

CLINICAL STUDY ON SURGICAL MANAGEMENT OF SIGMOID VOLVULUS

Dissertation submitted to

The TamilNadu Dr.M.G.R. Medical University, Chennai.

With fulfillment of the regulations for the award of the degree of

**MASTER OF SURGERY (GENERAL SURGERY)
Branch – I**



**DEPARTMENT OF GENERAL SURGERY
MADURAI MEDICAL COLLEGE
MADURAI – 620 020.**

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Certified that this dissertation is the bonafide work of ***Dr.J.KIRAN KUMAR*** on ***CLINICAL STUDY ON SURGICAL MANAGEMENT OF SIGMOID VOLVULUS*** during his ***M.S. (General Surgery)*** course from JUNE 2010 to APRIL 2013 at ***THE GOVERNMENT RAJAJI HOSPITAL AND MADURAI MEDICAL COLLEGE, MADURAI.***

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DECLARATION

I, Dr. J. Kiran Kumar solemnly declare that the dissertation titled “**A clinical study on surgical management of sigmoid volvulus**” has been prepared by me. This is submitted to the **Tamil Nadu Dr.M.G.R. Medical university, Chennai** in partial fulfilment of the regulations for the award of MS degree (Branch1) General Surgery.

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Place : Madurai.

Date :

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INTRODUCTION

“If he doesn’t evacuate for a twist in the bowel and the phlegm does not find a way out then it shall rot in the belly”-EBERS PAPYRUS. History of sigmoid volvulus dates back to 1500 BC, in which EBERS PAPYRUS ,one of the oldest preserved medical literature explains about this condition. Sigmoid volvulus (SV), which was described by von Rokitansky in 1836, has apparently increased in frequency during the past several decades. Sigmoid volvulus is a surgical emergency and significant cause of large bowel obstruction with mortality and morbidity. The disease is more prevelant in volvulus belt - includes middle east, Africa, India, Turkey and South America. Sigmoid colon volvulus, defined as an abnormal twisting of the sigmoid colon around its mesentery, is an infrequent cause of colonic obstruction. Volvulus of the sigmoid colon is a common cause of intestinal obstruction in Eastern Europe, Russia, Africa, India, and Iran. Typically, an elderly patient presents with constipation, abdominal pain, and distension of sudden onset. This classical clinical picture together with plain radiographs is usually sufficient to diagnose the condition. Diagnostic difficulties, however, are not uncommon. A recent report from Finland, where the disease is endemic, confirms the problem of poor diagnostic accuracy.

The mean age of sigmoid volvulus patients was 49 years (range 19-75) and male to female ratio was 1:1. In elderly patients, the common aetiology includes malignant obstruction, ischaemia, hernial incarceration, adhesions and rarely, volvulus. In many instances, the aetiology and level of obstruction can be identified radiologically. When a dilated loop of bowel is seen, clinicians have to identify the level of obstruction, the loop of dilated bowel proximal to it, as well as the undilated bowel distal to it. An abdominal radiograph is usually sufficient for diagnosing the level of bowel obstruction.

Although surgical exploration itself is an accepted mode for diagnosing acute abdomen, accurate pre-operative diagnosis will reduce the morbidity and mortality. Delay in diagnosis and treatment may lead to sigmoid ischaemia, infarction, peritonitis, and septicaemia, resulting in mortality of upto 60%.

In most instances, decompression can be done non operatively with insertion of a rectal tube, or performing flexible sigmoidoscopy.

However, sigmoidoscopy should not be performed in patients who have developed clinical evidence of bowel gangrene (such as those with sepsis, fever, or peritonitis). Emergency Laparotomy and resection with or without primary anastomosis is indicated when non-operative methods fail, or when there is evidence of strangulation, infarction, or perforation. Post-operative mortality ranges from 6% to 60%. Factors associated with poor

prognosis include advanced age, delay in diagnosis, presence of intestinal infarction, peritonitis, and shock at presentation.

This study involves the clinical course and manifestations of sigmoid volvulus, and the various methods of treatment in reducing the mortality rate in patients admitted in Govt Rajaji Hospital, Madurai during with period of October 2010 to November 2012.

OBJECTIVES

- To study the clinical course and manifestations of sigmoid volvulus.
- To study the various methods of treatment of sigmoid volvulus.
- To study the outcome of the disease by employing various methods of treatment.

REVIEW OF LITERATURE

Historical Aspects

Incidence of intestinal obstruction dates back as early as Hippocrates(460 BC) and Galen. Hippocrates coined the term ileus and Sushruta coined the term udra for abdominal catastrophes. Aambrose pare(1590) found the intestinal rotation as separate pathological entity. Rennie JA studied 57 patients with sigmoid volvulus in North India. He concluded that gangreneous colon treatment was resection and primary anastomosis and colopexy for nongangreneous bowel J.J shepherd⁹⁸ did a review of 425 cases of sigmoid volvulus. He concluded that in Mulago hospital conservative management as described by Brusgaard as initial management of choice and failure of intubation by sigmoidoscopy is indication for laparotomy. Ballantyne GH et al¹¹ studied between 1960 and 1980. 43% patients had sigmoid volvulus. Colonoscopic decompression tried in 21% of patients. Total mortality for all forms of volvulus was 17%.Suleyman⁹⁶ studied the patients of acute sigmoid volovulus. He studied 42 patients with PRA and 36 patients with HP. They were followed up to 7 years. Restoration of bowel continuity done in 2 of 36 patients. No recurrence were noted. He concluded sigmoidectomy with primary anastomosis is definitive management of sigmoid volvulus.

Percutaneous deflation for acute sigmoid volvulus was described by Salim AS(1990). It avoided the emergency surgery and high mortality rate. He also introduced colopexy by banding, a simple procedure instead of mesenteropexy and resectional surgery. Among y et al (1992) reported a case of intermittent sigmoid volvulus with secretory diarrhoea and hypokalemia. The patient was treated with somatostatin analogue and later surgical resection of redundant sigmoid.

Subrahmanyam M (1992)¹⁸ studied 126 patients of sigmoid volvulus who was treated with mesosigmoidoplasty. He included only non gangrenous bowel in his study. All patients were allowed for non operative management by proctoscopy and passage of rectal tube. Reduction was achieved in 38% following which mesosigmoidoplasty done electively later.62% patients undergone emergency mesosigmoidoplasty. It is the safe procedure with low mortality and morbidity rates.

Diaz plasencia et al (1993)¹⁹ studied a retrospective analysis of sigmoid volvulus in 123 patients. The main aim of the study was to identify prognostic value of operative mortality. He found that hypotension and presence of purulent or fecaloid peritoneal fluid or macroscopic bowel perforation were predictive factors for post operative mortality in gangreneous sigmoid colon. Age greater than 40 ,mean arterial pressure lower than 70 mmhg, and gangreneous bowel with perforation are associated with increased mortality.

Diaz Plasencia J Rebaza Iparragurrie H(1993)²⁰ studied retrospective analysis of 50 gangrenous colonic volvulus. Severity of gangrenous colon by volvulus –the score for predicting postoperative mortality has been designed. S.S.G.C greater than 4 has significant mortality.

Bhatnagar BN et al (2004) studied sigmoid volvulus in Indian population. The aim is to identify risk factors and various pattern of gangrene. Age greater than 60 ,shock on admission and previous history of volvulus are significant risk factors .Raveenthiran V (2004) studied 93 patients with sigmoid volvulus in India. He divided into two groups. Group A – vomiting preceded the abdominal symptom and group B vomiting after abdominal symptom. Circulatory shock, haemorrhagic shock and colonic gangrene were higher in group A patients. Safioleas M(2007)⁹³ studied sigmoid volvulus in elderly patients of 33 cases. He reported mortality rate of 5.9% in elective operation and 40% in in emergency operations .He introduced the procedure of sigmoidectomy, primary anastomosis and diverting stoma in emergency procedure.

El Bushra Ahmed Doumi(2007)⁹¹ studied 22 patients with acute sigmoid volvulus. Mean age is 59.7 years. He found viable colon in 72.7% patients and derotation fixing was done in all cases.27.3% bowel was gangreneous and resection anastomosis was done in all cases. G.Jumbi (2008)⁹⁵ studied the mortality and morbidity and duration of hospital stay of sigmoid volvulus in the year 2000 to 2005.They found 14.1% of sigmoid

volvulus in all cases of intestinal obstruction and 80% of all large gut obstruction. Mortality rate was 3.3% and morbidity is 21.7%. Mean duration of stay was 11.8 days. Inadequate post operative intra venous therapy affects the outcome of disease.

Akhtar Munir (2009)⁹² done a prospective study from July 2004 to 2008. 39 cases were studied. Of 37 patients 11 had mesosigmoidoplasty on elective list and 26 had emergency mesosigmoidoplasty. He concluded mesosigmoidoplasty is a definitive procedure in viable sigmoid volvulus.

Cirocchi et al (2010)⁹⁴ studied a retrospective clinical study of sigmoid volvulus from 1996 to 2009 at St. Maria hospital. They divided patients into obstructive and subocclusive symptoms. There was mortality rate of 44% who were treated with sigmoid resection. Mortality rate was nil in patients with intestinal derotation and colopexy. Hartmann's operation is the proper operation in generalised, peritonitis and Obstruction

Levsky et al¹⁰⁰ studied the CT findings of sigmoid volvulus. CT scan improves the diagnosis of sigmoid volvulus. New signs such as X-marks – the-spot sign which indicates complete twisting and split wall sign which indicates less severe twisting of bowel. These two signs aid in the diagnosis of volvulus. Akshay D Baheti⁹⁹ reported a case of ileosigmoid knotting as a cause for closed loop obstruction. Whirl sign on CT scan is diagnostic of ileosigmoid knotting. Amabara (2012)⁹⁷ reported a case of sigmoidopexy and tube sigmoidostomy in sigmoid volvulus. He showed it is an effective

option in volvulus without gangrene. Patel upendra (2012) did a study from 2010 to 2011. He compared mortality and morbidity in different operative procedures. 33.3% mortality was observed in primary resection and anastomosis. Wound infection rate was 16.6% in PRA without proximal colostomy. He concluded Hartmann's procedure decreases mortality in sigmoid volvulus during emergency.

Muhammad R Khan (2012)¹⁰¹ reported a case of sigmoid volvulus in pregnancy and puerperium. The treatment is much similar to that of non pregnant women. Delay in diagnosis has significant mortality rate both to the fetus and mother.

INCIDENCE

A great deal of variation exists in the incidence of sigmoid volvulus in many parts of the world.

Sigmoid volvulus accounts for 2-3% of all intestinal obstructions. Yet it is the most common strangulating obstruction of the colon, being second, only to carcinoma as a cause of colonic obstruction .

Campbell D.A.³⁸ quote an incidence of 4%, Griffin W.D et al³⁹ say the incidence to be 2.2% of intestinal obstruction as a whole and 8% of large bowel obstruction. Pool, R.M.⁴⁰ reported an incidence of 33% of the colonic obstruction and 3% of all intestinal obstruction.

Of 215 cases of intestinal obstruction reported from Russia by Perlmann,⁴¹ 111 cases i.e. more than 50% were due to sigmoid volvulus.

An impressive incidence was recorded by Scott J⁴² in Northern Iran. He states that sigmoid volvulus accounts for 85% of all cases of colonic obstruction. Sawyer Robert Bruce et al states that in Europe volvulus accounts for 40% of all cases of intestinal obstruction. But, Bolt DE states that on an average the British hospitals admit only one case of sigmoid volvulus per year, part from Hall Craggs E.C.E⁴⁵ report from Uganda no review of British literature is based on more than 40 cases.

In the monumental survey conducted by Vick, R.M.⁴⁶ of nearly 7,000 collected cases of intestinal obstruction throughout the British Isles, revealed that 8% cases were accounted for sigmoid volvulus.

In the series of Chakrabarty P.B. et al,⁴⁷ Anderson DA,⁴⁸ the incidence of volvulus of large gut was reported to between 50-69%. Jain B.L⁴⁹ reported an incidence of 66.8% from Rewa. Kamta Prasad Bhargava⁵⁰ 50.7%. Avots Avotins V. et al,⁵¹ found that of all volvulus in the elderly accounts of 75-80%, caecum and transverse colon accounting for 15-20% and 5% respectively.

Kerry, R.L⁵² found from his study of 306 cases, of age ranging from 1-90 years, that the incidence of sigmoid and caecal volvulus occurred at the same rate, 52% for sigmoid and left colon, 44% for caecum and 4% for transverse colon.

Age

Sigmoid volvulus has been reported in all age groups, right from early infancy to old age but it is considered generally to be an old men's disease.

Thus Arnold G.J⁵⁴ observed that, their patients are ranged from 9 years to 90 years. The highest incidence was noted in the 8th decade. The mean age was 66 years.

Dean, O.G.⁵⁵ reported that their patients age ranged between 4-80 years and the average age was 55 years. The average age reported by Anderson et al, is 65 years. Men being younger to women by four years, 86% of his patients were 50 years old or more, 45% patients were above 70 years. Sutcliffe, M.M.L.⁵⁶ states that his patients ranged between 5-87 years of age, 12 of them were over 70 years. Drapans Theodore⁵⁷ say that, of these patients, the youngest was an infant of 18 months, and the oldest patients was 94 years. 80% of their patients were over 50 years. Reporting from Chicago, Inness et al⁵⁸ stated that their patients average age was 66 years and it ranged between 31-92 years. Ballantyne GH¹¹ states that his patients averaged 68.5 years old.

In North India, from Rewa in Rajasthan, Jain B.L.⁴⁹ reported that they had patients from 3 years to 85 years. The majority of them were between 41-50 years, the next commonest being 31-40 years. From Madurai in South India, Sankaran, V.⁵⁹ reported sigmoid volvulus in a new born baby, all other patients of his were over 25 years. Kamta Prasad Bhargava⁵⁰ reported the maximum incidence to be seen between 40-50 years. Connolly S et al³² says that the mean age was 78 years in his study.

Sex

Sigmoid volvulus affects both sexes, the males are affected more. It is believed that wider pelvis which provides space of spontaneous untwisting, and a lax abdomen are said to be the reasons for lesser rate in females (Timothy S, String).⁶⁰ The males due to narrow pelvis, stronger abdominal muscles and heavy meals, are thought to be affected more (Sankaran).⁵⁹ Thus of 99 patients of Arnold, G.J.⁵⁴ 54 were males and 45 females. Dean O et al.⁵⁵ say that of their 21 patients, 14 were males and 7 females a ratio of 2:1. Timothy S, String⁶⁰ referring to Griffin W.D et al.³⁹ Drapans Theodore⁵⁷ and Smith Kirby, H.T.⁶¹ state that the male, female ratio ranged from 2:1 to 4:1. Struzaker H.G et al.⁶² reported male and female ratio of 1:2 this is in contradiction to many reported reviews. In India from Orissa Chakrabarty et al.⁴⁷ report, a male to female ratio of 3:1, De U³¹ reports the male female ratio to be 2.07:1. Ballantyne GH¹¹ reports that of 12 patients 7 men and 5 women and Connolly S et al.³² say that male to female ratio 5:3 of 45 patients of illness et al.⁵⁸ 28 were males and 17 females.

Jain, B.L.⁴⁹ series had a predominance of males. Sankaran⁵⁹ reports the male female ratio to be 5:1. Of 33 patients reported by Sutcliffe⁵⁶ 19 were females and 14 males. Rennie¹⁰ gives a report of over whelming

predominance of males with a ratio 5:1. From Ahmednagar, Anderson⁴⁸ gives the report of male female ratio to be 9:1. Sutcliffe⁵⁶ states that of 34 cases traced in literature, 33 were males. It is clear that the condition is common in men.

Diet and Colitis

The geographical variation in the occurrence of sigmoid volvulus, forming “volvulus Belt’s is related to the dietary factors leading to distention of the bowel.

The consumption of a high bulky, fibre diet is common through out the ages, where sigmoid volvulus is a common occurrence, this dietary habit is likely to be responsible for the “Volvulus Belts” resulting in a higher incidence of mega colons and volvulus.

An interesting case of obstruction of the recto-sigmoid was observed by Chakrabarty P.B et al⁴⁷ in a female child of 10 years. Swollen cereals were the cause of obstruction, due to swelling (about 250) which had impacted in the pelvic colon and rectum, this case exemplifies the role of diet. The role played by high fiber content vegetarian diet in the occurrence of volvulus is clearly shown by the fact that the incidence rose sharply in Norway during years of war, when temporarily the diet became mainly vegetarian and contained more roughage (Brussagaard, C⁴³).

A look at the diet of Maratha farmers in whom volvulus commonly occur in that area; showed that each man consumes about seer of cereals a

day; the residue of such a heavy meal will tend to accumulate in the pelvic colon and weigh down on a congenitally long colon; and over years it may further elongate it and pull on the mesentery leading to shortening of the base of the mesocolic attachment.

The seasonal increase in occurrence of sigmoid volvulus in August and December observed by Chakrabarty P.B⁴⁷ after harvesting of paddy and an increased consumption of rice and winter leafy vegetables like cabbage, cauli flower etc., also points to the diet as an important factors.

Ojha, DJ⁶³ has also made a similar observation. Kamta Prasad Bhargava⁵⁰ states that the constant loading of the pelvic colon with vegetable roughage over a long period in terms of years may be responsible for the lengthening which is frequently seen in pelvic colon.

Cicatrization in the pelvic meso colon causes narrowing of the pedicle, a condition which predisposes to volvulus. Cicatrization is a cumulative effect of repeated chronic inflammatory changes in the mesentery secondary to infection with amoebic and bacillary dysenteries.

It was explained by Kamta Prasad Bhargava⁵⁰ that a high incidence of volvulus among the poor was due to a combination of a high residue diet and frequent inflammatory diseases to which they become subjected.

Thus loading, lengthening of the pelvic colon and cicatrization of the meso colon causing a narrowing of the pedicle of the mesentery are the main factors causing volvulus. Similar instances also occur in Russia,

Finland and Poland, where a coarse vegetable diet is consumed by the poor people.

Burkit Denis⁶⁴ states that a high fiber may contribute to the pathogenesis of sigmoid volvulus, but by no means all communities with fibre rich diet are prone unduly to this disease. Rennie¹⁰ saying that a diet high in residue increase the length of the bowel along with its mesentery.

Psychiatric or Neurological disorders, constipation and drugs

Anticholinergics, ganglion blockers anti parkinsonian drugs and tranquilisers also have been said to produce megacolon or megacolon syndrome. If damage occurs to the ganglia or plexus, loss of co-ordinating contractions ensue. Colon being the most common site such injury. The excessive use of laxatives, may lead to the damage of myenteric neurons, resulting in side effects such as constipation, megacolon and ileus.

