the stomach contents are vomited, the patient is extremely nauseated and is unable to retain even liquids for even a short time.

Osier says that the contents are watery in contra distinction to most other authors. Then comes bile stained material and lastly when the pylorus is no longer able to shut out the intestinal contents fecal or stercoraceous vomiting occurs.

This vomiting may be accompanied by the severest kind of retching or it may be raised with little or no effort. Various explanations for fecal vomiting have been suggested as anti peristalsis, or Brinton's theory of a reversal axial current occurring at the same time as peristalsis takes place. Most recent authors however agree that it is due to hypersecretion of the small intestine and as the fluids and gases accumulate the pyloric valve sooner or later gives way under the tremendous strain and the intestinal contents regurgitate into the stomach and are finally vomited. Fecal vomiting may not occur until late in obstruction of the large intestine or may not occur at all and this still further proves the hypersecretion theory.

Constipation:- This symptom also usually placed last by authors should rightly be placed first as regards onset in a great number of cases. In following our cases this condition has usually been present to a greater or less degree previous to the initial pain. In the chronic cases it extends over a considerable period of time and is only partial in type. In the acute cases it is usually absolute constipation although the

intestinal contents below the obstruction are often passed after the onset, this is particularly true where the obstruction is high up as the fluid contents of the upper intestine may get by a partial obstruction besides the contents below the obstruction.

In chronic obstruction constipation is a variable factor. It may be insignificant in importance while in other cases it may be marked. Usually it is more gradual in onset as the hypertrophy of the musculature compensates just the same only to a less extent as in the case of cardiac lesions. Quite frequently certain authors report cases of chronic obstruction where diarrhoea is present rather than constipation and must be considered otherwise one will be misled.

Prostration and Collapse:- Lastly as the characteristic symptoms given for intestinal obstruction comes prostration and collapse which with many minor closely related symptoms produce a picture never to be mistaken when once seen. Collapse is seen earliest in those cases where the obstruction is situated high up, while in the chronic cases it is seen late in the attack. This condition of collapse is due to various factors, namely ,

- 1- Shock to intestinal nervous system.
- 2- Vomiting and loss of water,
- 3- Toxemia and infection.

Most important of these is the injury to the nervous system and the toxemia. Reports of the Mayo Clinic 1910, p 210 illustrate the latter by experiments of tying off the duodenum and stomach and come to the conclusion that the toxins forced in the duodenum are by far the most toxic of any in the intestinal canal, and therefore gives another reason by obstructions high up are so much more fatal.

The general appearance of the patient suffering from collapse of this type is most interesting. The skin is cold, pale and covered with cold sweat; sensation is more or less diminished due to the toxemia and often is misleading in that the patient feels better when really he is worse. The face is pinched, temples sunken, eyes less prominent and surrounded by dark rings. Respirations are shallow, rapid and audible. The temperature remains normal for a time then becomes subnormal, and later if peritonitis occurs it may rise. The pulse becomes rapid, feeble, finally thready and irregular. The pulse often is not palpable at the wrist for some time previous to death. The mouth is exceedingly dry, patient has an unquenchable thirst; urine becomes less in amount or may be complete suppression. Lastly the patient may become unconscious and comatose.

Physical examination is of considerable importance in some cases and will be treated mostly when the various types as regards cause are considered. Briefly, however on inspection of the abdomen one notices the amount and position of the distention. The latter pertaining as to whether over the midline it suggests small intestines while if in the flanks it suggests large intestine.

Visible peristalsis may be seen occasionally and suggests chronic obstruction. Localized tumors may be present as intussusception. Respiratory movements of the abdomen may be of some value

On palpation notice is taken of the amount of tenderness which is usually slight until the onset of peritonitis, also the presence of tumors and the condition present at the hernial apertures, as well as vaginal and rectal examination.

Percussion is of little value except in cases of tumor or any condition of solid masses or to ascertain changes in distention.

Auscultation is thought to be of some value by some authors but practically is of very little help.

The presence of indican in the urine is of some value as it is greatly increased in amount due to decomposition in the intestinal canal causing the blood to absorb the same and excreted by the kidney. The white corpuscles of the blood may be increased to 75,000 - 80,000. We were unable to get counts in all of our cases but none ranged higher than 25,000.

Perhaps of all the symptoms subjective and objective the most important are the ones summarized as subjective symptoms together with a subnormal temperature and a rapid, feeble pulse.

As regards differential diagnosis, one may say, that it includes all those conditions which affect the abdomen for most any of these may simulate obstruction. The more important being various calculi, kidney crises, peritonitis, acute pancreatitis, embolism of mesenteric vessels, colitis, tympanitis due to typhoid, pneumonia, etc; lastly nervous conditions. All of these, however, have something more or less characteristic which will enable one to rule it out.

It now becomes our task to describe briefly the various conditions causing intestinal obstruction and in doing so, we will attempt to bring out only the more practical signs and symptoms of the more common types of obstruction.

DYNAMIC.

General or Local Infective Peritonitis:- Here we have a paralysis of smaller or larger portion of the intestine secondary to the peritonitis. This form is very often the cause of mistaken diagnosis especially in cases of acute localized appendicitis and while the diagnosis may be composing especially in acute appendicitis where classical symptoms are not present nevertheless one should not make the mistake with

symptoms exactly the reverse as; History of repeated attacks, of localized pain in right inguinal region; rise in temperature, increase in pulse rate of febrile type not complete obstruction as gas passes and therefore less tympanitic while

on the other hand with obstruction one finds sub normal temperature, and the pulse almost characteristic of this condition. We are very much interested in this type in that five of our cases were acute appendicitis with localized peritonitis and simulated intestinal obstruction before operation and four of these cases subsequently did develop a complete obstruction after the operation. Another case of general peritonitis due to specific pyosalpinx also illustrates the close association of symptoms. These will be found later in our case reports.

Functional Paralysis:- This condition may be caused by innumerable causes the more important being blows to the abdomen, passage of renal or biliary calculi, following operation due to intestinal manipulation, or after paracentesis of large effusions, after reduction of hernias, toxemias from diseases or chemical toxins as lead. These conditions are practically all direct or reflex nervous conditions and may be either motor paralysis or irritation of the sensory nerves, or direct or reflex stimulation of the inhibitory splanchnics, the latter producing cessation of peristalsis.

The intestinal obstruction in these cases is secondary and gives typical symptoms, it nevertheless is hard to differentiate often for instance one case in particular, a good diagnostician was unable to make a positive diagnosis of biliary colic for three days as it simulated renal colic and intestinal obstruction so closely. In these cases the symptoms of intestinal obstruction follow those of the primary cause and usually are less marked especially the vomitus rarely becoming fecal.

If due to injury the prognosis is quite favorable, while paresis due to manipulation of the intestine during operation or those secondary to peritonitis local or general deserve a grave prognosis.

As to treatment one must treat the primary cause. The intestinal paresis may do well by treatment with eserine sulphate and atropine; cold enemata containing asafoetida, turpentine and milk.

Embolism and Thrombosis of Mesenteric Arteries:

This condition usually affects the superior mesenteric artery. The mesenteric arteries are affected according to statistics by Jackson, Porter and Quimby. Endocarditis and atheroma of aorta usually precede the embolism and emboli find their way to the smaller vessels. Severe enteritis, syphilitic endarteritis and injury are important causes. Thrombosis of the veins is common in cirrhosis of the liver, stasis in the portal vein from any cause. Men are more subject to this condition 64 to 34 in women.

This condition may affect the main trunks or the small terminals, in the latter ulceration of the mucosa occurs. Following the occlusion the bowel becomes dark red and filled with blood. Hemorrhage occurs into the tissue and a bloody fluid escapes into the peritoneal cavity. Rapid necrosis, gangrene and peritonitis may follow.