The effects of phenothiazine on the development of megacolon was studied by Sriram Krishan et al⁶⁵. There is enough evidence to show that phenothiazines used in the treatment of neurological or mental disorders results in ileus, characterized by pseudo obstruction and delayed transportation through the colon. Some psychotropic drugs have prolonged actions due to long half life, and in the urine of the patients the metabolites of these drugs can be found months after cessation of therapy.

Arnold GJ⁵⁴ state that Psychiatric diseases were prevalent in 30% of their cases. Timothy S. String⁶⁰ state that of the 7 patients, who died after initial treatment, 6 had associated severe mental disorders or psychiatric diseases compelling a more sedentary life. Sutcliffe⁵⁶ shown eight out of 33 patients were associated with psychiatric disorders with an average of 39 years.

EMBRYOLOGY

In the 5th week of embryo alimentary canal is formed by a tube suspended in the midline of the abdominal cavity. It consists of three portion each of which has its own artery and each of which is destined for a specific function.

Foregut	Stomach, duodenum as far as entry of the bile duct	Coeliac artery
Mid gut	From entry of bile duct to two thirds of transverse colon	Superior mesenteric artery
Hind gut	Left third of transverse colon, descending colon sigmoid and Rectum.	Inferior mesenteric artery

Error of development are rare in fore gut, whereas they are common in mid gut and Hindgut. So their development is considered. The mid gut loop is thus divided into a pre-arterial segment lying in front of the artery and post arterial segment, lying behind the artery. During the 5th week the bud for caecum and appendix appears on the post arterial segment. Then duodenocolic isthmus is formed. This is the state before rotation.

Rotation of gut occurs in 3 states

First stage of rotation :

This stage of rotation occurs between 5th and 10th week when the midgut is still lying in the extra-embryonic coelem. This is brought about by the rapidly growing liver and descent of the right lobe carrying the organ downwards and to the right taking the left umbilical vein with it. The growth of the liver and descent of its right lobe brings about the rotation of the mid gut loop by 90 degree in an anticlockwise direction.

Second stage of rotation:

This occurs at about 10th to 11th week. In this stage there is reduction of the physiological hernia into the abdomen which occurs in stages and in definitive order. The caecum is the last to be reduced. Increased in the length of the colon causes it to pass to the right in front of the small intestine and superior mesenteric artery lying beneath it. At the end of the second stage of rotation, duodenum crosses behind the superior mesenteric artery and the transverse colon in front of it and descending colon into the left flank, caecum in right loin and the coils of small intestine lie in the cavity from the left upper to right lower quadrant .

Third stage of rotation :

It is fixation of the gut to the posterior abdominal wall. Caecum in right iliac fossa, mesentery of small gut to the posterior abdominal wall and rest of abdominal organs are obliterated.

Developmental anomalies: Classified into 3 groups;

1. Non-rotation
2. Reversed rotation
3. Malrotation.

Non rotation is due to the return of caecum and post-arterial segment before the pre-arterial segment, Two common types of obstruction arise with non-rotation. The extrinsic obstruction to the terminal duodenum due to congenital bands and volvulus due to short mesenteric attachment. In reversed rotation mid-gut rotates clockwise and transverse colon lies behind the superior mesentery and duodenum in front of the artery. The transverse colon is enclosed in a tunnel and obstruction depends on the tightness of the tunnel. The ascending colon and caecum are not fixed to the posterior abdominal wall.

Malrotation the term is used by Dott to imply irregular defect of rotation. Derangement of third stage of rotation results caecum to be sub hepatic, or right lumbar or pelvic. Deficient fixation of the post-arterial mesentery causing mobile proximal colon.

ANATOMY^{67,68}

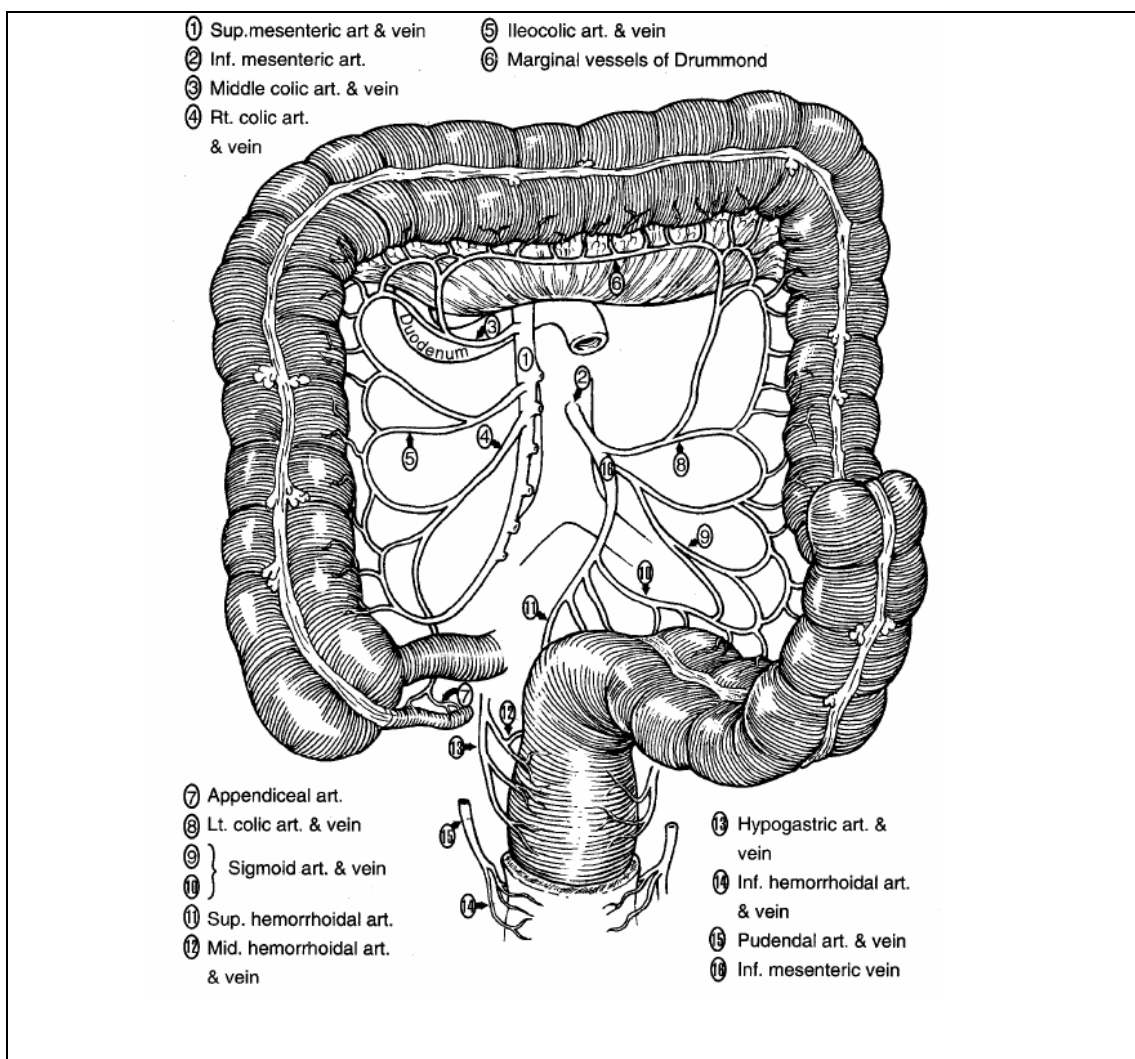
Large intestine

It is 6 feet long, except rectum and appendix it is characterized by taenia coli.

Sigmoid colon

It is 45cm in length extends from the pelvic brim to the commencement of rectum and it is attached to posterior abdominal wall by mesocolon. At L5-S1 it continues to form rectum.

Figure-1: Anatomy of the large intestine



Blood Supply

Descending colon, sigmoid colon and rectum supplied by branches of inferior mesenteric artery i.e. left colic, sigmoidal, superior haemorrhoidal arteries.

Lymphatic Vessels

Lymphatic drainage is arranged three groups.

1. Proximal
2. Intermediate
3. Distal

The proximal and intermediate glands are situated on the main blood vessels of the gut. The distal glands are situated near the gut between the numerous small vessels entering the gut.

Nerve Supply

The efferent nerve supply is from the parasympathetic and sympathetic division of autonomic nervous system. The parasympathetic pre ganglion fibers passing through the vagus nerve synapse with the nerves of the intrinsic plexus. The sympathetic innervation by preganglionic fibers from T9, T10 of spinal cord to synapse in the superior mesenteric ganglion.

Surgical Anatomy.

The colon has been divided into two types depending upon the mesentry.

Type of colon	Sex	Mesentry
Dolichomesocolic	Male	Longer than wide
Brachy mesocolic	Female	Wider than long

This explains the male predominance of sigmoid volvulus because of its anatomical variant, also the long ileal mesentry and redundant mesentry of sigmoid is responsible for ileosigmoid knotting.

Congenital Abnormalities, Bands and Adhesions

Anatomically a redundant long loop of sigmoid with a short mesenteric base or attachment which holds the two limbs of the sigmoid in close approximation tends to produce volvulus by allowing an easy rotation of the long. Narrowing of the base of the mesentery by inflammatory changes, adhesions and scarring of the peritoneum also encourage rotation. The longer sigmoid flexure commonly seen in males than in females, may explain the larger number of cases in males.

Mega colon particularly, tumours and inflammatory processes in general are the pathological conditions which predispose to sigmoid volvulus.

Metheney David⁶⁹ report a cases of sigmoid volvulus in a 3 month old infant, which could be due to congenital redundancy. Ligot believe that there is a familial tendency to congenital elongation of the pelvic colon and hence a predisposition to volvulus.

Metheney David⁶⁹ report a case of sigmoid volvulus in and young infant of 3 months and emphasizes that there is a congenital factor involved. They further state that sigmoid volvulus follows the well known law that many congenital anomalies of abdomen manifest only in adult life.

Sankarna, V⁵⁹ also favours the congenital factor as an aetiological factor. He states that existence of a long sigmoid mesocolon and a long flexure in which the loops are closely approximated could be a factor. Post operative inflammatory bands or adhesions may predispose to the occurrence of volvulus in a few cases, and also due to storing of high residual amount in faecal matter (Compensatory hypertrophy).

Anderson DA⁴⁸ states that a congenital predisposition may consist of a long pelvic loop, Brussagaard, C⁴³ to state that the average height of the mesocolon is 5” while in cases of volvulus it was 10”. Thus it can be said that in sigmoid volvulus there is a congenital predisposition, plus slowly acting acquired cases of a mechanical nature, as bands and adhesion and weighing down by a bulky diet.

Other factors

The individuals with excessive tone or activity would be at risk of developing diverticular diseases. While the ones with poor tone would develop colonic distension thus a predisposition towards large bowel volvulus so says Reasback.

PHYSIOLOGY^{70,71}

Physiology of colon

The principal functions of colon are to accept each day approximately litres of fluid intestinal content from the small bowel after it has complete its task of digestion and absorption, to reabsorb about 900ml of water, plus some sodium of chloride, to add a little potassium and generally to firm it up and retain it until convenient for a coordinated act of emptying. Further more, the colon is an important site for the reabsorption of nitrogenous substances.

Motility

Colonic motility may be classified basically into segmental and propulsive activations. Types II waves are probably associated with the haustration and therefore indicative of segmental contractions. Type IV waves are definitely propulsive. Segmental contraction, peristalsis and mass propulsion are the motility pattern seen in the colon and are indicative of the functional differences between the right and left colon. Segmental contraction includes haustral propulsion, haustral retropulsion and multihaustral propulsion and the rate of segmentation is only 204 per minute.

Factors affecting the motility

Immediately following a meal, the ileum rigorously empties chyme into the caecum and the intraluminal pressure in the colon increases, the left more than the right. An exaggerated rise in sigmoid pressure is seen in some individual after eating. Sight of food enhances colonic activity after vagotomy, and in paraplegic patients. Gastrin is known to stimulate the colon. Emotional reactions does effect colonic motility. Human experiments show that hospitality, anger and resentment are associated with hypermotility, while anxiety and fear lead to hypomotility. Sleep depresses the activity. Physical activity increases both segmental and peristaltic colonic motility.

Distension of the colon will stimulate motility. In constipation, motility may be normal or increased in the sigmoid colon. In contrast, with diarrhoea colonic pressure is low. Liquid and gas are easily propelled by a low pressure. With a solid bolus intra luminal pressure, generated by any form of contraction is small.

Flatus production

The major components of gas in human flatus are nitrogen, carbondioxide, methane, hydrogen and oxygen, the largest fraction being nitrogen. The daily output of gas in man ranges from 300ml to 2 liters. Combustible gases are products of bacterial fermentation. The major source of colonic gas is swallowed air, representing about 70% of large

bowel gas. The second source of gas is from bacterial action on food substances. Putrefaction of protein plays a minor role.

On the other hand, bacterial fermentation of carbohydrates is major source of gases produced in the colon from the food substances. The bad odour is due to indole and skatole.

Less flatus is produced in constipated patients. Cabbage, onions and other food products often associated with increase flatulence have their effect by enhancing propulsion of intestinal gas.

Colonic obstruction

The liquid nature of the contents of the right colon make obstruction less likely than on the left, where fecal material is semisolid. A competent ileocaecal valve will create closed loop obstruction as the obstruction becomes greater, the colonic peristalsis increases so that only fluid substances pass the obstruction. Diarrhoea often precedes complete obstruction with heightened peristalsis, the colon may hypertrophy, but eventually distension and thinning of the bowel wall ensue. As the distension increases the diameter, the blood supply, following the circumference after entering the bowel wall at the mesenteric border, gradually becomes impaired. The low pressure venous system is first compromised, when arterial circulation ceases, necrosis and perforation occur. Thus the most common site of obstruction perforation of the colon is the antimesenteric border of the caecum.

Although patients with strangulating obstruction may be toxic due to peritoneal absorption of products of bacterial activity and bowel wall necrosis, the toxicity of simple obstruction cannot be explained on the basis. Such patients do appear toxic, and much evidence now exists to show that the sequence of colon obstruction leads to the sequestration of an enormous amount of fluid and electrolytes within the lumen and colonic wall.

Since this comes from the vascular space, effective circulating blood volume decreases, and the patient may exhibit shock or at least some hypotension. While antibiotics may reduce the virulence of the obstruction, fluid and electrolyte replacement is the mainstay of pre-operative preparation.

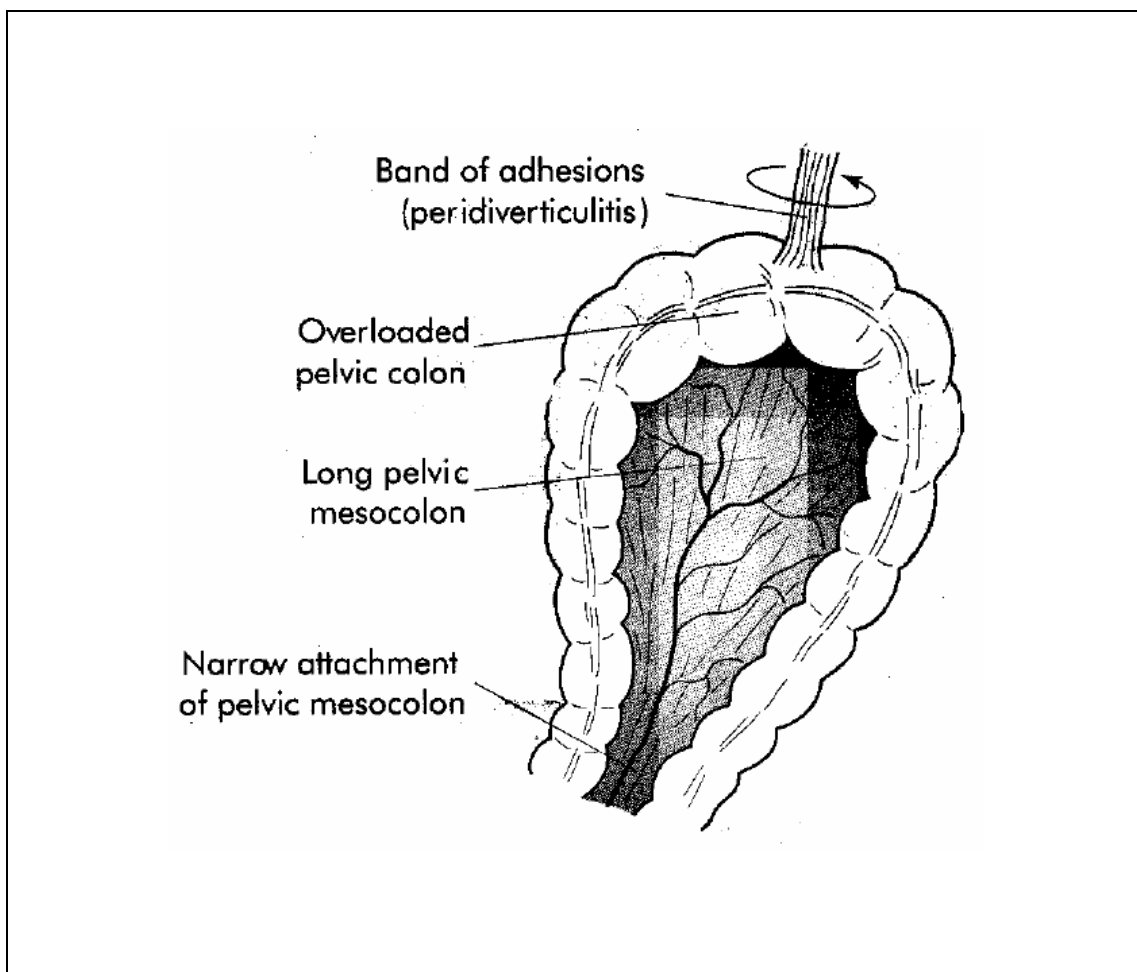
AETIOLOGY

Definition

Volvulus is an obstruction of the bowel that results from a twisting of the bowel on its mesentery with an associated torsion on its own long axis.

Aetiology and predisposing factors

Figure-2: Predisposing factors of volvulus



1. Sigmoid volvulus

- Congenital : Idiopathic
 - : Narrow attachment of mesentery.
 - : Long mobile loop of sigmoid
 - : Hirshsprungs disease and pseudomegacolon
 - : Congenital bands
- Acquired : Adhesions
- Predisposing factors : Loaded colon resulting from chronic Constipation
 - : dietary-large, heavy, coarse, rough diet
 - : Drugs and psychiatric patients
 - : Old age

Pathogenesis and Pathology

Pathogenesis:

A twist of more than 180° causes occlusion of the lumen. The degree of obstruction depends upon whether the axial torsion is evenly distributed throughout the sigmoid, or is limited to one short area.

In about 75% of cases, the ileo-caecal valve is so competent that no gas regurgitation is possible and a double closed loop obstruction ensues, which differs from volvulus in small bowel in that there is no proximal block to prevent regurgitation.