Marked distention occurs and the mesentery may be thickened by extravasation of blood. A line of demarcation extending around the bowel may result. As to symptoms and diagnosis Gerhard's rules

are the best:-

- 1- There must be a source of embolism.
- 2- Copious hemorrhages from the intestine not the result of organic disease of intestine or due to portal obstruction.
- 3- A rapid subnormal temperature*
- 4- Sudden severe colicky pain - this may be

intermittent or continuous.

5- Distention and free peritoneal fluid.

6- Palpable mass(hematoma).

On glancing over these symptoms one can see how similar they are to those of intestinal obstruction, differing in that in the former the moment becomes hemorrhagic, diarrhoea of a hemorrhagic nature although absolute constipation may be present, When the bowel is paralyzed, The pain may be general or localized and with the other symptoms is of a remittent type in the more chronic cases. The difficulty in diagnosis arises in the very acute cases where rapid distention and cessation of peristalsis occurs with most of the symptoms of acute intestinal obstruction being present.

The prognosis is very grave as only occasional cases recover. The treatment is purely surgical and of these the recoveries are less than 10 per cent.

MECHANICAL.

Under the division of mechanical strangulation

we have several forms, the first being

1- Strangulated hernia:- This may be of two kinds, internal and external. By strangulation means not only obstruction but arrest of the flow of blood in the blood vessels. It may arise in two ways, immediate strangulation as in congenital hernia of children; or, in adults it is due to sudden extension of additional contents in the sac.

The constriction is usually caused by the thick neck of the sac, or the tissues external (as Gibernats ligament).

The pathology is similar to obstruction. The circulation is only partly arrested, veins suffering first then arteries, hence we first have congestion then gangrene if allowed to reach this stage. The intestine is first dusky red due to this congestion, walls thicker than ordinary obstruction, distention depending on length of time strangulated. If allowed to continue, gangrene begins due to stagnation of blood and E. coli infection. This condition is recognized by the grayish or black color with the softening and offensive odor. Gangrene occurs in from 1 - 3 days and is more often seen in femoral and umbilical hernia. Gangrene occurs earlier at the point of strangulation but nature guards against it by keeping the same localized by adhesions.

The hernial sac is usually filled with serous fluid which later becomes dark and has a bad odor. The sac wall gradually becomes infected as well as the surrounding tissues and if left alone an artificial anus may be produced.

The symptoms are practically like those given earlier for general symptoms except the pain is localized to one of the hernia apertures at first.

The pain ceases usually as gangrene sets in. On inspection a tumor is usually found which becomes softer as gangrene takes place. This tumor is doughy if omentum is present, more firm if in testines.

In the treatment of external strangulated hernia some suggest toxins but this is a crude and dangerous method with the possible exception

of those large hernias that protrude quite often. The proper treatment is operative treatment and excellent judgment must be used as to whether just the gut is returned, whether resection should be done or whether an artificial anus or flatus tube shall be used.

Femoral hernia are of exceptional importance in that they are difficult to recognize especially what is known as Richter's hernia (i.e. where

only a portion of the intestine is strangulated) and hence only a partial obstruction ensues.

The internal hernia may occur in innumerable places;

1- Diaphragmatic being the most common.

2- Through foramen of Winslow.

3- Doxiplas pouch.

4- Pericecal.

5- Duodenojejunal-jejunum caught under the left side of the abdomen. These internal hernia may have the same symptoms as are commonly found in intestinal obstruction or symptoms may be a negligible quantity.

2- Obstruction Due to Bands: These may result from inflammation or be developmental conditions. These bands may extend from the intestines to parities, from appendix or tubes, but the small intestine is usually the part involved as the large intestine is more or less fixed. The intestine may be partially caught under a band for a considerable time before symptoms develop and they usually appear suddenly following some strain or exertion. The epiploic appendages or Meckel's diverticulum may produce bands but by far the more common forms are those due to old operation adhesions, appendix or pelvic inflammation'. This is the type that often follows operation and is one of the bad after- results of operations being present in 5.5 per cent according to Klatze and causes 1 to 2 per cent of the deaths following laparotomy.

Appendix: - This small portion of the intestine perhaps causes as much difficulty in the diagnosis of the condition of intestinal obstruction as anything else in the abdominal cavity. It may be attaching its free end to ileum, cecum or other form bands or holes for loops of intestines to drop through. A peculiar case is also cited in the Lancet where an

excessively long appendix had looped itself around the lower ileum producing a complete obstruction. Closely associated with the appendix is which is explained in the Mayo clinic as being due to a short mesentery of the lower ten inches of the ileum and a long mesentery of the cecum.

In following our cases we could not help but notice how frequently this appendix was related more or less, closely with intestinal obstruction either simulating it before removal or intestinal obstruction following its removal either from intestinal paralysis, adhesions or both. Besides a large number of obstructions are either directly or indirectly the result of disease of this organ.

This is frequently seen and is usually due to a slit in the mesentery or omentum. Treves has described a place in the mesentery between the ileo-colic and terminal mesenteric artery which normally is exceedingly thin and often becomes the site of this condition. This is usually brought on by some injury and the bowel is suddenly forced through. Adhesions may form so as to leave holes present or these holes may be congenital. One of our cases was a slit in the omentum following operation through which the bowel passed.

The only thing characteristic of these is that they come on suddenly with violent symptoms similar to incarceration from any cause.

Meckels diverticulum: A congenital condition due to persistence of the omphalo-mesenteric duct present in 2 - 5 per cent of all cases, and

usually found in male patients. Usually found in the last three feet of the small intestine and is 3-10 centimeters long. It may be patulous and open externally or be patulous except for closure at distal extremity and this end be found free in the peritoneal cavity or it may be attached to umbilicus or in rare cases to other organs in the abdominal cavity and produce obstruction. If free it usually adheres to the mesentery but may attach to any other point. A cyst may develop at the proximal end and

produce obstruction also. It also may produce a volvulus, intussusception or produce a stricture.

Besides the congenital diverticula, we have the acquired traction diverticula that may produce obstruction.

These conditions may have certain symptoms to diagnose them from obstruction first, but when obstruction begins it is impossible to tell it from various other kinds, it is much like that due to adhesions, slits, etc.

MECHANICAL OBTURATIVE TYPE.

Tumors of the Intestine;- These of course as elsewhere are divided into benign and malignant; the malignant being by far the most common and of the malignant carcinoma it composes 8 percent of carcinoma of all parts of the body and the large part of the malignant tumors involving the bowel .

It is interesting too, to note that the colon represents 22 per cent sigmoid and rectum 64 per cent, the remaining being in the small intestine.

This can be explained also by the old irritation theory in that feces are solid in the colon and again the short duodenum is involved equally as often as the jejunum and ileum together with their great length. Carcinoma of the intestines is usually primary and single while metastasis from surrounding organs are multiple and therefore give rise to numerous places of stenosis. Males are more often affected, the sigmoid and rectum being involved. The time of occurrence seems to be in younger individuals than carcinoma elsewhere.

Pathology - The carcinoma are usually cylindrical-celled adenocarcinoma arising from the glands, may have cylindrical, cell solid carcinoma less frequently and these are both divided into simple, medullary or scirrhous in type. The cecum, sigmoid and rectum are prone to be involved. The tumor may be oval, or more often encircles the bowel completely and these produce early symptoms of obstruction,

the latter type is usually a scirrhous carcinoma. Medullary carcinoma is found more often in the rectum and spreads rapidly.

The symptoms vary with the location of the growth.

1- Duodenal carcinoma of the duodenum - the first portion is very similar to those of pyloric obstruction only.

2- Carcinoma of second portion of duodenum gives those of (1) and if below papilla of Vater also signs of obstructive jaundice.

3- Carcinoma of ileum and jejunum is the first to simulate intestinal obstruction, but is not noticed so early as the contents here are liquid. The pain is colicky much like that of obstruction. Blood present in the stools and a tumor may or may not be present.

4- Carcinoma of Colon: The pain here is very variable and is more of a sense of discomfort with later localization. Colic intervenes at intermittent periods as the stenosis progresses. Constipation and diarrhoea alternate, the diarrhoea consisting partly of mucus and blood resulting from the ulceration and catarrhal condition. In the later stages constipation partial or absolute results with often fecal impaction and distention occurring. The point we wish to bring out is that with carcinoma of the colon acute intestinal obstruction may occur at any time due to kinking, impaction, paresis above the growth, volvulus or intussusception; and that this obstruction may be either of the acute or chronic type.

The treatment is surgical, symptomatic and regulation of the bowels.

CICATRICES:-

1- Tubercular - this is frequently met with and is explained by the deep ulceration and that the ulcer runs transverse to the long axis of the bowel. Typhoid ulceration rarely leads to this in that they run

longitudinally and are not so deep nor do they produce so much hyperplasia connective tissue .

2- Stercoral ulceration affects principally the large bowel especially the flexures. These also are annular in type.

3- Syphilitic strictures are most common in the rectum and may produce marked constriction.

4- Stricture following sloughing from intussusception and hernias are rare.

5- Congenital stenosis is usually at ano rectal junction, tho may occur any place.

Cicatricial obstruction involves the large bowel usually, at least appears so, but probably seems so because they produce less interference here on account of the contents being fluid in the small intestine. The symptoms are those of chronic stenosis.

FOREIGN BODIES: This condition is of rather rare occurrence and forms only a small per cent of the causes producing obstruction.

1- Gallstones - This is of most frequent occurrence in women and usually finds its way into the intestine by means of a fistulous opening between gall-bladder and intestine, rarely through the common duct. It may lodge any place in the small intestine the most frequent location being the ileocecal valve. It may however, lodge in the large intestine especially if a partial obstruction is already present. It may produce irritation and ulceration or obstruction be relieved by being enclosed in a diverticulum;. The stone may first give rise to symptoms of jaundice, later to partial obstruction and later complete obstruction. If the latter occurs the patient may go to a fatal termination or later the stone may become dislodged and recovery take place.

2- Intestinal Concretions - are very rare.

They consist of salts, masses of bacteria and mucus. Enteritis predisposes and therefore the symptoms of enteritis are followed by those of partial or complete obstruction.

3- Other Foreign Bodies- such as fruit stones, masses of hair, medicinal substances are rare and occur mostly in the large intestine. The obstruction is aided by accumulation of fecal material .

FECAL IMPACTION OR COPROSTASIS. Occurs as the result of long standing constipation and is therefore most common in adult and elderly females.

The cecum and sigmoid flexure are most often involved altho the, transverse colon is often the seat of the trouble. The symptoms are those of chronic constipation with repeated acute attacks of characteristic symptoms of colicky pain, vomiting, distention, absolute constipation lasting from a few days to two weeks. Repeated acute attacks occur until finally the patient may be carried off in one of them if not promptly attended .

On physical examination the abdomen is distended. A nodular mass palpable indurated in places, of doughy consistency in others. On rectal examination solid stools are present. A point of difference also from other forms of obstruction is that more or less toxemia is present here and results in a rigor and rise in temperature as contrasted with the subnormal temperature of other types. The treatment of chronic obstruction is preferable here and will be treated, later.

INTUSSUSCEPTUM - This is perhaps one of the most interesting forms of intestinal obstruction and may be defined as the protrusion or invagination of one part of the intestine into the other. Usually it is the upper into the lower but in the agonal direction. It consists of the intussusception and intussusciens made up of three layers, an outer or ensheathing layer, a middle or returning layer, and an inner or entering layer. The mesentery also enters with the intestine and hence with occlusion of the blood vessels we have ultimately gangrene, necro

is and peritonitis. If less serious adhesions may form and the canal remain patulous or the invaginated portion slough and spontaneous recovery take place.

The etiology is said to be irregular and violent peristalsis due to irritable intestinal contents, polypoid tumors, malignant tumors, severe injuries or blows developmental defects as where the large bowel is unduly large as compared to the small bowel, or abnormally long mesenteries which permit of intestinal prolapse. The latter has been illustrated by Nothnagel who tetanized portions of the bowel which really means contraction of the circular muscles, this allows of a prolapses and this portion is swallowed by the peristaltic contractions of the portion below.

This readily explains why a prolapsed tumor, inverted Meckel's diverticulum, appendix or ileocecal valve can be the initial cause of an intussusception.

There are four chief locations:-

1- The ileocecal is that type where the ileo-cecal valve prolapses into the caecum forming the apex dragging the ileum after it even to the extent of appearing at the anus, This forms 44 per cent

2- The enteric involves the small intestine and forms 50 per cent. Is usually situated in the lower jejunum.

3- The colic form makes up 18 per cent.

4- The ileo colic represents 8 per cent and consists of the ileum prolapsing through the valve, the valve at first holds but later the

valve and cecum follow the ileum and become invaginated

SYMPTOMS:- This is an affection mostly in children occurring 1 - 5 years, more particularly under two years. It usually comes on suddenly with violent cramp-like pain, sometimes localized and paroxysmal at first but rapidly becomes general and continuous. Nausea and vomiting

soon follow, less often fecal in character. In contradistinction to constipation diarrhoea consisting of mucus and blood with marked tenesmus is the rule.

On physical examination little or not distention or tenderness is present. Different authors describe a palpable tumor located at various sites. This is described as a sausage-shaped tumor which varies in location in relation to the upper right rectus. The extension of the bowel through the rectum should always be looked for collapse appears early and fecal vomiting appears sooner or later as in other cases of obstruction.

A less important chronic type occurring in adults is mentioned which terminates usually by an acute attack. The prognosis is to be guarded especially the acute cases. Treatment consists in keeping the patient quiet. Opiates to quiet peristalsis. Inflation of the bowel with air or copious enemata of warm water. If these fail surgical treatment only is left and consists of peeling off the ensheathing portion from the invaginated bowel. This is accomplished in only about half the cases when the only thing left is to resect the bowel providing the patients condition will permit.

VOLVULUS:- This is a condition characterized by a twisting or rotating of the intestine on its mesenteric attachment. It not only interferes with passage of intestinal content but also the circulation sooner or later. The cause is an abnormal long mesentery associated with lateral contraction of the same.

This condition may be present congenitally or may be produced by chronic constipation, adhesions to some portion of the abdominal cavity, protrusion of a coil of intestine through a hernial aperture and lastly the loss of fat in the abdominal wall and mesentery itself predispose.

This condition is usually found in the later adults and aged people because here the predisposing conditions are found. It is usually met with in the sigmoid flexure and consists of a simple rotation.

It may be occasioned by coiling around a pelvic tumor. Another site is the ileo-cecal junction and is produced by a long mesentery of both portions.

Lastly the site may be any place in the small intestine but usually low down where the mesentery is elongated. It may be caught under a band or a foreign body may be the predisposing factor.

The obstruction will be complete or partial depending as to whether the twisting is only partial or complete. In either case the distention appears early, the bowel becomes dark and swollen with ultimate extravasation of serous and bloody fluid into the intestinal lumen as well as into the peritoneal cavity. Gangrene occurs later and peritonitis is not an uncommon occurrence due to the injury.

Symptoms may be subacute, later becoming acute depending on the completeness and suddenness of onset. In volvulus of the sigmoid the colicky pain is followed by absolute constipation or occasionally the opposite condition of diarrhoea, mucous and tenesmus. Vomiting comes on late due to the obstruction being situated low down. The cases situated higher up are prone to develop vomiting earlier.

The prognosis is rather grave. Some cases recover spontaneously and occur more frequently with those cases involving the small intestine. We can plainly see how this could be accomplished from the condition in one of our cases as will be demonstrated in case reports. Surgical treatment is the only safe treatment.