The changes that occur in the vessels in the fulminating type case due to tight compression of the mesenteric circulation and to the rapid and immense distension of the rotated bowel loop. The distension of the bowel is by gas and fluid. In turn the distension is produced by increased peristalsis, which forces fluid and air into the closed loop, air and fluid enter the torsion, which acts as a valve, which only permits entry but prevents escape. The vascular hypertension in the involved loop impairs capillary blood circulation; submucosal vascular plexuses are particularly vulnerable to the flattening force exerted by pressure within the lumen.

The venous occlusion produces haemorrhagic infarction of the segment with blood loss sufficient to produce shock, especially in the case of a long loop. The bacterial toxins and blood pass through one bowel wall permitting the peritoneal fluid. This forms the basis of peritoneal irritation which can be recognized clinically. Aerobic and anaerobic organisms multiply within this obstructed loop, this bacterial growth in the bowel wall is another factor in precipitating the death of tissue and perforation.

There are thus two ways by which necrotizing mechanism in volvulus of the sigmoid colon combine to produce gangrene. Obstruction to the mesenteric blood flow occurs from torsion angulation as is often seen in the acute fulminating type and the ischemic necrosis from prolonged vascular hypertension, as seen in the sub acute progressive type.

Circulatory embarrassment can be suspected if the volvulus has been present for 6 hours. The mesenteric torsion while increasing, causes the veins to get increasingly obstructed, venous stasis occurs and sooner or later thrombosis of the mesenteric vessels sets and spreads (Brusgaard, C).

The three different points at which gangrene can occur are at the neck of the volvulus. It may or may not be associated with gangrene of the sigmoid loop either in part or in whole. Thirdly the gangrene of the descending colon and upper part of rectum, secondary to retrograde thrombosis of mesenteric vessels may occur.

The association with old age and Psychiatric disorders after factors which make the prognosis gloomy.

Writing about pathophysiology (Avots Avotins, V et al)⁵¹ states that if torsion is less than 180° the luminal obstruction is insignificant, provided it is evenly distributed along the longitudinal axis of bowel. In early 20th century, Max Wilms called it "Physiologic volvulus".

If volvulus occurs with torsion of 360° or more, it may lead to vascular obstruction in the mesentery involved with the possibility of gangrene of the bowel segment.

The colonic involvement may be furthered by poor peristalsis, resulting in delayed transportation, faecal retention and obstipation, which lead to a marked elongation of the longitudinal axis of the mesentery. This

added to the narrowed base of the loop and increased mobility of the segment may result in volvulus. The longitudinal scarring seen in the mesentery at laparotomy signifies previous torsion.

An increasing intraluminal pressure associated with mechanical obstruction or a dynamic ileus may lead to perforation especially in the caecum. The factors that seem to influence this are (1) intraluminal tension, (2) ischemic changes found on antimesenteric border, (3) increased bacterial activity.

It was shown by Wangensten,⁷² that an increased pressure gradient in the caecum renders it more susceptible for perforation. Gerwig, H Walter⁷³ writing about the pathology of sigmoid volvulus, states that the circulatory impairment early the walls of the intestine in volvulus is of the venous type. Since the walls of the veins can be easily compared in a mesenteric twist, venous obstruction will lead to irreversible damage, more rapidly than the arterial obstruction.

After obstruction and impairment of circulation, gaseous distension of the closed loop occurs, the gas products resulting from decomposition and putrefaction of the contents of bowel in the closed loop. The damage to circulation results in diffusion of blood gases, especially nitrogen into the lumen.

The obstruction if proceeds unabated, disturbances in circulation and gaseous distension progress into a viscous cycle. This leads to reduction of blood volume, decrease in the viability of the bowel wall and in increased permeability to the pathogenic organism and toxins. Peritonitis, shock and death ensue.

The grades of twists mentioned by Gerwig, H Walter⁷³ are

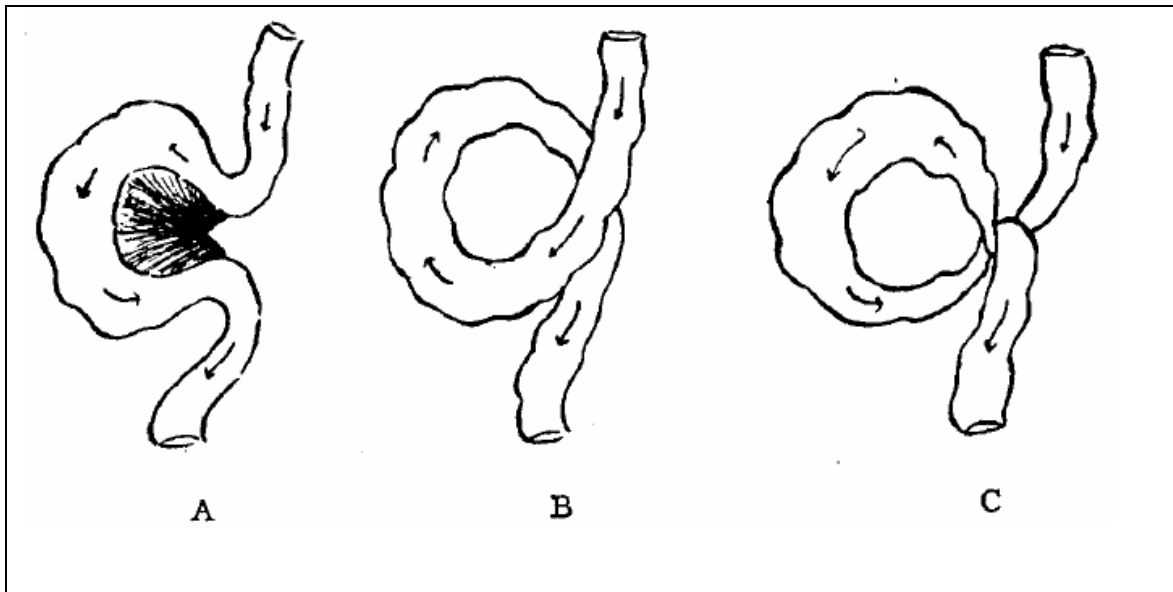
Grade I: volvulus less than 180° , which is asymptomatic and incidentally found on Barium enema.

Grade II: Volvulus more than 180° with partial obstruction which spontaneously untwists or can be decompressed by conservative methods.

Grade III: Volvulus more than 180° , resulting in an irreducible, complete obstruction with formation of a “closed loop”. If circulatory impairment is present it is reversible and the bowel is viable.

Grade IV: Volvulus more than 180° with an irreversible, ir-repairable complete closed loop intestinal obstruction and ir-repairable circulatory damage to the bowel.

Figure-3A: Predisposing long sigmoid loop, pelvic mesocolon and its narrow attachment bringing the two ends of the pelvic loop close together.



B. Rotation through 180⁰ C. Rotation through 360⁰

Ileosigmoid Knotting⁹⁹

This condition is more common in Asia, Africa and Middle East.

There are four types of formation of knot. They are

Type 1- ileum is active component wrapping itself around sigmoid

Type 2- sigmoid colon is active component wrapping around ileum

Type 3- ileocaecal segment is active component

Type 4- undetermined type.

The knotting leads to closed loop obstruction and causes gangrene of both ileum and sigmoid colon. The presence of whirl sign on CT scan which is medially deviated distal descending colon and caecum with mesenteric vascularity converging towards the sigmoid colon is characteristic of ileosigmoid knotting

Pathology of Intestinal Volvulus^{74,75}

This is extrinsic type of obstruction where in the infarction of vessels and strangulation supervenes. Even in absence of strangulation, however ischemic changes progressing to necrosis and perforation may occur, pressure necrosis may take place at the site of the tight band. In obstruction the progressive change takes place in –

1. Bacteriologic content of the obstruction level
2. Amount and composition of gas in the gut above the obstruction.
3. Circulation in the distended bowel
4. Fluid and electrolyte imbalance.

In strangulation the pathologic changes comprised of progressive vascular changes, in wall and its mesentery and eventually with peritonitis, toxæmia and actual death of gut wall.

Bacteriology⁷⁶

The contents of normal upper small bowel are virtually sterile containing the transient flora. Distal small gut fluid may contain the scanty growth of fecal organisms (Coliforms). In case of obstruction the situation is quite different. Longer the period of obstruction higher up was the contamination whereas the gut below the obstruction was sterile.

In obstruction rapid colonization of the gut lumen is seen. After needle aspiration at various sites of obstruction and by using the modern culture techniques that a considerable increase in the anaerobic organism

above the obstruction, specially bacteriods. This was particularly evident in large bowel obstruction. Faeculent fluid within the obstructed small gut represents break down of what are normally sterile contents.

Distension⁷⁷

Distended gut above the obstructive lesion contains both gas and fluid.

Average composition of gas (intestinal) in obstruction is –

Nitrogen	:	70%
CO	:	6-9%
Oxygen	:	10-12%
Hydrogen	:	1%
Methane	:	1%
Hydrogen sulphide	:	1-10%

Excessive air swallowing is likely to occur in patients suffering from the acute abdominal pain of obstruction and this is particularly aggravated by their anxiety and mouth breathing. It is true that faecal organism convert cellulose into carbon dioxide, methane and hydrogen.

Fluid loss

Fluid accumulates above the level of obstruction partly because of deprivation of absorptive surface of the intestinal distal to occlusion, partly due to alteration in fluid and electrolyte exchange across the gut wall above the obstruction. Every 24 hrs, 2 liters of gastric, biliary, pancreatic and small intestine secretion pour into the alimentary canal to be almost completely absorbed in the colon. In presence of obstruction, guts of the fluid from the absorptive surface of the colon and the accumulated intestinal juices will be lost to the body economy either by vomiting or by gastric aspiration or merely by sequestration within the dilated loops of the obstruction bowel. Vast fluid shift and loss is equivalent to above a quarter of the entire body or three time the total plasma volumes.

Apart from the loss of water there is loss of electrolyte specially sodium chloride and bicarbonate. The fluid loss becomes aggravated as intestine dilates and becomes venously congested. There is then and increase in fluid and electrolyte loss into the bowel lumen. With this there is considerably leakage of proteins from engorged capillaries. Strangulation of bowel will accompanied by accumulation of protein and electrolytes rich exudates into the peritoneal cavity and infarction of an extensive length of intestine will be associated with marked sequestration of blood into the bowel wall itself.

Strangulation of the bowel occurs in a volvulus in such a way that its blood supply is progressively interfered with. It is a very dangerous condition and demands early treatment before gangrene of the bowel arises. Mesenteric vascular occlusion alone give rise to gangrene without mechanical obstruction.

The onset of gangrene: The first effect of strangulation is to compress the veins so as to cause the strangulated bowel, and it involved mesentery, to become blue and congested. Much depend on the tightness of the constricting agent. When the venous return is completely occluded, the colour of the intestine turns from purple to black. About this time, in many instances, owing to increased oedema at the point of obstruction, the arterial supply is jeopardized. Then the peritoneal coat loses its glistening appearances, the mucous membrane becomes ulcerated and moist gangrenes is imminent. Loss of blood volume into the congested segment is proportional to the length of that segment. When a large coil of intestine becomes strangulated the loss of blood is sufficient to render the patient oligemia; when several feet of small intestine are involved the volume of circulating blood is so reduced as to imperil the patient's life.

Distension for a considerable time the strangulated segment along distends, the greatest distension occurring when the venous return is completely obstructed while the arterial supply remains un impaired. Unlike non strangulating obstruction, early distension of the proximal intestine is

absent, indeed, for a time varying from a few minutes to several hours the proximal intestine contracts. After this varying interval, vigorous peristalsis occurs in the proximal segment, but is still unaccompanied by distension. By the time gangrene of the strangulated segment is imminent, retrograde thrombosis is proceeding along the related tributaries of the mesenteric vein. Distension then appears both on the proximal and distal sides of the strangulation.

Transmigration of bacteria and toxins: When the wall of the intestine becomes partly devitalised, both bacteria toxins and the products of tissue autolysis pass into the peritoneal cavity, there to be absorbed into the circulation. This will be evident in the clinical features like toxemia shock and peritonitis.

Measures to be taken when the small intestine is strangulated, frequently the case is intra-abdominal strangulation, blood stained fluid is present in the peritoneal cavity, the fluid should be removed by suction or mopped up as completely as possibly, for it is toxic and infected. After the relief of strangulation a decision must be reached as to whether the segment that was strangulated is viable. When it is black and the peritoneal coat has lost its seen, when the mesentery shows a lack of arterial pulsation, thrombosis of its veins, it is non viable, if not already gangrenous, and if practicable, resection followed by anastomosis is carried out. In doubtful cases when the intestine blue, purple, or dark red, the

effect of wrapping it in a warm moist abdominal pack is noted. At the same time the anaesthetist administers pure oxygen for three minutes. By these means viable is differentiated from nonviable intestine thus (Table).

Intestine	Viable	Non-viable
Circulation	Dark colour becomes lighter; mesentery bleeds, if pricked.	Dark colour remains; no bleeding
Peritoneum	Shiny	Dull and lusterless
Intestinal Musculature	Firm, Pressure rings may or may not disappear peristalsis seen	Flabby, thin, and friable. Pressure rings persist. No peristalsis.

Strangulation is of the highest importance to distinguish from non strangulating intestinal obstruction, because strangulation progresses rapidly to gangrene. The diagnosis is made on clinical methods. The picture is that of obstruction with a degree of shock, pain is never completely absent. In strangulation, the symptoms usually commence very suddenly and spasms of intestinal colic recur three to four times a minute. Generalized tenderness and sometimes rigidity are indicative for laparotomy. The presence and character of local tenderness is of great significance, in strangulation there is always tenderness over and intra-abdominal strangulated coil and the rebound tenderness is a distinctive sign of strangulation.

Symptoms and physical findings

Pool, R.M.⁴⁰ found that, in most of the patients the onset was insidious, with slight abdominal pain, followed by obstipation and distension, a third of these patients had in the past experienced similar attacks. These relieved at home by purgatives or enema. Some patients complained only of obstipation. The patients with gangrene complained of constant pain, which was not severe. Tenderness and rebound tenderness indicating peritoneal involvement was also noted in few cases. Peristalsis was of little value in diagnosis. The patients with gangrene had fever and 75% of patients with viable bowel also had leucocytosis of some degree.

Physical findings:

Sutcliffe⁵⁶ reports that most of the patients presented between first and seventh day after the onset of symptoms. Full range of duration of symptoms was from 6hrs to 2 months .Of 33 cases, 50% patients had previous attacks. The features on admission were as follows.

Features	No. of cases	Percent
Distension	50	94
Pain abdomen	41	77
Nausea and vomiting	35	66
Constipation	28	51
Diarrhoea	7	13
Altered bowel sounds	43	81
Empty rectum	30	57
Dehydration	11	21
Fever	12	23

Illness et al⁵⁸ record that all their patients had obstipation and abdominal distension. In their series of 45 cases, 33 patients had constipation, 17 had pain abdomen, 11 had vomiting, 10 had malena and weight loss.

Matheney David⁶⁹ states that before obstruction occurs there may be tenderness on the left side and occasionally the redundant sigmoid may be palpable above the navel on the left side. It seems like a phantom cyst disappearing on being examined.

The clinical features noted by Sankaran⁵⁹ are the large gut obstruction syndrome, namely constipation, sudden pain and increasing distension. The abdominal wall, until the development of gangrene was soft. It became moderately rigid after setting of gangrene. There was evidence of free fluid in the abdomen in many cases. In early stages the pulse rate and general condition of the patients was normal. In cases that came late, marked pallor, signs of dehydration and electrolyte imbalance due to vomiting and exudation of fluid into the loop were seen by Sankaran.⁵⁹

Kamata Prasad Bhargava,⁵⁰ reports in his series that pain was seen in 83.5% of patients. It was seen that the severe the pain indicated better condition of the patient and better prognosis was directly proportional to the severity of pain. The duration of symptoms and physical findings

encountered by Arnold,⁵⁴ ranged from 3 hours to 40 days, the average was 5.2 days.

The most frequently reported symptoms were cramping, abdominal pain (52.4%). Other symptoms were nausea, vomiting constipation, diarrhoea, abdominal swelling, obstipation, anorexia and weight loss, rectal bleeding hematemesis and decreased caliber of stools.

The physical findings initially were abdominal distension (87.4%) abnormal bowel sounds, tympanic note, empty rectum, dehydration, generalized tenderness, localized tenderness, visible peristalsis, rebound tenderness, abdominal mass, rectal stricture, faecal odour to the breath, faecal impaction and umbilical hernia.

Clinical picture

It is influenced mainly by the rapidity of the twisting of mesentery resulting on gangrene of bowel. Writing about the clinical types Hinshaw, DB³⁷ 1957, state that was picture in acute fulminating type will be occurring in young patients with a sudden onset and rapid course, other symptoms will be early vomiting, diffuse abdominal pain, tenderness and marked prostration. Gangrene will set in soon due to occlusion of the mesenteric blood supply due to which it takes a fulminating course.

The subacute progressive type: Is more common in older patients. It has a gradual onset, history of previous attacks of chronic constipation is present. It usually has a benign course. Gangrene may develop slowly and may result from an enormous rise in intra colic pressure in the closed loop. There may be tremendous distension of abdomen, vomiting occurs late, and is generally characteristic of colonic obstruction.

Dean, O.G⁵⁵ writes that the symptomology of chronic volvulus appeared to be so benign that most victims of the condition either failed to seek medical attention or were neglected by their attendants until the syndrome of acute volvulus ensued, the findings in all cases suggested a predisposing megacolon. An acute case of volvulus occurred in a four year old child who had been undergoing treatment for Hirschsprungs type of megacolon.

Griffin, W.D et al³⁹ and others divide the patients in the two groups, the acute and the sub acute. The acute group is encountered in younger, they are more ill and with a short history.