Compression of the Bowel:- This may be produced by pressure of tumors, solid organs or exudate. Sixty percent of the cases are compression of the rectum. The exudates may be localized peritonitis with adhesions or more general conditions as tubercular peritonitis, exudates from malignant tumors, or those in chronic heart and kidney lesions, abscesses and extrauterine pregnancy are included here also. The tumors may be carcinoma or fibroids, the latter springing from the uterus.

Misplaced organs- as the uterus and liver are often the etiological factor producing the condition. The rule is to have a chronic obstruction but the condition may be acute as in one of our cases a sarcoma of the kidney in a child of two years presented primary symptoms of intestinal obstruction with the sarcoma being of secondary importance from the clinical history.

Prognosis:- This depends entirely upon the nature and completeness of the obstruction. The acute obstructions are rapidly fatal unless treated at once and then the per cent of deaths is very high. Nauyrl' reported 75 percent recoveries on those cases operated upon on the first two days and only 35 - 40 per cent recoveries in those cases left until the third day . This shows the importance of early diagnosis and immediate radical treatment. Spontaneous recoveries may take place as in fecal impaction, and occasionally in some of the more acute types as intussusception when sloughing takes place. Kocker says that one-third of the cases will recover spontaneously and this is not so much less than with the more radical treatment .

After following a number of these cases one cannot help but feel that the mortality of 75 percent estimated by one pessimistic author is not far from correct but we do not feel that his next statement that almost the same fatality is present whether one follows medicinal or operative treatments.

So in conclusion we would say make an early diagnosis and even though you cannot predict the condition for certain advise exploratory laparotomy and we feel that the mortality will be greatly lessened.

Treatment;- This portion of our subject alone is sufficiently important to require a long paper to discuss it, so we will only consider it briefly and attempt to bring out grossly those things that you should do and some of the things you should not do in the treatment of intestinal obstruction. In the first place practically all cases of intestinal obstruction require surgical treatment excepting conditions of partial obstruction impacted feces or malignant growths that are beyond

the operative-stage. Here medicinal or conservative treatment is to be employed.

In the chronic forms as fecal impaction, advanced malignant tumors and also acute condition caused from a foreign body the patient should be put at complete rest, diet withheld only small amounts of ice being given per mouth. Although most authors advise against the use of cathartics and enema nevertheless the majority will be found to be using both, perhaps the most effective being small doses of calomel frequently repeated followed by a saline cathartic or an enema consisting of water or oil.

The above treatment is especially good for a preventative measure in the two former conditions but the purgatives should be used cautiously and if complete obstruction occurs operative treatment alone is left and usually consists in an enterostomy for impaction or malignancy or removal in the case of a foreign body.

Acute Obstruction- Here one may say operative treatment is the only one but the general practitioner or even the surgeon first attempts to relieve the obstruction by medicinal means, the most common consisting of the following things

Gastric lavage - Too much cannot be said for this as the nausea and toxic properties of the stomach contents often lead to early prostration of the patient. In the wayo clinic 1910, Page 210, J.W.D.12 Maury J reported 400 cases of experiments on dogs showing that the contents of the duodenum were the most toxic and hence the use of the stomach tube to wash out the stomach and the use of salines eub cutaneously were of considerable importance.

Again gastric lavage just previous to operation is highly important in that it allays the danger from subsequent anesthesia in preventing the stomach contents to be taken into the lungs Some men have even gone so far as to say that this procedure has even brought about an actual

cure. This statement no doubt is a little far fetched although we do consider that stomach lavage is a good plan of treatment.

Enema - These if cautiously used should cause no harm and are valuable in fecal impaction and foreign bodies but should never be used as advised years ago as a means to reduce intussusception or volvulus. Alexius McGlannon in his report in the American Medical Journal of March 8th, 1913, says, "That when a patient suffering from abdominal pain alone, or pain with either vomiting, or constipation, or both, is not permanently relieved by lavage or effectual enemas, immediate operation is indicated." He also reports ten cases that were operated upon immediately this condition appeared with ten recoveries, while out of thirteen other cases that were allowed to progress until other symptoms developed they had three recoveries and ten deaths.

Purgatives - Although these are given largely, it only aggravates the condition and causes the patient more pain and may even do harm. They should by no means be employed unless it be in paresis providing the bowel has had time to rest or in those cases that refuse operation when one may hurry up the symptoms and cause the patient to consent to earlier operation.

Drugs - Opium and atropine are often used to quiet spasm and if judiciously used are of considerable value. It is often absolutely necessary to give opiates to control the intense pain even after operation has been decided upon; however, one should use it only at this time as it masks symptoms and may make the patient feel better when really he is steadily growing worse. Morphine is better in that it allays the pain but does not inhibit the bowel so much.

A great many other things have been suggested in the way of treatment but outside of the judicious use of gastric lavage, purgatives when indicated, enemata, opium and atropine occasionally eserine and turpentine stupes we know of no means that the condition of intestinal obstruction can be improved by and much the less cured excepting by treatment as used by competent surgeons.

Surgical Treatment:-

1. General or local peritonitis:- can be treated properly only by immediate drainage and removal of the cause providing the patients condition will permit. Beware here of the medicinal treatment until sufficient drainage has been established and by no means err on the side of inadequate drainage as some occasionally do. Surgical treatment followed by the medicinal treatment and Murphy method of salines and the Fowler position lower the mortality appreciably.

2- Manipulating Intestine - causing paresis or functional paresis are best treated by fractional doses of calomel, followed by enemas containing turpentine, asafoetida and milk, turpentine stupes, atropine and eserine, with occasional small doses of morphine for the pain. However, these sometimes fail and the more radical treatment by means of enterostomy may be necessary.

3- Embolism of mesenteric Arteries. This can be treated only surgically and then the recoveries are less than 10 per cent. The line of demarcation is often hard to ascertain, therefore resection and immediate anastomosis is unsafe, so resection is done both ends fastened in the wound and allowed to drain for a week when anastomosis may be undertaken.

Moynihan has suggested making a slit in the intestine passing in a glass tube and the intestinal contents "milked out" and the slit closed transversely.

Fecal fistula is only resorted to in desperate cases where the patient is unable to stand further operative work.

4- Strangulated hernia. Here if the bowel is not gangrenous, as shown by the return of color on applying hot towels, the treatment is to reduce the hernia by firm steady pressure. If the condition of the bowel is doubtful the bowel is replaced just inside the abdomen and a large

drainage tube inserted down to it. The bowel is already paralyzed and will remain here and if perforation or gangrene occurs a local inflammation occurs and the feces have a method of escape.

If the gut is gangrenous resection several inches below and above is indicated especially the latter as the toxin and infective power above the point of strangulation are never absolutely known and the bowel may appear in fair condition at the operation only to slough at a later time.

End to end anastomosis is then performed. If the general condition will not permit artificial anus is produced and a Paul's tube tied in position - of course first resetting the gangrenous gut; the anastomosis being done at a later date when the general condition of the patient is improved.

Adhesion consisting of both bands and adhesion proper necessitate careful sponging, cutting and sometimes ligation with careful attention being paid to the covering of denuded areas to prevent further formation.

Recently certain men have advocated the use of large quantities of vaseline in the abdomen following operative work for adhesions. It occasionally happens that the adhesions are so dense as in tubercular peritonitis that it is almost impossible to separate the coils and if this is more or less localized resection and anastomosis is the easier method of treatment

Perhaps the most troublesome forms of adhesions are those following operations for gangrenous appendicitis. With our cases in the past year they were so complete as to produce a complete obstruction and necessitate an enterostomy. Meckel's Diverticulum demands excision and in version of the stump, care being taken not to narrow the lumen of the intestine.

Mesenteric and Omental Slits. These may necessitate enlargement in order to release the intestine. They are then closed by continuous

suture. Intestinal Tumors, whether benign or malignant require early excision. If they are too far advanced before diagnosed the only treatment is that tending towards prevention of fecal impaction, namely as easily digested foods and liberal use of cathartics. Sooner or later, however, these means fail and acute obstruction necessitates the production of an artificial anus. Stricture and Cicatrice - These if single or multiple but closely approximated are best treated by excision of the whole segment. If widely separated each stricture is treated individually.

Again if the general condition of the patient will not permit, short circuiting is operation of choice. Foreign Bodies. If these fail to pass by an obstruction or become lodged are best treated by incising the intestine in the dilated portion and working the foreign body up here as it facilitates the closure and also there is less danger of stenosis later.

Intussusception:- Reduction by means of hydrostatic pressure is not good treatment, excepting to facilitate reduction in those cases that extend well into the colon and then only as a means to aid the operator. Intussusception is reduced by grasping the tumor in one hand and attempting to peel off the ensheathing layer from the upper portion of the bowel. This usually fails due to adhesions and then resection and anastomosis is attempted. This often, fails as the patient usually cannot stand so prolonged operative procedure, so only resection is done, the ends being attached in the wound.

The chronic types of intussusception offer a much more favorable prognosis and is usually treated by excision or lateral anastomosis. Quite often the long mesentery requires plication and this must be done cautiously to avoid disturbance of the blood supply.

Volvulus. If the loop of bowel is greatly distended incision and evacuation may be necessary before uncoiling can be accomplished. The obstruction may be overcome in some cases simply by untwisting the bowel, in other cases this must be followed by fixation of the bowel to the abdominal wall or shortening the mesentery. If these fail, excision is the only procedure left to do.

METHODOLOGY

Study design : RETROSPECTIVE CROSS SECTIONAL STUDY
BASED ON SECONDARY DATA

Study period : 1-month period for each patient with symptomatic abdominal pain admitted between March 2018 to August 2019 (18 months)

Study area : Government Royapettah Hospital, Chennai

Study population:Patients getting admitted in Department of General Surgery at Government Royapettah Hospital with acute abdomen.

Criteria : abdomen girth chart,rising pulse rate, elevated wbc count,multiple air fluid level, nasogastric fecal content

Sample size : 126

This study includes 126 Patients got admitted in Dept of General Surgery at Government Royapettah Hospital with Acute abdominal pain and vomiting. The patients were and are to be chosen randomly, irrespective of gender, age and nature of disease respectively.In all cases, diagnosis was confirmed by Computed Tomography of Abdomen which suggests multiple air fluid levels either after admission or they are previously diagnosed cases.

The patients were followed up for minimum 3 months directly. Patients who did not turn up for follow up were asked to notify the development or re of abdomen pain.Each patient of the sample will be assessed given a score and thoroughly examined to rule out other causes of abdomen pain.

Patients will be asked to measure pulse rate,abdomen girth and monitored every 2hours for variations in pulse rate abdomen girth,

Patients will be inserted nasogastric tube for the content examination and its consistency,taken blood parameters.

SCORING OF VARIOUS PARAMETERS

CRITERIA	SCORE
RISING PULSE RATE	2
ABDOMEN GIRTH CHART	2
ELEVATED WBC COUNT	2
MULTIPLE AIR FLUID LEVELS	2
NASOGASTRIC FECAL CONTENT	2

Once the score is more than 7 patient is thoroughly examined and taken for surgery,if the score is less than 7 the patient is monitored continuously for 5 days.Then the scoring pattern

daily shows less than 7 they can be managed conservatively. In our case study 23 cases mentioned below even score less than 7 are taken up of surgery for retroperitoneal haemorrhage, adhesions and bands.

SYMPTOM SCORE	SURGERY DONE	CONSERVATIVE
MORE THAN 7	84	18
LESS THAN 7	13	11

SENSITIVITY 80.43% A/A+B

SPECIFICITY 65.83% D/C+D

CONFIDENCE INTERVAL 95

RESULTS

Statistical Methods: Retrospective case control study is employed with a confidence interval of

95% sensitivity, specificity and positive predictive value of the study were assessed.

Statistical software

The Statistical software namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables, etc.

The incidence of acute intestinal obstruction in adult age group was studied from the cases admitted in Department of Surgery of Government Royapettah Hospital attached to the Kilpauk Medical College, Chennai. The data regarding the symptoms and signs and laboratory investigations has been adopted in 126 cases during the study period.

AGE INCIDENCE

Age (years)	MALE	FEMALE	Total
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11 TO 20	10	3	13
21 TO 30	12	3	15
31 TO 40	14	4	18
41 TO 50	13	6	19
51 TO 60	16	11	27
61 TO 70	13	2	15
71 TO 80	11	3	14
81 TO 90	2	3	5
Total	91	35	126

As per the TABLE maximum seen in the people of 51-60 years around 27 cases.

SEX INCIDENCE

Sex	Number of cases	Percentage
male	91	72.22
female	35	27.78
	126	100

Male patients were more commonly affected when compared to females in the ratio of 4:1 in the above table

Symptoms and signs

Symptoms and signs	Number of cases	Percentage
Pain abdomen	44	87

Vomiting	39	78
Distension	33	69
Constipation	28	55
Tachycardia	41	84
Previous surgical scar	21	44
Tenderness	19	39
Rigidity	18	38
Mass	38	69
Visible peristalsis	30	60

The present study the most common symptoms were pain abdomen (88%) and vomiting (78%), and the most common signs were tachycardia (80%) and visible intestinal peristalsis (60%)

INCIDENCE OF DIFFERENT AETIOLOGY

The incidence of different etiologies of intestinal obstruction in the present series are as follows.

Causes of intestinal obstruction in adults

Clinical condition	Number of cases	Percentage
Postoperative	58	46.03

adhesions		
Obstructed hernia	32	25.39
Volvulus	2	1.58
TB abdomen	7	5.57
Malignancy	21	16.67
Intussusception	3	2.38
Mesenteric ischaemia	3	2.38

Total

126

100

The most common cause of intestinal obstruction in our study was postoperative adhesions. The next common was obstructed hernia. Other conditions include volvulus, intussusception, tuberculosis, malignancy, mesenteric ischaemia, in descending frequency.

POST OP COMPLICATIONS:

In this study post op complications noted in 9 cases

Follow-up status

Follow-up Complications month	Follow-up		
	One month	3rd month	6th
A. Wound infection	1	Nil	Nil
B. Septicemia	2	1	Nil
C. Enterocutaneous fistula	Nil	Nil	Nil
D. Prolonged ileus	Nil	Nil	Nil
E. Fever	2	1	Nil
F. Respiratory infection	1	1	Nil
G. Death	Nil	Nil	Nil

In the present study group there were 3 cases of septicemia, 2 cases of respiratory tract infection, 3 cases of fever and 1 cases of wound infection.

S.no	NAME	AGE	SEX	SCORE	DIAGNOSIS	TREATMENT
1	Ramaswamy	43	M	8	Postoperative adhesions	R & A
2	Navaneethan	28	M	8	Postoperative adhesions	CON
3	Velswamy	86	M	8	Postoperative adhesions	R & A
4	Rathinam	68	F	8	Postoperative	R & A

					adhesions	
5	Muniyama	83	F	6	Postoperative adhesions	R & A
6	Velama	54	F	8	Postoperative adhesions	R & A
7	Revathy	41	F	8	Postoperative adhesions	R & A
8	Ramesh	38	M	8	Postoperative adhesions	R & A
9	Suresh	39	M	8	Postoperative adhesions	AD REL
10	Vignesh	29	M	6	Postoperative adhesions	CON
11	Balaji	38	M	8	Postoperative adhesions	AD REL
12	Sornam	43	F	8	Postoperative adhesions	AD REL
13	Vimal	38	M	8	Postoperative adhesions	AD REL
14	Kamal	52	M	8	Postoperative adhesions	R & A
15	Vijay	48	M	8	Postoperative adhesions	CON
16	Vikram	51	M	6	Postoperative adhesions	R & A
17	Ajith kumar	48	M	8	Postoperative adhesions	R & A
18	Vishal	41	M	8	Postoperative adhesions	R & A
19	Vaiyapuri	48	M	8	Postoperative adhesions	R & A
20	Vivek	53	M	6	Postoperative adhesions	R & A
21	Geetha	28	F	8	Postoperative adhesions	R & A