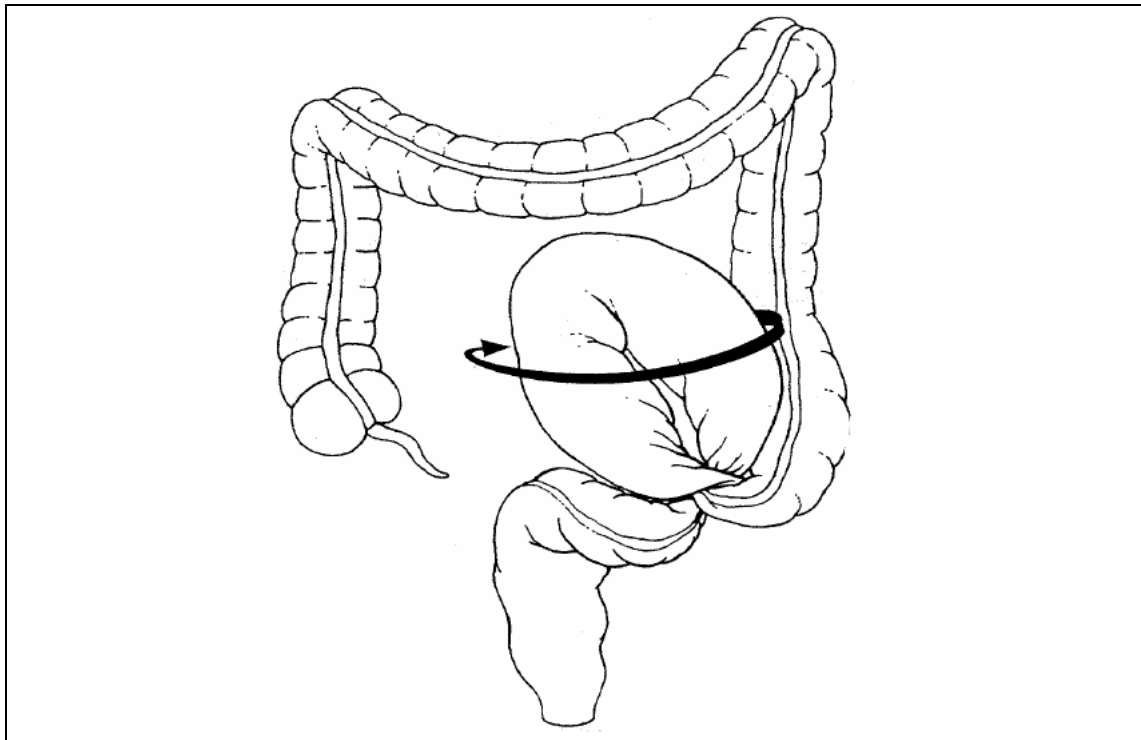
Acute volvulus of the sigmoid colon

Features	Acute fulminating	Sub-acute progressive
Previous attack	Infrequent	Frequent
Onset	Sudden	Gradual
Pain	Diffuse, severe, steady	Less marked, cramps
Clinical course	Rapid catastrophic	Slow progressive
Vomiting	Early	Late
General appearance	Prostration, shock common	Shock late
Distention	Less marked	Extreme
Signs of peritoneal irritation	Definite, rebound tenderness	Not present
Peristalsis	Violent, hyperactive later silent	Usual pattern in colonic obstruction
Leucocytosis	Frequent	Infrequent
X-ray findings	Not distinctive	Diagnostic
Presence of strangulation	Frequent and early	Infrequent and late
Differential diagnosis	Perforated viscus, of strangulated bowel	Obstruction of left colon

Diagnosis and investigations

A tentative diagnosis could be made by Hinshaw, DB³⁷ from a scout roentogram of the abdomen. A large circular dilated loop running from the pelvis exhibiting a bent inner tube effect is very characteristic.

Figure-4: The axial clockwise twist of the mobile sigmoid colon leads to a closed loop obstruction and vascular compromise. Reason for the “bent inner tube” appearance



Other features such as marked distension, increase thickness of the bowel wall and loss of haustral markings are seen. (**Frimann – Dahl’s Sign**). On barium enema the findings of the spiral twist at the site of torsion is pathognomonic, this twist depends upon its location and has been referred to as a “**Bird Beak**” or “**Ace of spades**’ deformity. If plain x-ray is not helpful, an emergency barium enema may be of help.

Dean, O.G⁵⁵ say that 17 out of 21 cases could be correctly diagnosed before surgical exploration or death. Barium enema revealed to “**Cork Screw**” like defect at the points of torsion. Many cases showed seepage of the barium enema past the area of torsion and into the dilated

loops of sigmoid with out subsequent evacuation of the barium. The enormous capacity and distention of the sigmoid colon was noted as diagnostic.

Smith-Kirby H.T⁶¹ state that Griffin W.D et al³⁹ found that 78% of their patients were unable to take more than 500 cc of enema fluid.

About x-ray Chakrabarty P.B⁴⁷ from Orissa has to say that a highly distended “**Omega Loops**” was found in all cases of sigmoid volvulus. There was associated distention of the proximal colon and caecum when the ileocaecal valve was competent. Plain x-ray abdomen was diagnostic in all but one case.

In most patients the “**AY**” sign formed the thickening of and adjacent thickened walls of colon. Barium enema was diagnostic in all eleven patients in whom this test was done in the study of illness et al.⁵⁸

Avots’ Avotins, V et al⁵¹ writing about radiological examination say that the plain x-ray usually demonstrate the colonic dilatation by gas and fluid, the sigmoid walls appears to be smooth with loss of haustrations. The diagnostic signs are ‘**Bird Beak**’, “**Large Horse Shore**”, or “**Y**” sign on occasion, single or double fluid air level pockets may be seen. The first denoting caecal and the second signifying sigmoid. Evidence of

“Summation line” a thickened soft tissue line formed by the two gas filled loops when opposing each other suggests volvulus. The identification of the out line of the distended colon is of extreme importance in diagnosis.

Arnold GJ⁵⁴ retrospective study of plain x-ray films of abdomen proved to be diagnostic in 61.5% cases. “Pair of Scales” was the pathognomonic sign described by Anderson, D.A.

Role of CT Scan¹⁰⁰

This is more accurate in diagnosis of sigmoid volvulus. Absence of rectal gas and inverted U shaped distended sigmoid are features of sigmoid volvulus. X marks spot sign which is complete twisting of colon and split wall sign which is incomplete twisting are specific features. The transition point and disproportionate enlargement are also taken into account.

Coffee bean sign : Sigmoid colon is distended with gas. It arises in the pelvis and extends above T10 level. Dilated bowel forms the walls of bean. It signifies closed loop obstruction.

Northern exposure sign : Sigmoid colon is normally found below transverse colon. When it is above it, then it is known as northern exposure sign.

Location of the obstruction^{79,80}

The following recapitulates the features that suggests the level of obstruction.

1. High small gut obstruction:

Suggested by early profuse and frequent vomiting with rapid development of dehydration due to excessive fluid loss, oliguria, intractable thirst, a rising blood urea, early collapse and sunken facial features and other features of fluid and electrolytes losses. Distension may be absent in early previous but later on it becomes manifest to be limited to epigastrium. Flatus and faeces may be passed with or without aid of enema.

2. Low small gut obstruction

It tends to be more gradual and case pursues a less urgent course. There is severe frequent colicky pains. Vomiting is later distension involves central abdomen. In both the case the step ladder pattern of coils of intestine may be visible.

3. Acute large gut obstruction

Little or no vomiting ,no shock, no dehydration (unless a gangrene) absolute constipation and considerable abdominal distension is seen. In early cases the caecum bears the brunt of the distention and become ballooned. While at a later stage whole abdomen and flanks are blown out. At times a mass of tumour may be felt per abdomen or per rectal. Final picture is **Huge Barrel Shaped Abdomen.**

MANAGEMENT OF SIGMOID VOLVULUS^{78,80,81,82}

Treatment of sigmoid volvulus is subject of controversy. Treatment differs depending upon the mode of presentation of volvulus. The two main considerations in treatment is relief of obstruction and curative resection of sigmoid colon. Consequently it is mandatory for surgical procedure in sigmoid volvulus either after non conservative management or as a primary curative procedure.

First stage is done by nonoperative decompression either with a rectal tube or laparotomy with detorsion only or resection including exteriorization of bowel. The second stage is elective resection of bowel. If resection performed in primary stage, then colostomy closure becomes the second stage.

Treatment Principles

1. Resuscitation of the Patient

2. Finding the Definitive Treatment for Volvulus which may be nonoperative and operative depending upon the bowel viability.

Resuscitation

This is the prime and initial goal of management even before proceeding the patient to investigations. Third space loss must be corrected with ringers lactate. Aggressive fluid resuscitation should be followed.

In event of impending perforation of bowel ,broad spectrum antibiotics including the coverage of both aerobic and anaerobic organisms should be given.Nasogastric tube is inserted for gastric decompression, it relieves vomiting and brings relief of pain and distention. It also minimizes the risk of aspiration . Foleys catheter is put to assess the fluid balance by urinary output. If the patients are anemic whole blood transfusions are done before surgery. Preoperative preparation of the patient and improving the general condition has a definitive role in post operative morbidity and mortality.

Course of Management

There may be spontaneous remission of sigmoid volvulus which doesn't require any surgical procedure. The diagnosis was established either by radiology or by laparotomy in another attack. There are incidences of reduction by placing the patient in knee elbow position followed by enormous escape of flatus. There are reports of spontaneous reduction after therapeutic barium enema. A success rate of 67% has been reported.(Arnold JG)⁵⁴.

Sigmoidoscopy and Intubation

Non operative decompression can be done by using a sigmoidoscope and a long rectal tube or with an endoscope. Sigmoidoscopic decompression was credited by Anderson A et al and described in detail by Brussagaard C⁴³. It was considered successful when 1. Passage of rectal tube resulted in

immediate release of large quantities of gas and fluid 2. There was immediate and lasting improvement of patients condition and 3. There was no damage of bowel. This procedure is objected in the presence of gangrenous colon and intubation may damage the oedematous bowel wall. The major limitations are the twist may be higher up which can be missed by endoscopy. Twist greater than 360 degree cannot be reduced by rectal tube and there may be unrecognised mesenteric occlusion. Visualisation of devitalised mucosa and blood stained fluid are indications for giving up the procedure. Complications include perforation and reperfusion syndrome following untwisting of bowel. It is preferable to use flexible endoscopy rather than rigid endoscopy.

Apex of volvulus is visualised as spiralling of mucosa with edema. If reduction is successful, rectal tube of size 18 F can be left in situ and patient prepared for elective surgery. Success rate was higher with colonoscope rather than sigmoidoscope. [Turan et al] and also with flexible than rigid endoscopy [oren et al] the protection of atonic proximal bowel is very important as there is association between ileus and volvulus. (Botsford W.T).

Sigmoidoscopic Reduction

A rigid or flexible sigmoidoscope can be used. The patient is put in left lateral position. Air is insufflated in regular intervals. This may sometimes reduce the twist. Air insufflation slowly expands the rectal

ampulla and prevent perforation. If reduction has been done ,rubber rectal tube of size 32 is pushed into the apex of spiral segment and beyond the obstructed part. If reduction not possible ,try the patient in different positions such as knee elbow position. This makes the colon to fall away and open the angle of volvulus. A forceful rush of gas and stool confirms the decompression of the bowel. If in doubt never attempt forcefully and never blind forcefully.

An effective length of 105 cm is needed for reduction with minimal risk. Reduction should not be attempted in any gangreneous bowel. Sigmoidoscopic reduction can also be tried in children even though it is very rare in children.

Operative Management

Sigmoid volvulus is surgical emergency and treatment of choice is essentially surgical. It can be either open or laparoscopic. Treatment for sigmoid volvulus broadly divided into resectional and non resectional procedures. Atherton first proposed surgery for volvulus in 1883. Terms lumbar colotomy and inguinal colotomy has been used. Nowadays primary resection and anastomosis is the gold standard for sigmoid volvulus.

Non Resectional Procedures

1. Laparotomy and derotation.
2. Laparotomy and fixation.
3. Plication.

4. Anterior sigmoidopexy.
5. Colopexy.
6. Mesosigmoidoplasty.
7. Mesocoloplasty.

Laparotomy and derotation

This can be done only when the bowel is viable. After opening the abdomen twist of the volvulus has been released. A flatus tube has been passed through the anus upto the pelvic loop. It is fixed to the perianal skin. It is kept for upto 2 days. This procedure is associated with high recurrence rate when elective resection of sigmoid has not been performed. It allows to determine the viability of bowel. By this technique acute phase of volvulus has been relieved. Laparotomy, fixation, plication simple derotation of the bowel doesn't solve the problem of volvulus. Recurrence could be prevented by fixing the mesentery and sigmoid loop. Effective fixation of pelvic colon prevents the recurrence of volvulus. It minimizes the risk of operative mortality. In non gangrenous bowel, the pelvic colon is usually fixed in the retroperitoneal space in the left side of abdomen. Depending upon the loop of sigmoid, the peritoneum is incised. The pelvic colon and the margins of peritoneum are sutured with silk Sutures. The main advantages are duration of stay in hospital is minimized and there is no leak or peritonitis. Kamata Prasad Bhargava described exteriorization of the gut.

The apex of the loop about 3" to 4" brought out and peritoneum sutured round it as in Paul's procedure. The bowel being allowed to be between deep muscles and external oblique. In this procedure and else in Lahaut's exteriorization which is similar to the above except that it lies deep to the abdominal muscles of the anterior abdominal wall, the disadvantages are possible herniation of the small intestine in the recess between the loop and the lateral abdominal wall. Besides the first procedure described above is likely to weaken the abdominal wall.

Anterior Sigmodopexy

This is not a reliable procedure. Primary retroperitoneal sigmoidopexy is done. Reduction of the volvulus is done. Bowel deflated by rectal tube. A length of about 10 to 12 cm of sigmoid is detached from its mesentry. This is done by a paracolic incision made between the sigmoid branches of inferior mesenteric vessels. Pulsation of marginal artery and viability of the bowel is maintained. Divided mesocolon stitched with the peritoneum by cat gut. Next extra peritonealisation of detached sigmoid is done. Anterior parietal peritoneum is dissected and the peritoneum sutured behind sigmoid colon and its vessels, anterior rectus sheath and skin is front of bowel.

Colopexy

In this procedure, sigmoid colon is sutured to the lateral abdominal wall with interrupted sutures. This does not require bowel preparation. Average mortality is 11% and average recurrence is 22%.

Mesosigmoidoplasty

Tiwari and Prasad proposed this procedure. It corrects the narrow base which is the main pathological problem. Flaps raised from the root of the sigmoid mesocolon and they are transversely sutured. Inverted T shaped peritoneal incisions are made. It extends upto the descending colon and upper rectum. This widens the base of the mesocolon. Arain and Oettle done a retrospective study for seven years. Mesosigmoidoplasty is done in half of cases and it carried a high failure rate. Modified procedure is described by Bach et al. In this all the vessels crossing the line of dissection is divided. But this does not correct the narrow base.

Mesocoloplasty

In this procedure volvulus is delivered and reduced. Viability of colon is confirmed. Mesocolic fibrous band which is present from base to apex of mesocolon is divided. The lateral leaf on either side of incision is mobilised. The longitudinal incision is sutured in transverse manner with interrupted stitches. This also done on medial leaf of peritoneum, the long mesosigmoid is shortened, root of the mesosigmoid is broadened and the mesocolic fibrous band is removed.

Percutaneous endoscopic sigmoid colostomy

In this procedure, colonoscope is inserted along with snare. Under local anaesthesia small incision is made in skin and a hollow needle is passed. Snare passes over the visualised needle to grasp it and then it is withdrawn with the wire and the colonoscope is delivered through anus. 20 Fr catheter is securely tied with the wire and pulled retrogradely. This procedure can be done for sigmoid volvulus, fecal incontinence, fecal constipation, for delivery of drugs and acute colonic pseudoobstruction. Crisp done first percutaneous deflation in cadavers using trocars.

Resectional Procedures

When the colon is gangrenous it is an indication for immediate resection. The various procedures are

1. Paul mikuliczs' operation
2. Primary resection with end to end anastomosis
3. Hartmann's procedure
4. Elective sigmoidectomy

Paul Mikuliczs Operation

It is a double barrelled colostomy formation. It relieves the condition and recurrence rate is reduced. Incision in the left iliac fossa is made. Sigmoid colon brought out. Resection of the colon is done outside the abdomen. The proximal and the distal ends are brought out as colostomy in the surface. It prevents the second major colostomy closure surgery. This is done when the bowel is gangreneous. The resection is carried out without detorsion. The general peritoneal cavity is not contaminated. The resection is carried without detorsion,so the toxic contents are not released into the general circulation.. The disadvantages are gangrene of the lower stump and several staged procedure. This procedure is no longer recommended.

It consists of three stages.

1. Mobilisation and exteriorisation of the gangrenous bowel, resection of bowel followed by double barrelled colostomy.
2. Crushing of the spur to sufficient length.
3. Closure of colostomy.

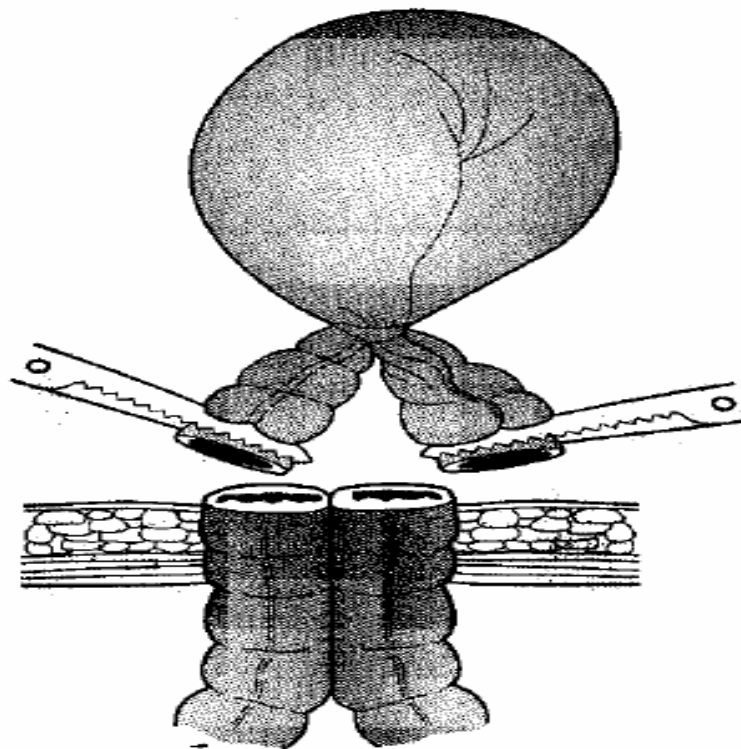


FIG5-showing Paul Mikulicz's Operation applied to volvulus of Pelvic colon

Primary Resection and Anastomosis

The redundant colon is excised completely and primary end to end anastomosis is done. This becomes the procedure of choice when the colon

is viable. Sutcliffe M.M.L said that resection is ideal against recurrence and it is also the treatment for recurrent volvulus. Wilson H (1965) said that early relief of acute obstruction before the colon becomes gangrene and curative resection of redundant sigmoid to prevent recurrence can be done by early primary resection of sigmoid colon. But in the presence of gangrenous bowel this procedure is questioned. Hughes in his article said that wall of the distal colon is hypertrophied and it offers best for anastomosis. The risk of leak is minimal as the proximal bowel contains hard feces prior to evacuation. De and Ghosh favoured RPA without colonic lavage for colonic resections in sigmoid volvulus. In stable patients RPA is recommended procedure. (Oren et al) RPA is questioned in emergency setting because of toxic condition of patient. The edema at the site of anastomosis, tension of anastomosis and spreading thrombosis of sigmoidal arteries discourage the use of anastomosis. The place to do anastomosis becomes a problem when the line of demarcation was not clear. In such cases Hartmann's procedure can be done. Bhatanagar et al showed 26% of patients with no clear line of demarcation. In such cases resection of colon was done, the proximal part brought as stoma and the distal end is closed. To conclude RPA can be done in hemodynamically stable patient where tension free anastomosis can be performed. It depends upon the hands of experienced surgeon.

Two controversies in RPA are

1. Role of on table colonic lavage
2. Role of proximal colostomy

On Table Colonic Lavage

The main considerations are preoperative mechanical bowel preparation and intraoperative colonic lavage. The idea of bowel preparation comes in favour of better operative environment of surgery and the healing capacity of anastomosis. It increases the perianastomotic collagen content of colon. The risk of spillage is minimised. But nowadays bowel preparation has been questioned. The main reasons are on table lavage increase the operating time. More volumes of fluid has been used. This lead to electrolyte abnormalities. There is a risk of spillage during lavage. Silm et al showed preoperative bowel preparation is detrimental to anastomosis. Sule et al showed low rate of leak in absence of colonic lavage. Many reports suggest that intraoperative colonic lavage has no added advantage in outcome of anastomoses. Muir described on table lavage in 1968. On table colonic lavage done by inserting sterile evacuation drain into the descending colon and the other end is passed off the field. Foleys Cathether is inserted into caecum or base of appendix. Sterile saline is flushed through Foleys. Volume of upto 10 liters is used until the clear effluent. Caecostomy

is closed upon irrigation or converted into tube caecostomy. Effluent tube is removed along with colon distally. And then anastomosis is performed.

Role of Proximal Colostomy

Colostomy has been done proximal to anastomosis to prevent leak. This has added advantage to the procedure. The distal anastomotic site can be studied through the stoma. Bhatanagar et al showed in his study that addition of proximal diversion colostomy did not add any significant survival in his patients. Different studies from India showed that diversion colostomy has reduced the early complications and mortality rates. The need for proximal colostomy has to be justified in future.

Hartmann's Procedure

The Length of the distal Bowel available may not permits its cut end being brought to the surface in this event. The distal cut end is oversewn in two layers and returned to pelvis (Leaving long non-absorbable suture to mark its position), while the proximal cut and brought out as an end colostomy. Intestinal continuity is again restored at a later date. But the procedure is usually technically more difficult than a mucus fistula has been formed.

Elective sigmoidectomy

Sankaran, V (1962) Goligher, J.C (1975), recommended an elective sigmoidectomy after a varying period of detorsion usually during the same

hospital stay. Elective resection, however is not free from objection, since this involves risk of another major surgical operation in an elderly patient. Many operative procedures to prevent recurrences of sigmoid volvulus are described is indicative that there is none which is ideal". The procedure to be ideal must be one that can be carryout as a primary procedure, which does not increase the morbidity and mortality, prevent recurrences, and should be very simple. A procedure that would be was – laparotomy, derotation and deflation of sigmoid colon using a Malecot's Catheter, create a temporary colostomy to ensure prevention of recurrences. This colostomy requires no colosure .

Laparoscopic Surgery for Sigmoid Volvulus

Treatment of sigmoid volvulus by laparoscopic resection has only limited value. Only elective resection of sigmoid has a role. This is useful in elderly and debilitated patients where minimally invasive surgery would be beneficial. Laparoscopic mobilisation becomes easier because of redundant omega loop. Stapled primary anastomosis is also easy because of shortened base of mesocolon.

Laparoscopic Assisted Resection

The patient is placed in supine position with legs supported by llyod davies stirrups. Carbondioxide pneumoperitoneum is established. Abdomen inspected with 10 mm trocar. Additional two trocar in right lower quadrant and two in left lower quadrant. Small bowel is pulled out of pelvis. Distal sigmoid colon and proximal rectum is retracted. If there are less

adhesions in root of mesentery, anastomosis is performed intracorporeally. If not extra corporeal anastomosis done. An incision of about 1.5 inches made in trocar site. Apex of sigmoid colon and entire colon is pulled through incision. Enterotomies are made in antimesenteric borders of colon and rectum. Anastomosis is established by GIA 60 tm instruments. The anastomosis is dropped back into abdomen. Colon is insufflated and checked for leaks.

Laparoscopic Sigmoid Resection

When the sigmoid mesentery is less scared, sigmoid resection can be performed. Proximal rectum, sigmoid and descending colon are mobilised medially. Then the presacral fascia is entered. Then intracorporeal transection of proximal rectum and division of sigmoid is done. The inferior mesenteric and superior haemorrhoidal arteries are preserved. The end of specimen and colon is pulled through incision. This has added advantage over laparoscopic assisted resection, but this can be done only in selected cases.

Prognosis Complications and Mortality

Prognosis and complications

The prognosis depends upon the rapidity with which gangrene develops in a given case and the mortality rate in sigmoid volvulus directly proportional to the incidence of the gangrene of the bowel. The major complications in volvulus , are gangrene and perforation.

Perforation

The most common site of obstructive perforation of the colon is the antimesenteric border of the caecum. There are instances where perforation has occurred to the gangrenous sigmoid resulting in fatal fecal peritonitis.

Post-operative complications

The post-operative complications include the following.

1. Aggravation of pre-operative toxemia
2. Uraemia with renal failure
3. Septicemia
4. Leakage from the anastomotic site
5. Wound sepsis
6. Paralytic ileus
7. Burst abdomen
8. Faecal fistula
9. Stricture formation at the anastomotic site
10. Bronchopulmonary and cardiac complications
11. Diarrhoea
12. Intraperitoneal abscesses
13. Thrombophlebitis
14. Electrolyte imbalance
15. Mal-absorption syndrome

Mortality

The mortality in the sigmoid volvulus is directly proportional to the incidence of the gangrene of the bowel, so says Hinshaw D.B.³⁷ The over all mortality in their study was 41%. The mortality in cases of non viable bowel was 75%.

Dean OG⁵⁵ write that delayed treatment and the development of gangrenous bowel in several cases greatly increased the mortality. The over all mortality was 15% and 66% in cases of gangrenous bowel in their series.

The highest mortality with sigmoid volvulus was seen in patients who had longest delays from onset to medical attention and from detection to management. Ironically delay was most in patients who resided in the hospital when volvulus occurred.

Botsford, W.T et al⁸³ write that mortality for sigmoid volvulus was 11.1%. But there were no deaths after resection. Chakrabarty P.B et al⁴⁷ report that the mortality in their series for viable sigmoid volvulus resection and anastomosis was attended with 15.2%, for gangrenous bowel it was 40.8%.

It was noted that patients with a shorter history has more sever torsion and gangrene. The mortality in case of gangrene was three times more.

Illnes et al⁵⁸ write that in their series, when the patients were follow up for a long time the mortality rate increased from 22% on the first hospitalization to 40% subsequently.

Bowel when turns gangrenous, increases mortality by many folds. In absence of gangrene the figures are low.

The other factors incriminated for the high mortality are delay in diagnosis in old patients who are having some, psychological or neurological derangement, in whom the volvulus of sigmoid colon is observed to be more prevalent.

Increases in the absorption of toxic material from the strangulated bowel (Wangensten)⁷² and profuse mucoid diarrhoea after derotation leading to hypokalemia.

Recurrence Rate

Drapans Theodore⁵⁷ report 116 episodes in 40 patients, 60% had 2 or more episodes of volvulus. While 9 patients (22%) had 5 or more episodes, on the whole they had 2.9 demonstrates the high recurrence rate. In all types of treatment there was recurrence with an interval of few days to five years, these were observed by Illness et al.⁵⁸ In their series a recurrence were observed by Illness et al. In their series a recurrence rate of 90 percent was noted i.e, 28 of 31 patients.

Brussagaard, C⁴³ noted that 31 out of 60 patients were readmitted with the same condition. Arnold's JG⁵⁴ study of 99 patients of sigmoid volvulus showed that a 55% of recurrence was seen, when non-definitive reduction was employed.

Arnold JG⁵⁴ quoted (Kerry, R.L⁵² Shepherd, J.J² Sutcliffe, M.M.L⁵⁶) that a recurrence rate of 20 percent to 90 percent exists after successful non operative reduction of sigmoid volvulus.

Anderson, JR and Lee, D⁶ Quote Hines, R.J. et al⁹¹ to make it clear that patients not under going colectomy had a increased morality from 22% after first hospitalization to 40% subsequently when followed.

Factors helpful in judging bowel viability

Bowel sounds were the most important features in distinguishing non viable bowel. Diarrhoea was not associated with gangrene. Only 2 of the 11 patients whose x-ray had been taken evidence of pneumoperitoneum. Sutcliffe, M.M.L⁵⁶ writes that it is very difficult to recognize clinically whether gangrene has occurred or not the features according to him which suggest gangrene are signs of peritonitis i.e. abdominal tenderness and guarding rise of leucocytes count, absent bowel sounds, shock and ill looking patients. The presence of the free gas on plain x-ray in erect position, and lastly discolouration, mucosal inflammation or ulceration or pain on sigmoidoscopy, suggests gangrene.

‘Pain is severe, continuous and unremitting, and the patient has no relief until such time as the nerves of the strangulated coil become poisoned or exhausted. The disappearance or abatement of pain in a clear out clinical picture of acute intestinal obstruction may have similar significance and may indicate that gangrene or perforation of the strangulated coil has eventuated or it may result from depending nervous of intense, toxemia or collapse.

METHODOLOGY

Source of Data

For the study, the patients admitted in emergency ward in all surgical units of Government Rajaji Hospital, Madurai and all surgical units of Government Rajaji Hospital, Madurai due to sigmoid volvulus.

The present work is a detailed study of 36cases of Sigmoid Volvulus, carried out as regards to the aetiological factors which predispose to the Sigmoid volvulus, the clinical features, modes of treatment and the out come. Particular stress has been laid on the various treatment.

The duration study was 2 years and was conducted between November 2010 to October 2012.

Inclusion Criteria

All the patients who are coming to surgical OPD to Government Rajaji Hospital, Madurai presenting with large bowel obstruction due to sigmoid volvulus.

Exclusion Criteria

All large bowel obstruction representing as emergency other than sigmoid volvulus is excluded.

A proforma was made for the study of these cases. The cases are subjected to a detailed clinical examination, and essential investigations

namely sigmoidoscopic examination if possible and X-ray of erect abdomen. And if possible CT scan of abdomen and pelvis is taken

A detailed history was obtained and examination was done. The history of presenting illness, past illness, related to bowel disorders, diet habits, constipation was taken and the detailed findings at physical examination were recorded. The x-rays were taken in all cases. Plain x-ray of abdomen in erect posture was of great diagnostic aid. This confirmed the diagnosis of sigmoid volvulus in most instances pre operatively. The treatment given, operative findings, complications, mortality and results of various types of operation and follow up (when ever possible) were recorded.

Various surgical procedures were performed. After the volvulus of sigmoid was diagnosed, in a few patients when clinically no evidence of gangrene was presents, the volvulus could be reduced with a flatus tube passed in knee elbow position. The index finger was inserted along the side of the flatus tube to guide and to prevent it from coiling within the rectum. The flatus tube was negotiated at the twist. In some cases this method was successful. If the volvulus could not be reduced in the above position it was tried with the patient in right and left lateral positions. When this method too failed, then it was decided to operate upon the patients.

The patients were administered intravenous solutions, mostly 5% Dextrose in normal saline. When feasible and desirable on clinical grounds, other electrolyte solutions were administered. In all patients general

anaesthesia administered. Antibiotic prophylaxis injection salbactam + ceftriaxone 1.5gm given at the time of induction of anaesthesia to bring down wound infection rate of post-operatively.

The abdomen was opened through a left lower paramedian incision when the diagnosis was confirmed preoperatively. The twisted gut was delivered out gently. Some times incision had to be extended to deliver the tremendously distended loop of the pelvic colon. The twist was examined for the number of turns and the direction in which twisting has taken place and untwisting done in opposite direction. In few cases it was necessary to puncture the gut and relieve distension to facilitate reduction. In cases where only simple untwisting was required nothing more was done and the abdomen was closed in layer without drain.

In some cases, the colon was fixed to the antero-lateral abdominal wall with non absorbable suture material. .

In cases of gangrene, primary resection and anastomosis was done. In some others exteriorisation of the gangrenous loop was performed. At a later date, colon continuity was restored

If the colon is viable, primary resection and anatomises has been done. In some cases proximal colostomy has been done to prevent anastomotic leak. The anastomosis technique followed is single layer full thickness intermittent sutures. It has been done with absorbable material like vicryl. Meticulous attention has been given to viable margins of ends of

anastomosis. Hartmann's procedure was done when the bowel is gangrenous. The distal stump closed and proximal bowel brought as end colostomy. Colostomy closure was done on later stage.

Post operatively all the patients received Dextrose Saline, 5% Dextrose and blood, if required. Inj. Ceftriazone + Salbactam 1.5gm was given intravenously 12th hourly. If Bowel was viable. Inj. Amikacin 500mg was administered intravenously in the appropriate divided doses, 12th hourly..In addition, I.V. Metronidazole solution was administered. 500mg, 8th hourly for seven to ten days in gangrenous bowel.

Patients were kept nil orally till the return of bowel sounds and during this period nasogastric suction was carried.

After appearance of bowel sounds, sips of oral fluids were given. This was increased in quantity, gradually tea, and fruit juices, then semisolid and solid food were given if the post operative period was uneventful.

Stitches were removed usually on 10th day of operation depending upon wound healing. Patients were followed up for colostomy closure after discharge.

RESULTS

In this series of 36 cases, all the patients who presented with distention of abdomen with acute symptoms, and diagnosed to have sigmoid volvulus were included in the study.

Incidence

Males were affected twice the time of females, 24 and 12 cases respectively.

It would appear that sigmoid volvulus occurs almost with equal frequency between the age groups 21-30 years, 31-40 years these groups accounted for 27.6% of patients. The maximum number i.e. 36.1% were belonging to 41-50 age group. The disease 2nd common in 51-60 years i.e. 19.4% This disease is very uncommon below the age of 20 years and above the 70 years

Table-1: Showing Age distribution of cases

GE in years	Total No	Percentage
1-10	-	-
11-20	-	-
21-30	5	13.8
31-40	5	13.8
41-50	13	36.1
51-60	7	19.4
61-70	3	8.3
71-80	3	8.3

Figure-6: Showing Age distribution of cases.

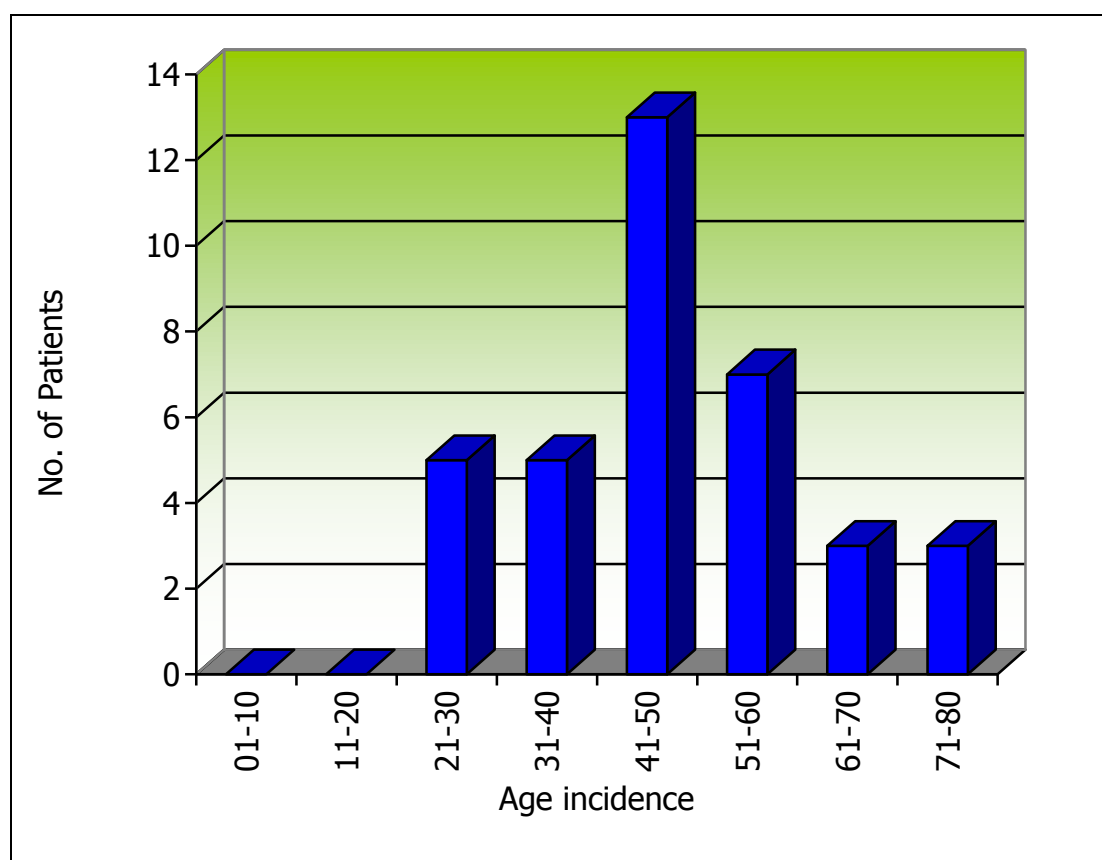
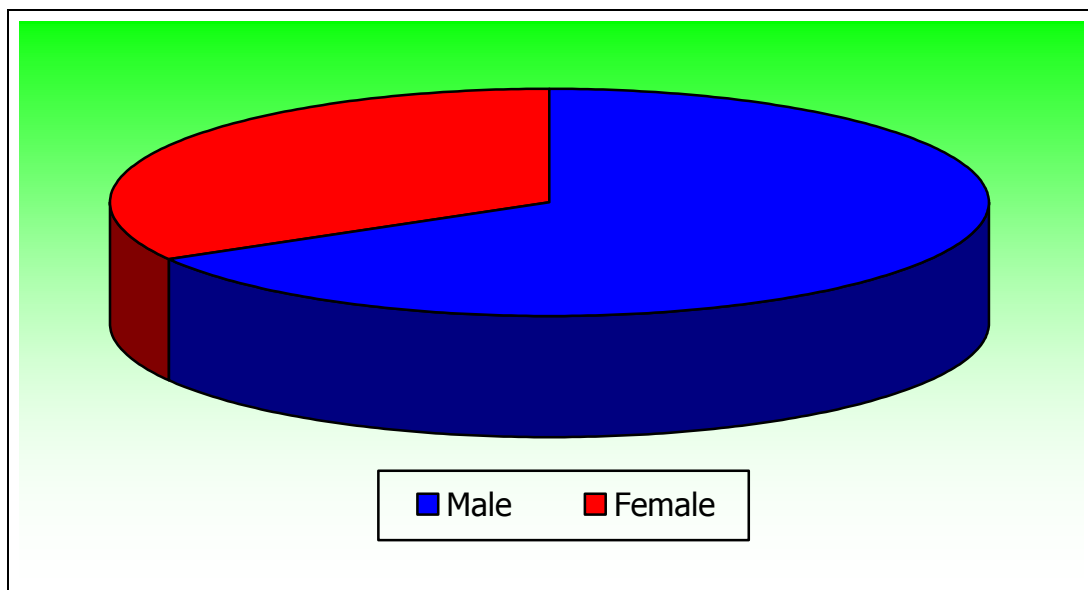