22	Seetha	39	F	8	Postoperative adhesions	AD REL
23	Vani	21	F	8	Postoperative adhesions	CON
24	Rani	29	F	8	Postoperative adhesions	AD REL
25	Kokila	34	F	6	Postoperative adhesions	AD REL
26	Keerthana	32	F	8	Postoperative adhesions	AD REL
27	Ajay	35	M	8	Postoperative adhesions	R & A
28	Blesson	42	M	8	Postoperative adhesions	CON
29	Vipin	49	M	8	Postoperative adhesions	R & A
30	Raj	51	M	6	Postoperative adhesions	R & A
31	Rajesh	35	M	8	Postoperative adhesions	R & A
32	samundeswar i	65	F	8	Postoperative adhesions	R & A
33	Lalitha	58	F	8	Postoperative adhesions	R & A
34	Vijaya	81	F	8	Postoperative adhesions	R & A
35	Murugan	80	M	6	Postoperative adhesions	AD REL
36	Saravanan	81	M	8	Postoperative adhesions	CON
37	Shanmugam	68	M	8	Postoperative adhesions	AD REL
38	Ayyapan	81	M	8	Postoperative adhesions	AD REL
39	Thirumal	49	M	8	Postoperative adhesions	AD REL

40	Natarajan	54	M	6	Postoperative adhesions	R & A
41	Chidambaram	31	M	8	Postoperative adhesions	AD REL
42	Palani	32	M	8	Postoperative adhesions	R & A
43	Kannagi	84	F	8	Postoperative adhesions	AD REL
44	Meenatchi	82	F	8	Postoperative adhesions	AD REL
45	Muthu	55	M	6	Postoperative adhesions	AD REL
46	Saraswathy	51	F	8	Postoperative adhesions	R & A
47	Bala	35	M	8	Postoperative adhesions	R & A
48	Chellamal	85	F	8	Postoperative adhesions	R & A
49	Mariyapan	64	M	8	Postoperative adhesions	AD REL
50	Soundappan	88	M	6	Postoperative adhesions	CON
51	Sheela	25	F	8	Postoperative adhesions	AD REL
52	Mary	48	F	8	Postoperative adhesions	CON
53	Kani	28	F	8	Postoperative adhesions	AD REL
54	Yazmozhi	41	F	8	Postoperative adhesions	AD REL
55	Indran	39	M	6	Postoperative adhesions	AD REL
56	Subramani	68	M	8	Postoperative adhesions	CON
57	Anusha	26	F	8	Postoperative adhesions	R & A

58	Vedhamal	80	M	8	Postoperative adhesions	CON
59	Zakir Hussain	54	M	8	Obstructed hernia	R & A
60	Ibrahim	36	M	6	Obstructed hernia	MESH
61	Nancy	24	F	8	Obstructed hernia	OMEN+ MESH
62	Jerin evangelin	38	F	8	Obstructed hernia	ANA
63	Aravindh	48	M	8	Obstructed hernia	R & A
64	Dhanvanth	42	M	8	Obstructed hernia	MESH
65	Sridhar	30	M	6	Obstructed hernia	OMEN+ MESH
66	Naresh	38	M	8	Obstructed hernia	ANA
67	Gopi	48	M	8	Obstructed hernia	R & A
68	Arjun	55	M	8	Obstructed hernia	MESH
69	Ritesh	51	M	8	Obstructed hernia	OMEN+ MESH
70	Sekar	39	M	6	Obstructed hernia	ANA
71	Chandramouli	48	M	8	Obstructed hernia	R & A
72	Mohan	58	M	8	Obstructed hernia	MESH
73	Srinivasalu	65	M	8	Intussusception	OMEN+ MESH
74	Venkatesh	58	M	8	Obstructed hernia	ANA
75	Mamallan	23	M	6	Obstructed hernia	CON
76	Naveen	29	M	8	Obstructed hernia	MESH
77	Karthi	34	M	8	Obstructed hernia	OMEN+ MESH
78	Gunasekaran	38	M	8	Obstructed hernia	ANA
79	Priya	41	F	8	Obstructed hernia	R & A
80	Priyanka	29	F	6	Obstructed hernia	MESH
81	Sandeep	39	M	8	Obstructed hernia	OMEN+ MESH

82	Samyuktha	38	F	8	Obstructed hernia	ANA
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83	Selvakumar	48	M	8	Obstructed hernia	R & A
84	Chandhini	45	F	8	Obstructed hernia	MESH
85	Ekamabaram	64	M	6	Obstructed hernia	OMEN+ MESH
86	Puttamal	58	F	8	Obstructed hernia	R & A
87	Madaiah	55	M	8	Obstructed hernia	MESH
88	Suseela	59	F	8	Obstructed hernia	OMEN+ MESH
89	Rahman	39	M	8	Obstructed hernia	ANA
90	Raghuram	39	M	6	Obstructed hernia	CON
91	Ramkumar	41	M	8	Malignancy SB	R & A
92	Govindasamy	48	M	8	Malignancy LB	CLEARANCE
93	Bhagyalakshmi	43	F	8	Malignancy LB	OSTOMY
94	Kalpana	44	F	8	Malignancy LB	CLEARANCE
95	Nagaraju	69	M	6	Malignancy SB	R & A
96	Yeesappa	65	M	8	Malignancy SB	R & A
97	Sudhakar	49	M	8	Malignancy LB	OSTOMY
98	Dhanalakshmi	48	F	8	Malignancy LB	OSTOMY
99	Kanchanama l	32	F	8	Malignancy LB	OSTOMY
100	Manjula	31	F	6	Malignancy SB	R & A
101	Pratap	38	M	8	Malignancy SB	R & A
102	Kamalammal	88	F	8	Malignancy LB	CLEARANCE
103	Ettappan	36	M	8	Malignancy LB	R & A

104	Idumban	28	M	8	Malignancy LB	OSTOMY
105	Somasundram	29	M	6	Malignancy SB	OSTOMY
106	Mani	34	M	8	Malignancy SB	OSTOMY
107	Venkataiah	43	M	8	Malignancy LB	R & A
108	Nawaz khan	38	M	8	Malignancy LB	R & A
109	Rathinamari	88	F	8	Malignancy LB	CLEARANCE
110	Suriyan	48	M	6	Malignancy SB	R & A
111	Amsavalli	65	F	8	Malignancy CX	TAH BSO
112	Chittan	52	M	8	MILIARY TB	CONS
113	Ammavasai	84	F	8	ILEOCAECAL TB	DRUGS
114	Nagendra reddy	49	M	8	STRICTURE SB	R & A
115	Royappan	61	M	6	MILIARY TB	CONS
116	Vincent raj	83	M	8	MILIARY TB	CONS
117	Anthony	64	M	8	ILEOCAECAL TB	DRUGS
118	Sagaya mary	49	F	6	ILEOCAECAL TB	DRUGS
119	Lingesan	55	M	8	VOLVULUS	R& A
120	kumar	39	M	8	POSTOPERATIVE ADHESIONS	AD RELE
121	Madhavan	36	M	6	ILEOCAECAL TB	DRUGS
122	Shanthi devi	44	F	8	MALIGNANCY SB	R & A
123	sadayappan	66	M	8	OBSTRUCTED HERNIA	MESH
124	ayarammal	82	F	8	RECTOSIGMOID GROWTH	CLEARANCE
125	keshavanthi	24	F	6	ILEOCAECAL TB	DRUGS
126	basavammal	63	F	8	OBSTRUCED HERNIA	MESH

ABBREVIATIONS

R & A- RESECTION ANASTOMOSIS

CON - CONSERVATIVE MANAGEMENT

ANA - ANASTOMOSIS

DISCUSSION

Acute intestinal obstruction continues to be the most common surgical emergency. In our study a total number of 12233 patients were admitted in the surgery department during that time period. Among these 126 cases of operated cases were randomly selected for the present study. The commonest cause was found to be postoperative adhesions followed by obstructed/ strangulated inguinal hernia, malignancy, intussusception, volvulus, tuberculosis and mesenteric ischaemia. Although in developing countries like India, the commonest cause used to be obstructed/strangulated hernia, in our

study commonest cause was adhesions followed by obstructed/strangulated hernia as second cause. The decrease in the incidence of obstructed hernias indicate a changing trend towards early operation before hernia gets complicated.