Table-2: Showing Sex distribution of cases

Sex	Number(n=36)	Percentage
Male	24	66.6
Female	12	33..3

Figure-7: Showing Sex distribution of cases

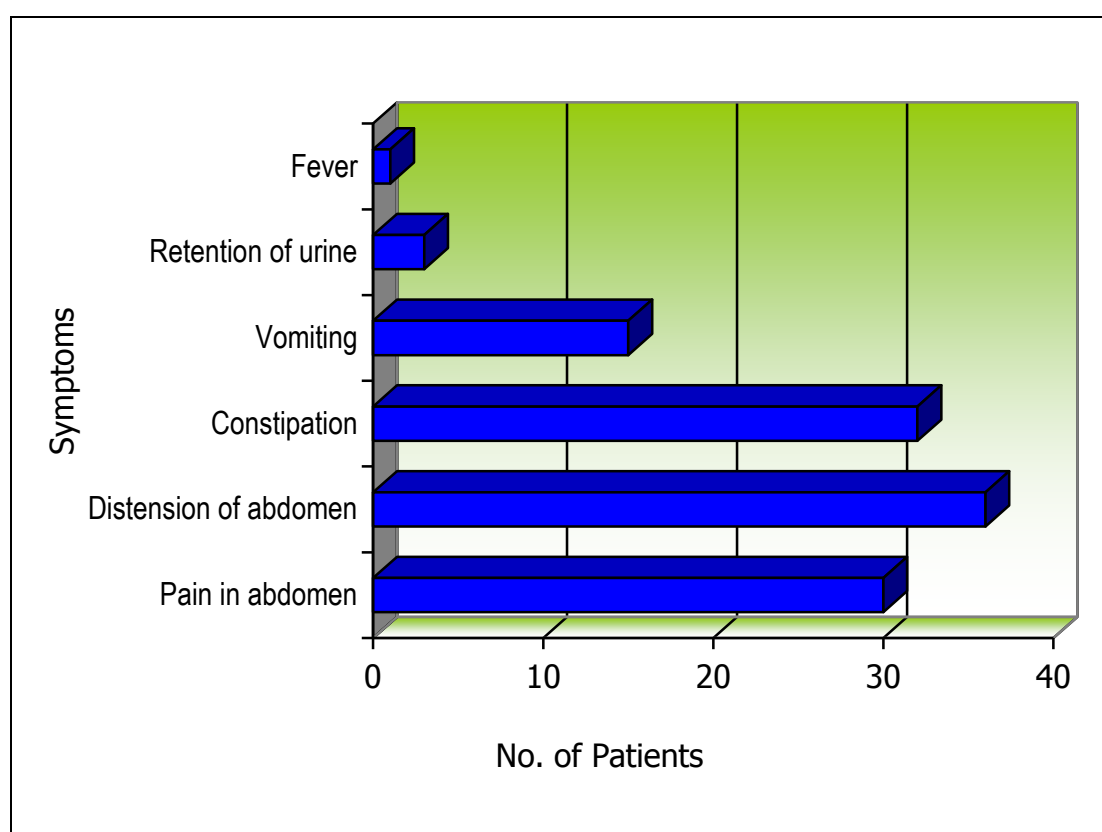


Males are affected twice as females.

Table-3: Showing modes of presentation

Symptoms	No. of patients	Percent
Pain abdomen	30	83
Distension of abdomen	36	100
Constipation	32	88
Vomiting	15	42
Retention of urine	03	8
Fever	01	3

Figure-8: Showing modes of presentation

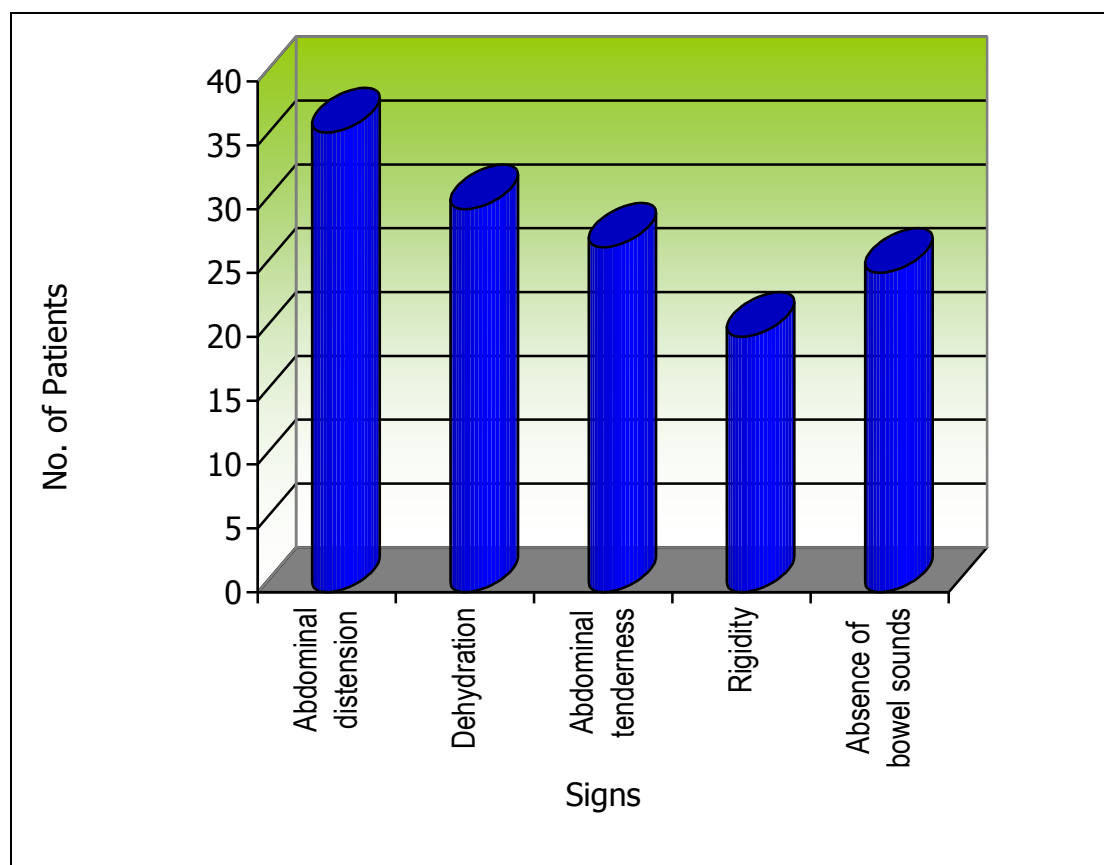


In the present study distention of the abdomen (100%) was the commonest symptom followed by constipation (88%) and pain abdomen (83%).

Table-4: Showing physical findings

Signs	No. of Cases	Percent
Abdominal distension	36	100
Dehydration	30	83
Abdominal tenderness	27	75
Rigidity	20	55
Absence of bowel	25	70

Figure-9: Showing physical findings

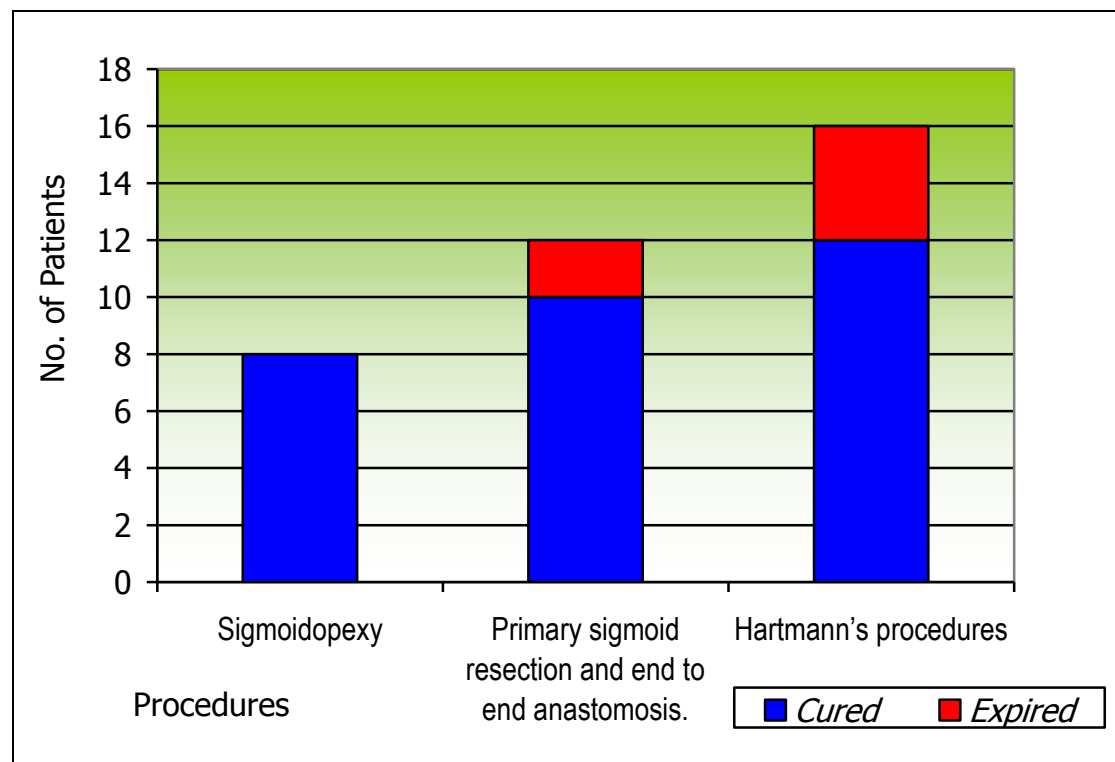


In present study abdomen distention (100%), Dehydration (83%) was the commonest physical findings followed by Abdominal tenderness (75%) and absence of bowels sounds (70%).

Table-5: Showing various types of surgery performed and outcome of the procedure

Procedure	No. Patients	%	Cured	Expired
Sigmoidopexy	8	22	8 (100%)	-
Primary sigmoid resection and end to end anastomosis.	12	34	10 (83%)	2 (17%)
Hartmann's procedures	16	45	12 (75%)	4 (25%)

Figure-10: Showing various types of surgery performed and outcome of the procedure



When the bowel was viable 56%, the procedure performed is either sigmoidopexy or resection and anastomosis. All patients survived in sigmoidopexy group. there were two deaths in resection and anastomosis group. Mortality rate is 17% in this group.83%survived in this group. Amongst the patients with gangrenous bowel. 45% all patients underwent

Hartmann's procedure. The 75 % patients were survived. Four patients were dead. mortality rate is 25% in this group.

Table-6: Showing wound infection in different types of procedure

Procedure	Wound Infection	Percent
Sigmoidopexy(8)	1	12.5%
RPA (12)	3	25%
Hartmann's (16)	11	68%

RPA-Resection And Primary Anastomosis.

Wound infection rate was higher in patients who underwent Hartmann's procedure and least in patients who undergone sigmoidopexy.

Figure-11: Showing wound infection in different types of procedure

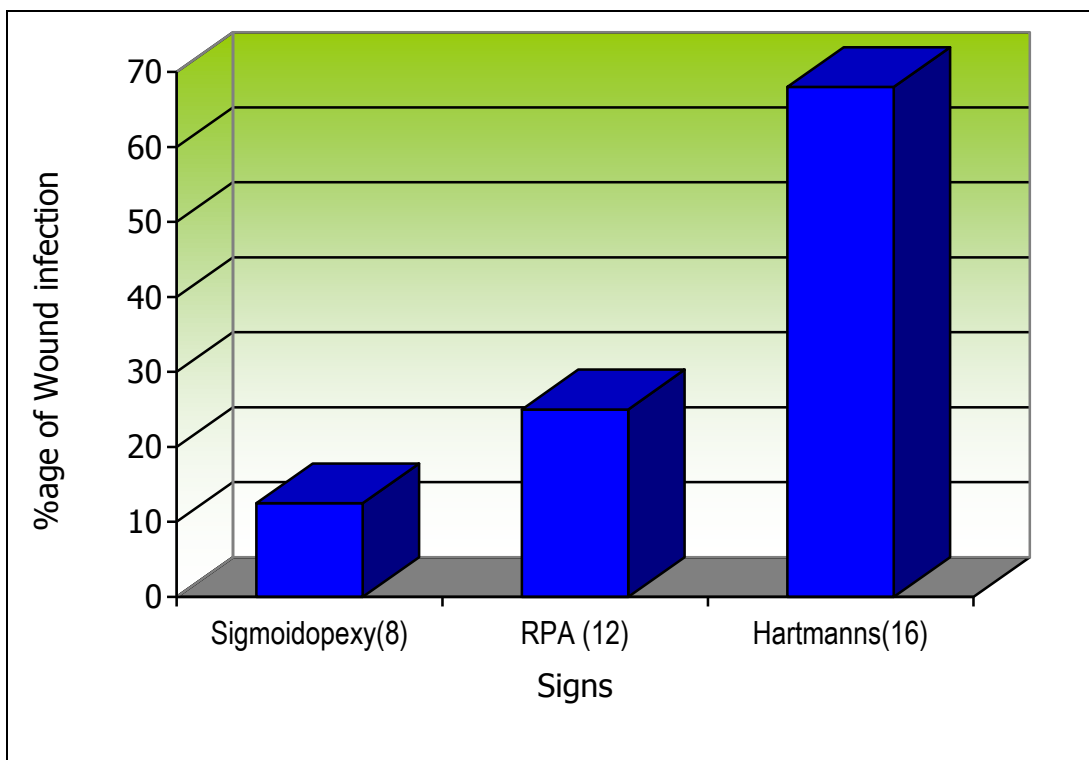
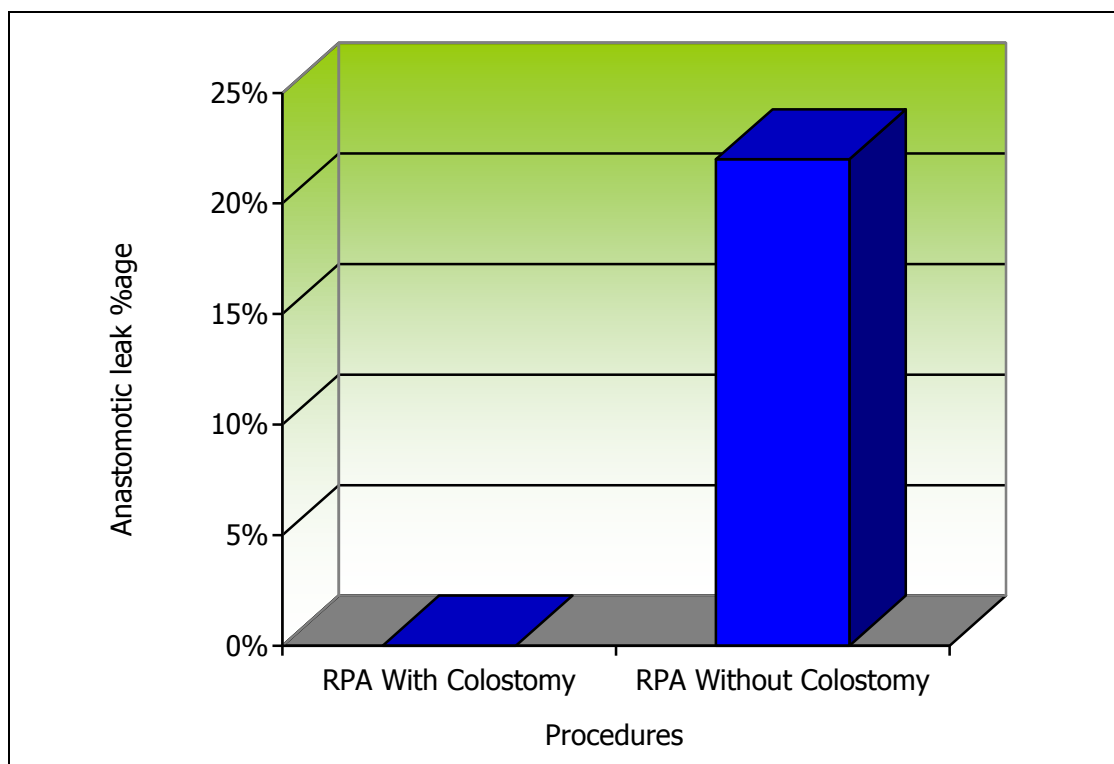


Table-7: Showing anastomotic leak in resection and anastomosis

Procedure	No of cases	Anastomotic dehiscence
RPA With Colostomy	3	NIL(0)
RPA Without Colostomy	9	2(22%)

RPA-Resection and Primary Anastomosis.