Intestinal obstruction although occurs in all age groups, the age spectrum in our clinical study, with the spectrum age group of 15 years to 85 years. The study showed the peak incidence is in the age group 51-60 of 40% which is comparable with the previous study groups Souvik Adhikari et al., Cole GJ et al. group, which are almost similar to our clinical study of intestinal obstruction.

Etiology

The cause of intestinal obstruction differs from different geographical locations. In the present clinical study about 76% of the patients were poor socioeconomic class and remaining 24% were middle class which does not yield much statistical significance. But our hospital being a government hospital, which is serving most of the poor socio-economic status hence the percentage of poor socio-economic status are high. The diet pattern in this study showed 64% non-vegetarians and 36% were vegetarians which did not indicate any significance in relation to the disease.

In the present study of 126 cases of acute intestinal obstruction 40% of the cases are due to post operative adhesions who has undergone previous surgeries.

In the present study, postoperative adhesion is the commonest cause of intestinal obstruction, which is comparable with the other study groups Playforth et al. Although the incidence of obstructed/strangulated hernia is more in the developing countries in this study group it is the second common aetiology for obstruction. It may be because the awareness of public, the availability of surgical facilities in the periphery for the hernia repair, the hernias are treated early.

Clinical features

The clinical feature of intestinal obstruction pain abdomen, vomiting distension of abdomen and constipation are not present in all cases. Pain abdomen was present in 88% of the cases in the present study, whereas vomiting was present in 78% of the cases. Whereas distension was present in 66% and constipation was present in 54% of the cases. The comparative table showing percentage of clinical features by various other study groups are as follows.

The mass per abdomen on palpation is present in 24% of the total study group in Malignancy and ileocaecal tuberculosis. Visible peristalsis is present in 60% of the intestinal obstruction cases. The rectal examination did not reveal any abnormality except in four cases of intussusception (8%) and 2 cases of malignancy (4%) where in red current Jelly and rectal growth were the per rectal findings respectively.

CONCLUSION

Acute intestinal obstruction remains an important surgical emergency in the surgical field.

- Success in the treatment of acute intestinal obstruction depends largely upon early diagnosis skilful management and treating the pathological effects of the obstruction just as much as the cause itself.
- Erect abdomen X-ray is valuable investigation in the diagnosis of acute intestinal obstruction.
- Postoperative adhesions are the common cause to produce intestinal obstruction. Clinical radiological and operative findings put together can diagnose the intestinal obstruction.

- Mortality is still significantly high in acute intestinal obstruction. Acute intestinal obstruction remains an important surgical emergency in the surgical field.
- SCORE of more than 7 requires immediate surgery whereas 7 or less than 7 requires constant monitoring ,thorough analysis of pathology and complete extended procedure with margin free as in case of tumor of large bowel instead placing ostomy as in emergency procedure.
- Score of less than most probably requires conservative line of treatment mostly but monitor vitals,if any increase in score noted planned for surgery at the earliest.

Summary

The dissertation titled “A RETROSPECTIVE STUDY OF SCORING IN ACUTE BOWEL OBSTRUCTION - TIMING OF SURGERY” is done in two parts.

In the part-1, review of literature, embryology, anatomy, physiology, pathology, clinical features, investigations and management of different conditions were discussed.

In the part-2, materials and method followed in the above study, proforma of study, master chart, analysis of data regarding incidence, symptoms and signs, investigations and treatment and comparative study with discussion has been done.

The study group consisted of 126 cases of acute intestinal obstruction in the adult age group from 12 years on wards to 85 years in the Department of Surgery, Government Royapettah Hospital, Chennai.

The commonest cause of intestinal obstruction in the adults in this study series was postoperative Adhesions (40%) followed by obstructed Hernia (30%). The clinical features of pain abdomen, vomiting, constipation were the main symptoms in this study. Tenderness, guarding, rigidity, rebound tenderness and shock are the cardinal feature of strangulated obstruction.

The most common type of obstruction was due to adhesions or band arising from the previous surgeries. This constituted about 40% of the cases of the study group. In these cases conservative management was initially planned surgery was performed as there was no significant improvement in the general condition of the patients.

The second most common type of intestinal obstruction was due to obstructedstrangulated external hernia. Salient features were pain in the groin lump, acute onset of swelling which is tender, irreducible and absence of cough impulse. Obstructed hernia constituted about 30% of the total cases studied. Volvulus of the sigmoid was 4% in this series. Conservative measures included insertion of flatus tube but all the cases were undergone laparotomy due to failure in the recovery of symptoms. Derotation and sigmoidopexy was done in one case and in one case where there was vascular compromise, resection and anastomosis was done.

Malignancy of the large bowel was seen in 7 cases constituting 14% of cases. 35% of the cases diagnosed as malignancy were in the age group 35-75 years. Of these 2 cases were managed with Hartman's procedure. One case was managed with transverse loop colostomy and remaining cases were managed with resection and anastomosis. Most of the deaths occurred in malignancy.

Although pulmonary tuberculosis more prevalent in India due to advent use of antitubercular drugs incidence of abdominal

tuberculosis is becoming less. In our study incidence of ileocaecal tuberculosis was 4% and both were managed with resection and anastomosis. In the present study intussusception causing intestinal obstruction was 6%.

One case was managed with simple reduction and the remaining two were undergone resection and anastomosis. One case of mesenteric ischaemia was present in our study. The case was managed with resection and anastomosis but patient died due to septicemia.

Overall mortality of this study was 14%. The result obtained from this study was comparable to various other studies. Malignancy and mesenteric ischaemia had more mortality outcomes than simple obstruction caused by postoperative adhesions. The poor outcome of the disease were due to late presentation to the hospital which had high incidence of bowel damage with associated faecal contamination of the peritoneum. The mortality in the postoperative period was mainly due to faecal peritonitis, bronchopneumonia and respiratory tract infection.

Bibliography

.Elhardello OA, MacFie J. Digital rectal examination in patients with acute abdominal pain. *Emerg Med J.* 2018 Sep;35(9):579-580.

.Maleki Verki M, Motamed H. Rectus Muscle Hematoma as a Rare Differential Diagnosis of Acute Abdomen; a Case Report. *Emerg (Tehran).* 2018;6(1):e28.

.Kaushal-Deep SM, Anees A, Khan S, Khan MA, Lodhi M. Primary cecal pathologies presenting as acute abdomen and critical appraisal of their current management strategies in emergency settings with review of literature. *Int J Crit Illn Inj Sci.* 2018 Apr-Jun;8(2):90-99.

.Li PH, Tee YS, Fu CY, Liao CH, Wang SY, Hsu YP, Yeh CN, Wu EH. The Role of Noncontrast CT in the Evaluation of Surgical Abdomen Patients. *Am Surg.* 2018 Jun 01;84(6):1015-1021.

.de Burlet K, Lam A, Larsen P, Dennett E. Acute abdominal pain-changes in the way we assess it over a decade. *N. Z. Med. J.* 2017 Oct 06;130(1463):39-44.

.Bhosale PR, Javitt MC, Atri M, Harris RD, Kang SK, Meyer BJ, Pandharipande PV, Reinhold C, Salazar GM, Shipp TD, Simpson L, Sussman BL, Uyeda J, Wall DJ, Zelop CM, Glanc P. ACR Appropriateness Criteria® Acute Pelvic Pain in the Reproductive Age Group. *Ultrasound Q.* 2016 Jun;32(2):108-15.

.Nakashima T, Miyamoto K, Shimokawa T, Kato S, Hayakawa M. The Association Between Sequential Organ Failure Assessment Scores and Mortality in Patients With Sepsis During the First Week: The JSEPTIC DIC Study. *J Intensive Care Med.* 2018 Jan 01;:885066618775959.

.Pucher PH, Carter NC, Knight BC, Toh S, Tucker V, Mercer SJ. Impact of laparoscopic approach in emergency major abdominal surgery: single-centre analysis of 748 consecutive cases. *Ann R Coll Surg Engl.* 2018 Apr;100(4):279-284.

.Geng WZM, Fuller M, Osborne B, Thoires K. The value of the erect abdominal radiograph for the diagnosis of mechanical cause of pain

. Scott G Houghton, Antonio Ramos De la Medina, Michael G Sarr. *Bowel*

obstruction. 11th ed. Chapter 17. In: *Maingot's Abdominal operations*, Michael J Zinner, Stanley W Ashley, eds. New York: McGraw-Hill Medical; 2007. pp. 479-505.

.Haridimos Markogiannakis, Evangelos Messaris, Dimitrios Dardamanis, Nikolaos Pararas, Dimitries Tzerzemelis, Panagiotis Giannopoulos, et al. Acute mechanical obstruction: Clinical

presentation, aetiology, management and outcome. *World J Gastroenterol* 2007 Jan;13(3):432-7.

.Owen H.Wangensteen. Historical aspect .of the management of the acute intestinal obstruction. *Surgery* 1969;63:363-83.

. Kloiber H. Die. Roentgen diagnose Des Ileus Ohne Koutrastmittel. *Arch F Klin Chir* 1919;112:513.

. Akgun y. Mesosigmoidoplasty as a definitive operation in treatment of acute sigmoid volvulus. *Dis Colon Rectum* 1990;39:579-81.

. Decker GAG, du Plessis DJ. The duodenum, jejunum and ileum. 12th ed. Chapter 4. In: Lee McGregor's *Synopsis of Surgical Anatomy*. Bombay: Wright Verghese; 1986. p. 30.

. Richard L Drake, Wayne Vogl A, Adam WM Mitchell. Abdomen. 2nd ed. Chapter 4. In: *Gray's Anatomy for students*. Philadelphia: Churchill Livingstone Elsevier; 2010. p. 30

William F Ganong. Regulation of gastrointestinal function. 19th ed. Chapter 26. In: *Review of medical physiology*. Philadelphia, USA: Appleton and Lance; 1999. p. 483.

. Robert M Berne. Gastrointestinal regulation and motility. 5th ed. Chapter 31. In: *Physiology*, Robert M Berne, Mathew N Levy, Bruce M Koeppen, Bruce A Stanton, eds. Mosby Publication; 2008. p. 539.

. Edwin A Deitch, William M Bridges, Jing Wen Ma, Li Ma, Rodney D Berg, Robert D Specian. Obstructed intestine as a reservoir for systemic infection. *The American Journal of Surgery* 1990 Apr;159(4):394-401.

. Norman S Williams, Christopher JK Bulstrode, Ronan P O'Connell. Intestinal obstruction. 25th ed. Chapter 66. In: *Bailey and Love's Short practice of surgery*.

London: Hodder Arnold; 2008. pp. 1188-203. . El-Amin LC, Levine MS, Rubesin SE, Shah JN, Kochman ML, Laufer I. Ileocal valve: Spectrum of normal findings at double-contrast barium enema examination.

. Soo Y Kim, Jon B Morris. Small bowel obstruction. 6th ed. Chapter 68. In:

Shackel Ford's Surgery of the alimentary tract, Charles J Yeo, ed. Philadelphia:

Saunders Elsevier; 2007. pp. 1025-33.

. Norman L Browse. The abdomen. 4th ed. Chapter 15. In: Brown's Introduction to the symptoms and signs of surgical disease. USA: Book Power; 2005. p. 413.

. Maglinte DD, Heitkamp DE, Howard TJ. Current concepts in imaging of small bowel obstruction. Radiol Clin N Am 2003;41:263. Small intestine. In: Schwartz's Principles of surgery, Brunicki, Dana K Anderson, Timothy R Billiar, David L Dunn, John G Hunter, Jeffrey B Mathews, et al. New York: McGraw-Hill Publication; 2010. pp. 980-1011.

. Hayanga AJ, Bass-Wilkins K, Bulkley GB. Current management of small bowel obstruction. Adv Surg 2005;39:1-33. Jack R Pickleman, Josef E Fischer. Small and large bowel obstruction. 5th ed.. In: Mastery of surgery, Josef E Fishcer, Kirby I Bland. Boston: Lipincott Williams & Wilkins; 2009. pp. 1380-7.

. Wilson MS, Ellis E, Menzies D, Moran BJ, Parker MC, Thompson JN. A review of the management of small bowel obstruction. Ann R Coll Surg Engl 1999; 81:320-8.

. Donald Menzies, Michael Parker, Rosemary Hoare, Alastair Knight. Small bowel obstruction due to postoperative adhesions: treatment patterns and associated costs in 110 hospital admissions. Ann R Coll Surg Engl 2001;83:40-6.

. Francisco Lopez Kostner, Graham R Hool, Ian C Lavery. Management of causes of acute large bowel obstruction. Surg Clin N Am 1997 Dec;60-77.

- Distension
- Bowel habits
- H/o passing blood in stools
- H/o fever
- H/o Jaundice

Past History

- H/o tuberculosis
- H/o any surgeries
- H/o passing worms blood in stools
- H/o altered bowel habit

Personal History

- Micturation
- Bowel habits
- Sleep
- Weight loss
- Appetite
- Smoker
- Alcoholic

Menstrual History (females)

Obstetric History (females)

Family History

General Physical Examination

Vital Signs

- Pallor:
 - Cyanosis:
 - Clubbing:
 - Jaundice:
 - Edema:
- Pulse:
Blood pressure:
Respiratory rate:
Temperature:

- LN:

Inspections

- Shape: Distension:
- Respiratory movements of each region:
- Peristaltic movements:
- Position of umbilicus:
- Scars:
- Any skin changes:
- Any mass:
- Hernial sites
- Renal angles:
- Supraclavicular fossa:

Palpation

- Cutaneous hyperaesthesia:
- Tenderness:
- Rebound tenderness:
- Muscular rigidity:
- Palpable coils of intestine:
- Is caecum palpable:
- Palpation of hernial orifice:
- Any mass palpable:
- Supraclavicular fossa:
- Testes:

Percussion

Auscultation

Per rectal

Per vaginal

Cardiovascular system

Respiratory system

Central nervous system

Investigation

Blood

Hb% TC: DC: BT: CT:

ESR Urea: RBS: Blood grouping and Rh typing:

Urine: Sugar: Albumin: Microscopy:

ECG:

X-ray: X-ray of the chest

X-ray of the abdomen (Erect):

Preoperative Diagnosis

Treatment

Preoperative treatment

Hourly

Pulse

Blood pressure

Temperature

Respiratory rate

IV fluids

Ryles tube

Urine Output

Abdominal girth

Blood transfusion:

Drugs:

Operative management

Anaesthesia:

Incision:

Gross appearance: Peritoneum

Colour:

Small bowel:

Perforation:

Colour

Large bowel: Gangrene:

Perforation:

Gangrene:

Pathology note

Surgical procedures

Postoperative treatment

Days

Pulse

Blood pressure

Temperature

Respiratory rate

Blood transfusion

IV fluids

Ryles tube

Urine output

Drain

Drugs

Postoperative complications

Histopathological report of the specimen

Condition at the time of discharge

Advice on discharge

Follow-up for any complaints

Remarks