Figure-12: Showing anastomotic leak in resection and anastomosis



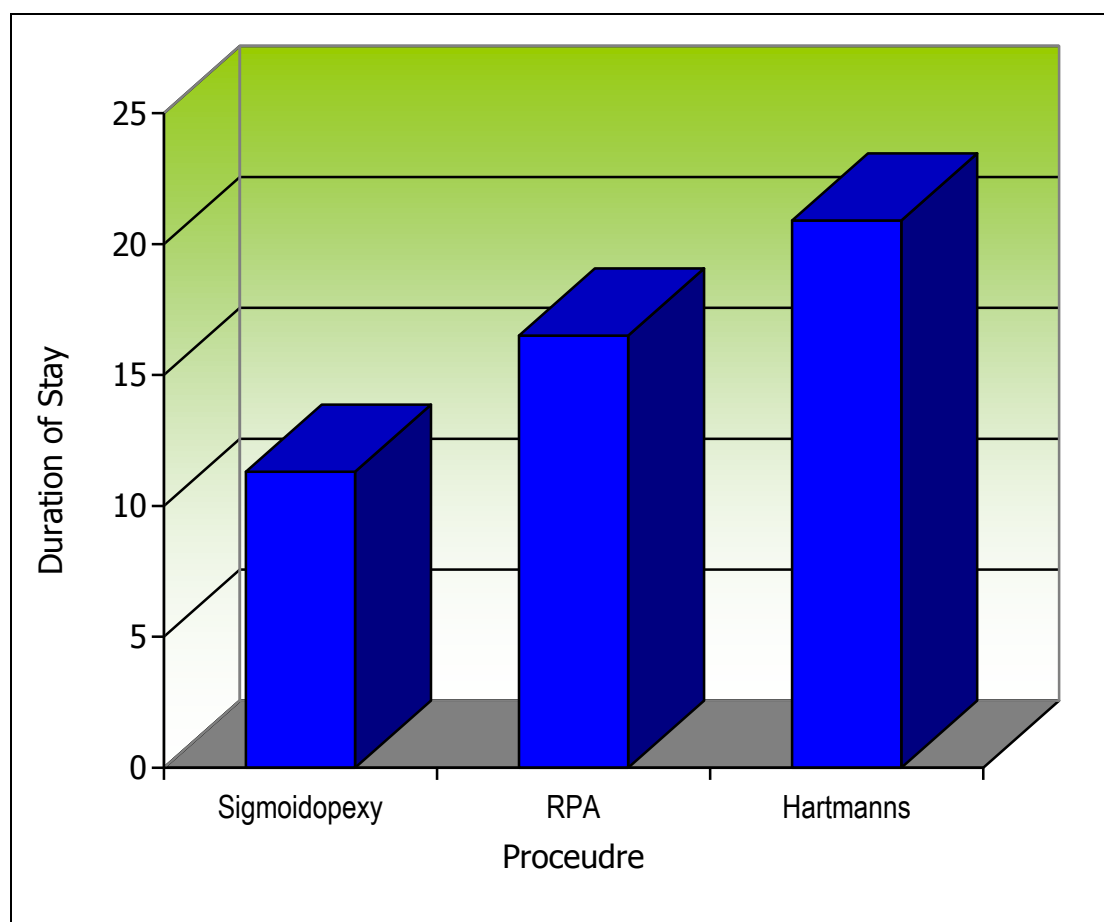
There was no leak in patients who undergone resection and primary anastomosis with proximal colostomy. there was 22% leak in anastomosis without colostomy. colostomy closure was done at later stage

Table-8: Showing mean duration of stay in various procedures

Procedure	Duration of stay
Sigmoidopexy	11.3 Days
RPA	16.5 Days
Hartmann's	20.9 Days

RPA-Resection And Primary Anastomosis.

Figure-13: Showing mean duration of stay in various procedures

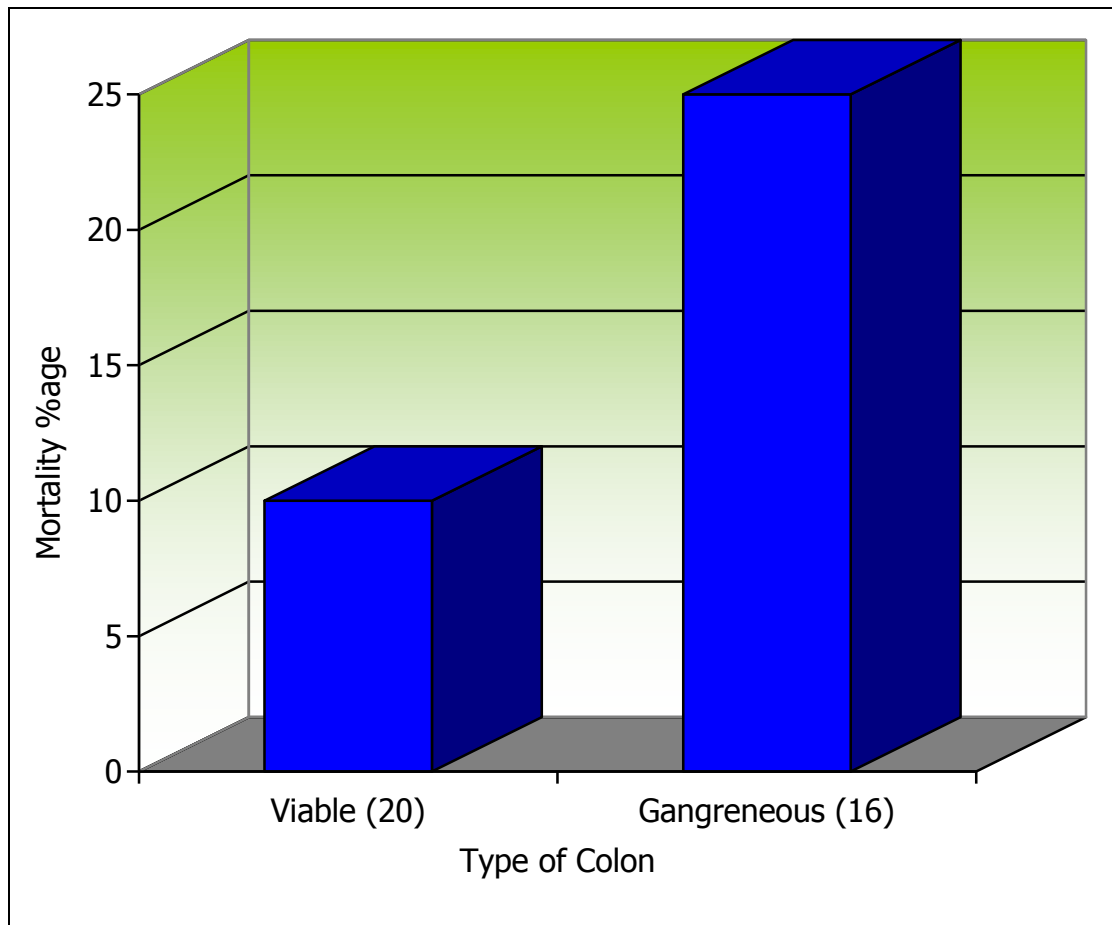


The mean duration of stay in hospital was least for sigmoidopexy patients and higher for patients undergone Hartmann's procedure

Table-9: Showing mortality in viable and gangrenous colon.

Colon	No. of Cases	Death	Mortality%
Viable	20	2	10
Gangrenous	16	4	25

Figure-14: Showing mortality in viable and gangrenous colon.



DISCUSSION

A total of 36 cases of sigmoid volvulus has been analysed. Age, symptoms, sex, signs investigations and operative findings are analysed. Different surgical options for sigmoid volvulus has been compared with each other.

Age

Akhtar Munir et al showed a mean age of 63 years in his study. Age range is between 48-70 years and it is very rare in children. Khanna AK et al in his study showed 51 years as the mean age. G.Jumbi et al showed a mean age of 48 years. So sigmoid volvulus is common in 4th to 5th decade. In our study the incidence is peak in 41-50 years.

Sex

The male to female ratio is variable. In general there is male predominance than females. In our study males are affected more than females.

Signs and symptoms

The main symptom of sigmoid volvulus in our study is abdominal distention which is the most common symptom. It is also the most common sign.

Diagnosis

All most all our cases has been diagnosed clinically and with the help of X-rays. The typical coffee bean sign helps in the preoperative diagnosis. In some chronic cases CT scan of abdomen and pelvis helped in the diagnosis. Signs of septicaemia which is indicative of gangrenous colon has been noted preoperatively and it has been managed accordingly.

Treatment

The treatment of sigmoid volvulus has been varied. These variation depended on many factors, such as general health of the patient prior to the onset of the disease. Condition at the time of operation, availability of ancillary help such a blood. Investigations facility, good anaesthetist, and individual preference of the surgeon. The fact that many operative procedure have been described in the treatment of sigmoid volvulus, would probably mean that no single operation is suitable in all patients or there is difference in the outlook of pattern of diseases.

There are two basic problems in management of the patients. There is a high incidence of recurrence of sigmoid volvulus after the commonly performed procedures such as rectal tube deflation, sigmoidoscopic deflation. Laparotomy and simple derotation, and operative derotation and fixation of the “omega loop” to the lateral or anterior abdominal wall or the transverse colon. High incidence of postoperative recurrence has been noted. Resection and end to end anastomosis as an emergency procedure,

in an un prepared bowel, in conditions like that make the situation far from ideal and in our under nourished patients has its own price in the increased morbidity and mortality. Sigmoidopexy, simple fixation of the colon to the intraabdominal structures can be effective procedure in viable redundant colon. The mortality and morbidity is almost nil in this procedure. The main problem associated with this procedure is recurrence. This can be done safely in elderly debilitated patients. In primary resection and anastomosis there are different studies showing variable cure rates and mortality rates. This is the gold standard procedure when colon is viable. The main problem is anastomotic leak. This can be prevented either by covering proximal colostomy and general condition of the patient. Wound infection rates are decreasing with this type of procedure. This is the procedure of choice in young patients with viable colon.

Hartmann's procedure: this is life saving procedure in emergency conditions when the bowel is gangrenous. This removes the part of colon and also relieves the sepsis. The main problem is patient needs second major surgery i.e. colostomy closure and larger wound infection rates. This is done in elderly patients with gangrenous bowel. Non resectional procedures should be tried in all cases of sigmoid volvulus with viable colon. This has acceptable mortality and morbidity rates. Sigmoidoscopic intubation can be tried when facilities and experts are available.

In our study resection and primary anastomosis with proximal colostomy has showed no anastomotic leak. This can be safely done in gangrenous colon where chances of leak are high. But the need for proximal colostomy in cases of viable colon is still questionable. Two patients showed anastomotic leak in resection and primary anastomosis. They are managed conservatively and the leak rate gradually reduced. All cases of anastomosis has been done with unprepared bowel.

Hartmann's procedure though done in gangrenous colon, has its own significant mortality and morbidity rates. Among the various procedures done in our hospital ,this procedure has high mortality and high wound infection rates. Also the need for second major surgery demands this procedure in future.

CONCLUSION

Emergency laparotomy conducted in all the cases. Sigmoid volvulus is more common in males than females and highest incidence in 5th and 6th decade of life. Sigmoid volvulus constituted 10-15% of the total large bowel obstructions.

The outcome of the surgical procedures like derotation and fixation to abdominal wall and lateral abdominal wall fixation had almost similar results. These procedures were carried out in viable bowel.

Mortality was observed to be higher in procedures like resection anastomosis and Hartmann's procedures which were carried out in viable and gangrenous bowel.

Our patients were elderly debilitated patients, prior to the onset of the volvulus. An absence of associated diseases was notable features.

Understandably, the mortality was more in patients with gangrene than without gangrene.

. Diagnosing preoperatively by clinically and X-rays helps in prompt management of sigmoid volvulus early.

When the sigmoid colon was viable, resection end to end anastomosis was carried out. This has lower mortality than Hartmann's procedure. But resection end to end anastomosis can be done in gangrenous bowel also.

In old debilitated patients, with associated gangrenous bowel Hartmann's procedure was conducted. This has got high mortality..

The over all mortality was 17.5% in this series.

ANNEXURES

BIBLIOGRAPHY

1. Bolt DE. The management of volvulus of the sigmoid colon. Br J Surg. 1956; 44: 172-5.
2. Shepherd JJ. The epidemiology and clinical presentation of sigmoid volvulus. Br J Surg 1969; 56: 353-9.
3. Hiltunen KM, Syrja H, Matikainen M. Colonic volvulus: diagnosis and results of treatment in 82 patients. Eur J Surg 1992; 158: 607-11.
4. Kahi CJ, Rex DK. Bowel obstruction and pseudo-obstruction. Gastroenterol Clin North Am 2003; 32:1229-47.
5. Mangiante EC, Croce MA, Fabian TC, et al, Sigmoid volvulus. A fourdecade experience. Am Surg. 1989; 55: 41-4.
6. Anderson JR, Lee D. The management of acute sigmoid volvulus. Br J Surg 1981; 68: 117-20.
7. Brothers TE, Strodel WE, Eckhauser FE, Endoscopy in colonic volvulus. Ann Surg 1987; 206: 1-4.
8. Peoples JB, McCafferty JC, Scher KS. Operative therapy for sigmoid volvulus. Identification of risk factors affecting outcome. Dis Colon Rectum 1990; 33: 643-6.
9. McDonald CC, Boggs HW Jr. Volvulus of the sigmoid colon. South Med. J. 1975 Jan; 68(1)55-8.

10. Rennie J.A. Peptic ulceration and sigmoid volvulus in India. *Ann. R Coll Surg Engl.* 1981 Mar;63(2):105-7.107
11. Ballantyne GH. Sigmoid volvulus: high mortality in county hospital patients. *Dis Colon Rectum.* 1981 Oct; 24(7):515-20.
12. Ballantyne GH. Brandner MD, Beart RW JR et al. Volvulus of the colon. Incidence and mortality. *Ann. Surg.* 1985 Jul; 202(1):83-92.
13. Salim AS. Percutaneous deflation and colopexy for volvulus of the sigmoid colon: a new approach. *J R Coll. Surg. Edinb.* 1990 Dec; 35(6)356-9.
14. Gibney EJ. Volvulus of the sigmoid colon. *Surg. Gynecol Obstet.* 1991 Sep; 173 (3): 243-55.
15. Almog Y, Dranitzki-Elhalel M, Lax E et al. Sigmoid volvulus presenting as chronic secretary diarrhea responsive to octreotide. *Am J Gastroenterol.* 1992 Jan;87 (1): 148-50.
16. Asbun H J, Castellanos H, Balderrama B et al. Sigmoid volvulus in the high altitude of the Andes. Review of 230 cases. *Dis Colon Rectum.* 1992 Apr; 35 (4):350-3.
17. Moore JH, Cintron JR, Duarte B et al. Synchronous cecal and sigmoid volvulus. Report of a case. *Dis colon Rectum.* 1992 Aug; 35(8): 803-5.
18. Subrahmanyam M. Mesosigmoplasty as a definitive operation for sigmoid volvulus. *Br J Surg* 1992 Jul; 79 (7): 683-4.

19. Diaz-Plasencia J, Sanchez C, Bardales M et al. Operative mortality in sigmoid volvulus. *Rev Gastroenterol Peru*. 1993; 13 (1) : 37-44. 108
20. Diaz-Plasencia J, Rebaza-Iparraguirre H. An index of the severity of intestinal gangrene due to colonic volvulus. *Rev. Gastroenterol Peru*. 1993 May-Aug; 13 (2): 96-104.
21. Koto Z. Spontaneous untwisting in sigmoid volvulus – the case for ‘prophylactic’ surgery. A report of 3 cases. *S Afr J Surg*. 1994 Sep; 32 (3): 94-6.
22. Kocak S, Gecim E, Kesenci M et al. Treatment of acute sigmoid volvulus. *Acta Chir Belg*. 1995 Jan-Feb; 95(1):59-62.
23. Kiviniemi HO, Makela JT. Metachronous cecal and sigmoid volvulus. *Ann Chir Gynaecol*. 1997; 86 (4): 364-6.
24. Jagetia A, Verma S, Mittal D et al. Sigmoidopexy (tube sigmoidostomy) as definitive surgical procedure for sigmoid volvulus. *Indian Jr Gastroenterol*. 1998 Oct-Dec; 17 (4): 129-30.
25. Chung YF, Eu KW, Nyam DC et al. Minimizing recurrence after sigmoid volvulus. *Br J Surg*. 1999 Jul; 86 (7): 966-7.
26. Khanna AK, Kumar P, Khanna R. Sigmoid volvulus: study from a north Indian hospital. *Dis Colon Rectum*. 1999 Aug; 42(8):1081-4.
27. Dulger M, Canturk NZ, Utkan NZ et al. Management of sigmoid colon volvulus. *Hepatogastroenterology*. 2000 Sep-Oct; 47 (35):1280-3.

28. Puneet, Khanna R, Gangopadhyay AN et al. Sigmoid volvulus in childhood: report of six cases. *Pediatr Surg Int.* 2000; 16 (1-2):132-3. 109.
29. Pinedo G, Kirberg A. Peroutaneous endoscopic sigmoidopexy in sigmoid volvulus with T-fasteners: report of two cases. *Dis Colon Rectum.* 2001 Dec; 44 (12): 1867-9.
30. Echenique Elizondo M, Amondarain Arratibel JA. Colonic volvulus. *Rev Esp Enferm Dig.* 2002 Apr; 94 (4) 201-10.
31. De. U. Sigmoid volvulus in rural Bengal. *Trop Doct.* 2002. Apr; 32(2): 80-2.
32. Connolly S, Brannigan AE, Heffeman E et al. Sigmoid volvulus: a 10 year audit. *Ir J Med Sci* 2002 Oct-Dec; 171(4): 216-7.
33. Bhatnagar BN, Sharma CL, Gautam A et al. Gangrenous sigmoid volvulus: a clinical study of 76 patients. *Int J Colorectal Dis.* 2004 Mar; 19 (2): 134-42.
34. Atamanalp SS, Yildirgan MI, Basoglu M et al. Sigmoid colon volvulus in children: review of 19 cases. *Pediatr Surg Int.* 2004 Jul; 20(7):492-5.
35. Raveenthiran. V. Observations on the pattern of vomiting and morbidity in patients with acute sigmoid volvulus. *Journal of postgraduate Medicine,* 2004; 50(1): 27-29.
36. De Utpal, Kamal De K. Case Report-Sigmoid volvulus complicating pregnancy. *Indian Journal of Medical Sciences,* 2005; 59(7):317-319.

37. Hinshaw, DB, Carter R. Surgical Management of acute volvulus of the sigmoid colon. *Ann Surg* 1957; 146:52-60
38. Campbell, D.A, and Smith, R.G. The diagnosis and treatment of volvulus of the sigmoid colon, *Surg Clin North Amer.* 1950, 30: 603-611. 110
39. Griffin, W.D., Barton J.R. and Meyer, K.A. "Volvulus to the sigmoid colon, a report of 25 cases. "*Surg Gynec Obstet* 1945;181, 287.
40. Pool, R.M, and David, W. Dunavant volvulus of the sigmoid colon *Ann Surg.* 1951; 133: No.5, 719-25.
41. Perlmann. (*Arch. f Klin, Chir*, 137; 245, 1925) quoted by Maingot, R. 1955.
42. Scott J, Martin, J.P. Volvulus of sigmoid in elderly patients: *Amer J Surg.* 151.
43. Brussgaard, C: "Volvulus of the sigmoid colon and its treatment". *Surg*, 1947; 22: 466-78.
44. Sawyer Robert Bruce, Kenneth, C. Sawyer. Volvulus of the colon. *Amer Jr Surg.* 1962;104: 468-73.
45. Hall-Craggs, EC. Sigmoid volvulus in an African population. *Birt. Med. Jr.* 1960; 1:1015-7.
46. Vick, R.M. "Statistics of acute intestinal obstruction", *Brit. Med. Jr*, 1934;2:546.

47. Chakrabarty, P.B., Rath, G.C., Senapati, N.B. et al. Acute large gut obstruction. *Ind Jr Surg.* 1979; 7: No.7 and 8, 113-116.
48. Anderson, D.A. volvulus, *Ind Jr Surg*, 1954; 16: 25.
49. Jain, B.L., Seth, K.K: Volvulus of Intestine, A clinical study, *Indian. Jour. Surg.* 1968; 30:239-246.
50. Kamata Prasad Bhargava. Clinical aspects of acute Intestinal obstruction. *Ind Jr Surg*, 1947; 9: 60-71. 111
51. Avots Avotins, V. Karlis, Waugh, E. David. Colon volvulus and the geriatric patient, *Surgical Clinics of North America*, 1982; 62: No.2, 249-260.
52. Kerry, R. L. and Ransom, H. K. volvulus of the colon. Etiology, diagnosis and treatment. *Arch. Surg.* 1969;99: 215-222.
53. Anderson A, Berdhal, Vander Linden. Volvulus of Caecun, *Analysis of Surgery*, 1958; 187: 876-880.
54. Arnold GJ, Nance, FC. Volvulus of the sigmoid colon, *Ann Surg.* 1973;177:No.5,527-34.
55. Dean O. Gilbert, Murray, J.Warren.: Volvulus of the sigmoid colon. *Ann. of Surg.* 1952;135: No.6, 830-838.
56. Sutcliffe M.M. Volvulus of the sigmoid colon. *Brit Jr Surg*, 1968; 55: No.12, 903-910.
57. Drapanas T, Stewart D J. Acute sigmoid volvulus. *Amer Jr Surg* 1961;101:70-1.

58. Illnes, Geurkink, Bass. Recurrence and mortality rates in sigmoid volvulus. *Surg. Gyn. Obst.* 1967;124:547-573.
59. Sankaran V. Volvulus in South India, *Ind Jr Surg*, 1962; 24: 784-90.
60. String S T, DeCosse JJ. Sigmoid volvulus. An examination of the mortality. *Amer Jr Surg* 1971; 121: 293-297.
61. Smith-Kirby, H.T., Gatling, R.R. volvulus of the sigmoid colon. *Ann. Surg*, 1948; 128: No. 5, 1023-1027.
62. Sturzaker, H.G. Lawrie, R.S. and Joiner, C.L. Recurrent sigmoid volvulus in young people: A missed diagnosis. *Brit M Jr*, 1975; 4: 338, 39. 112
63. Ojha, D.J. "Volvulus of small intestine" *Ind. Jr. Surg.* 12: 42-50.
64. Burkitt Denis. No relation of sigmoid volvulus to fibre content of African diet. *The New Eng. Jour. of Med.* 1981; 304: No.15, 914.
65. Sriram Krishan, William, Schumer, Seymour Ehrenpreis, et al. Phenothiazine effect of gastrointestinal tract function. *American Journal of Surgery.* 1979;137:87-91.
66. Inderbir Singh *Human Embryology.* 7th edition. Published by Rajiv Beri for Macmillan. New Delhi India.. 2004;p.169-176
67. Lawrence H. Bennister, *Alimentary system, Gray's Anatomy* 38th edition. Harcourt publisher, Churchill Livingstone. 2000; p.1777.
68. Richard S. Snell. *Clinical Anatomy* 7th edition 2004;p.206- 216.

69. Metheney David and Nichols, H.E. Volvulus of the sigmoid. Surg. Gynec. and Obst. 1943;76: 239-46,.
70. William. F. Ganong. Review of Medical Physiology 21st edition, Lange Medical Publications. 2003 p.512-515.
71. Guyton and Hall. Textbook of Medical Physiology 10th edition. Published by Elsevier, New Delhi. India. 2003; 65: 762-769.
72. Wangensten: Intestinal Obstruction, IIIrd ed. Charles C. Thomas. Publishers, Springfield, Illinois, 1955.
73. Gerwig H. Walter. Volvulus of the colon: The Surgical Clinic of North America, 1995; 403.
74. Robinson Pathologic Basis of disease 7th edition 2005.p.856. 113
75. Gastro intestinal tract Harshmohan "Textbook of Pathology, 3rd edition 1998. Jaypee Brothers Medical Publishers. New Delhi.1998; 17. 669-670.
76. Macfarlane S: Human colonic microbiota: Ecology physiology and metabolic potential of intestinal bacteria. Scand J Gastroenteral suppl. 1997; 2223-29.
77. Suarez F, Furne J, Springfield J, Levitt M, Insight in to human colonic physiology obtained from the study of flatus composition. Am. J. Physion. 272 (5 patients 1) 1997; G.1028, G.1033.

78. Mika N. Sinanan, Carlos A. Pellegrini, "Large Bowel obstruction". "Operative procedures". Maingot's Abdominal Operations, 10th edition. Appleton and Lange publication, USA.1997; volume II, 1404-1405,
79. Dr. S.Das, A Concise Textbook of Surgery. 3rd edition. Published 13 old Mayors Court Calcutta, India. 2004;1030 -1032.
80. Kelli M. Bullard; David A. Rothenberger., Colon, Rectum, and Anus. Schwartz's "Principles of Surgery" 8th Edition, McGraw Hill publication, New York.2005; p. 1098.
81. Najja Mahmoud, John Rombeau, Howard.M. Ross et al. "Colon and Rectum". Sabiston Textbook of Surgery. 17th edition, published by Elsevier, New Delhi. India. 2005; Vol.2: p.1422-1424
82. D.C.C. Bartolo, J.M.S. Johnstone, I.B. Marleod, R.F. Rintoul "Operations on the intestines" Farguharson's Textbook of operative surgery, 8th edition. Churchill Livingstone.1995; p.470-471.114
83. Botsford. T.W., Healey, S. J. Volvulus of Colon, Amer. J. Surg., 1967, 114: 900-903.
84. Aird, I : A companion in surgical studies, E. & S. Livingston LTd., Edin. & Lond.1958;p. 219.
85. Wilson, H. and Dunavant, W.D. Volvulus of the sigmoid colon. Surg. Clin. North Amer., 1965, 45: 1245-1251.
86. Goligher, J.C. "Surgery of the Anus, Rectum and Colon." 3rd Edition, Bailliere Tindall and Co., London, 1975, p.1134.

87. Tanga, M.R., Sigmoid Volvulus: A new conception treatment. American Journal Surgery, 1974;128: 119-121.
88. Shapiro, S. W., Mason E. E.: Ileus as a cause of volvulus of the sigmoid. Review of results of management. Surgery, 1957, 41: 512-521.
89. Wuepper, K.D. Otteman, M. G., Stablgren, L.H.: An appraisal of operative and non-operative treatment of sigmoid volvulus. Surg. Gynaecol. & Obstet., 1966, 122: 84-88.
90. Hines, R.J, Geurkink RE, Bass RT. Recurrence and mortality rates in sigmoid volvulus. Surg. Gynaecol Obstet 1967;124: 567-570.
91. el bushra ahmed doumi; emergency laparotomy for sigmoid volvulus; Sudan JMS vol 2 no 3 Sep 2007
92. Akhtar Munir management of viable sigmoid volvulus by mesosigmoidoplasty. Gomal journal of medical sciences Jan June 2009 vol 7 no 1
93. Michael safioleas ; Clinical considerations in elderly;wjg 2007 feb 14
94. Roberto cirocchi ;surgical timing and mortality of sigmoid volvulus;wjes 2010 5:1
95. G. Jumbi; emergency resection of sigmoid volvulus; east african medical journal vol 85
96. Suleyman; long term clinical outcome in sigmoid volvulus.sajs vol 50 no 1

97. Amabra; sigmoidopexy and tube sigmoidostomy; Nigerian health journal
vol 12 no 1
98. J.J. Shephed ;treatment of sigmoid volvulus; bmj 1968
99. Akshay d baheti; ileosigmoid knot a case report;ijri may 2011 vol 12
issue 2
- 100.Levsky J M,ct findings of sigmoid volvulus:AJR AM J,2010 jan ;194
- 101.Khan and Rehman:sigmoid volvulus in pregnancyand puerperium
Wjes 2012:7:10

MASTER CHART

Patients History

Sl.No.	Name	Age	Sex	IP No.	Intraoperative findings	Procedure done	Wound infection	Anastomotic leak	Stoma closure	Total duration of stay	Death
1.	Rajendran	45	M	1621	Gangrenous Colon	Hartmann's	Yes	No	Yes	15	No
2.	Anbalagan	40	M	43934	Viable Colon	RPA & Colostomy	No	No	Yes	12	No
3.	Joseph	40	M	48985	Gangrenous Colon	Hartmann's	No	No	Yes	18	Yes
4.	Nagu	61	M	41893	Gangrenous Colon	Hartmann's	Yes	No	Yes	19	No
5.	Selvakumar	30	M	8221	Gangrenous Colon	Hartmann's	No	No	Yes	20	No
6.	Pappu	22	M	37041	Viable Colon	RPA	No	Yes	No	24	No
7.	Alagammal	80	F	45032	Viable Colon	RPA	Yes	No	No	16	No
8.	Seeniammal	49	F	8278	Gangrenous Colon	Hartmann's	No	No	Yes	20	No
9.	Ganesan	40	M	16148	Gangrenous Colon	Hartmann's	Yes	No	Yes	23	No
10.	Murugan	50	M	78851	Gangrenous Colon	Hartmann's	Yes	No	Yes	20	No
11.	Perumal	25	M	90584	Redundant Colon	Sigmoidopexy	No	No	No	12	No
12.	Murugan	38	M	84174	Redundant Colon	Sigmoidopexy	No	No	No	14	No
13.	Muthukrishnan	60	M	49318	Gangrenous Colon	Hartmann's	Yes	No	Yes	19	No
14.	Antoniammal	52	F	77634	Viable Colon	RPA	No	No	No	10	No
15.	Ramanathan	60	M	1413	Redundant Colon	Sigmoidopexy	Yes	No	No	16	No
16.	Pandithiagu	73	M	83586	Viable Colon	RPA & Colostomy	No	No	Yes	18	No
17.	Ganesan	28	M	40182	Gangrenous Colon	Hartmann's	Yes	No	Yes	22	No

Sl.No.	Name	Age	Sex	IP No.	Intraoperative findings	Procedure done	Wound infection	Anastomotic leak	Stoma closure	Total duration of stay	Death
18.	Vellaisamy	60	M	80032	Viable Colon	RPA & Colostomy	Yes	No	Yes	13	No
19.	Shanmugavel	50	M	47629	Viable Colon	RPA	No	Yes	No	18	No
20.	Muthupetchi	60	F	47985	Viable Colon	RPA	No	No	No	10	Yes
21.	Murugesan	47	M	24312	Redundant Colon	Sigmoidopexy	No	No	No	12	Yes
22.	Nasir	58	M	56272	Redundant Colon	Sigmoidopexy	No	No	No	13	No
23.	Subbulakshmi	42	F	67111	Viable Colon	RPA	No	Yes	No	19	No
24.	Murugesan	45	M	63280	Redundant Colon	Sigmoidopexy	No	No	No	12	No
25.	Govindarajan	50	M	78289	Gangrenous Colon	Hartmann's	Yes	No	No	_	Yes
26.	Malaisamy	65	M	12152	Gangrenous Colon	Hartmann's	Yes	No	No	19	No
27.	Raja	40	M	12307	Redundant Colon	Sigmoidopexy	No	No	No	12	No
28.	Banumathy	49	F	54835	Viable Colon	RPA	No	No	No	17	No
29.	Periyam	40	M	62990	Gangrenous Colon	Hartmann's	Yes	No	No	_	Yes
30.	Muthulakshmi	48	F	62612	Gangrenous Colon	Hartmann's	No	No	Yes	19	No
31.	Ganga	53	F	26123	Viable Colon	RPA	Yes	Yes	No	23	No
32.	Muthu	46	F	54213	Gangrenous Colon	Hartmann's	No	No	Yes	17	No
33.	Ramu	38	M	53218	Redundant Colon	Sigmoidopexy	No	No	No	15	No
34.	Begam	25	F	76321	Viable Colon	RPA	No	No	No	12	No
35.	Lakshmi	65	F	51803	Gangrenous Colon	Hartmann's	Yes	No	Yes	20	No
36.	Banu	80	F	76122	Gangrenous Colon	Hartmann's	Yes	No	No	_	Yes

RPA-Resection and Primary Anastomosis.

CLINICAL PROFORMA

Name : Age :

Sex :

I.P.No : Occupation :

Address :

Chief complaints :

History of presenting complaints:

1. Adominal distention
2. Vomiting - feculent/bilious/blood
3. Constipation/obstipation
4. Abdominal pain
5. Bleeding per rectum
6. Haemetemesis/malena

Past history:

Any significant abdominal surgery

Dietary pattern of patient

General examination:

Pallor

Icterus

Hydration

Primary vitals

System examination:

Per abdomen:

Abdominal distension

Tenderness

Guarding/rigidity

Bowel sounds

Free fluid

Per rectum findings

Provisional diagnosis :

Investigations :

Basic investigation

Plain x-ray abdomen erect

Chest X-ray PA view

CT Abdomen and pelvis

Ultrasound abdomen and pelvis

Intra operative findings

1. Viable/gangrenous colon.
2. Redundant colon.
3. Distended colon.

Surgical procedure done:

- 1.Sigmoidopexy
- 2.Primary anastomosis of colon
- 3.Hartmanns procedure

Postoperative period:

- 1.Mortality
- 2.Morbidity
 - wound infection,anastomotic leak,
 - re laparatomies
- 3.follow up- colostomy closure
- 4.total duration of hospital stay:

Institutional Review Board / Independent Ethics Committee.

Dr. A. Edwin Joe, M.D (F.M), B.L.,
Dean, Madurai Medical College & 2521021 (Secy)
Govt Rajaji Hospital, Madurai 625020.
Convenor
grhetinsecy@gmail.com.

Sub: Establishment-Govt. Rajaji Hospital, a/madurai-20-
Ethics committee-Meeting Agenda-communicated-regarding

The next Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held at 11.00 Am to 1.00Pm on 27.01.2012 at the Dean Chamber, Govt. Rajaji Hospital, Madurai. The following members of the committee have been attended the meeting.

1. Dr.N.Vijayasankaran,M.ch(Uro.) 094-430-58793 0452-2584397	Sr.Consultant Urologist Madurai Kidney Centre, Sivagangai Road, Madurai	Chairman
2. Dr.P.K. Muthu Kumarasamy, M.D., 9843050911	Professor & H.O.D of Medical, Oncology(Retired)	Member Secretary
3. Dr. T.Meena, MD 094-437-74875	Professor of Physiology, Madurai Medical College	Member
4. Dr. S. Thamilarasi, M.D (Pharmacol)	Professor of pharmacology	
5. Dr. Moses K. Daniel MD (Gen. Medicine) 098-421-56066	Professor of Medicine Madurai Medical College	Member
6. Dr. M. Gobmath, MS (Gen. Surgery) 097-871-50040	Professor of Surgery Madurai Medical College	Member
7. Dr. S. Dishadh, MD (O&G)	Professor of OP&Gyn Madurai Medical College	Member
8. Dr. S. Vadivel Murugan., M.D, 097-871-50040	Professor of Medicine Madurai Medical College	Member
9. Shri. M. Sridher, B.sc. B.L. 099-949-07400	Advocate, 623-B.II.Floor, East II Cross, K.K. Nagar, Madurai.20.	Member
10. Shri. O. B. D. Bharat, B.sc., 094-437-14162	Businessman Plot No. 588, K.K. Nagar, Madurai.20.	Member
11. Shri. S. Sivakumar, M.A (Social) Mphil 093-444-84990	Sociologist, Plot No. 51 F.P, K.K. Nagar, Madurai.	Member

Following Projects were approved by the committee

No	Name of P.G.	Course	Name of the Project	Remarks
1.	J. Kiran kumar	PG, M.S (genl Surg)	Sigmoid colonic volvulus: a clinical study.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution to Government.
2. She/He should inform the institution Ethical Committee in case of any change of study procedure site and investigation or guide.
3. She/He should not deviate for the area of the work for which applied for Ethical clearance.
She/He should inform the IEC immediately, in case of any adverse events or Serious adverse reactions.
4. She/he should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and apply for if any Extension of time is required She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the work or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

[Signature]
DEAN

To
All the above members and Head of the Departments concerned.
All the Applicants.

[Signature]
[Signature]
Professor and Head
Department of Surgery
MADURAI MEDICAL COLLEGE
Govt Rajaji Hospital
Madurai-20

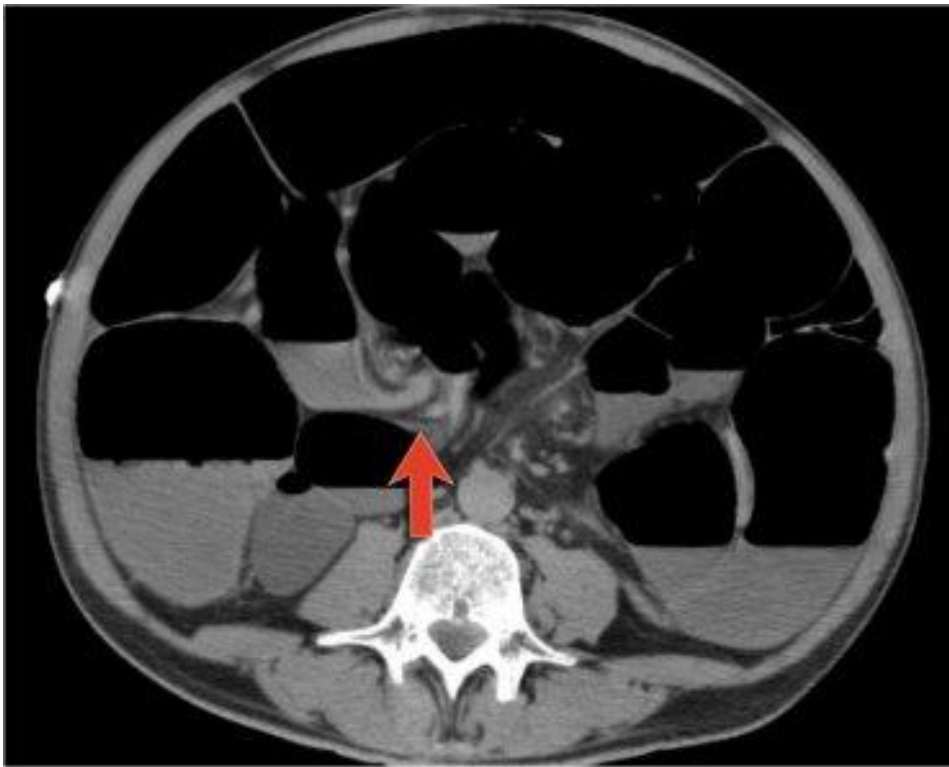
VIABLE AND REDUNDANT COLON



GANGRENOUS SIGMOID COLON



CT SCAN SHOWING TWIST AND TRANSITION POINT IN SIGMOID VOLVULUS



X-RAY SHOWING COFFEE BEAN APPEARANCE



PRIMARY ANASTOMOSIS OF COLON



HARTMANN'S PROCEDURE WITH END COLOSTOMY

