Acute Mesenteric Ischaemia: An Abdominal Calamity

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Abstract

Background: Managing acute mesenteric ischaemia continues to be a nightmare for the surgeon and a calamity for the patient. Literature on the subject is fragmented and is devoid of uniformity with authors describing their personal experiences.

Aim: To identify and evaluate factors which affect outcome in patients suffering from acute mesenteric ischaemia.

Materials and methods: Retrospective study of all the records of patients diagnosed as acute mesenteric ischaemia at surgery managed in a single surgical unit of an urban civic hospital in India.

Results: Delayed presentation associated with co morbidities, delayed surgical intervention due to hemodynamic instability, extensive gangrene of the bowel requiring resection of significant lengths of the bowel and post operative complications involving the cardiopulmonary system are associated with poor outcomes.

Conclusion: Identification of co morbid conditions, early diagnosis by CT after hemodynamic stabilisation, prompt surgery followed by close postoperative monitoring can help lower the morbidity and high mortality.

INTRODUCTION

Acute mesenteric ischemia is a catastrophic abdominal emergency. The aetiology is multi-factorial. The symptom complexes associated with this disorder are many a time subtle or even at times deceptive leading to delay in diagnosis. Delayed diagnosis in majority of such cases leads to increased morbidity and mortality. Identification and evaluation of factors leading to delay in diagnosis is therefore pivotal in the successful management of these patients.

AIM

The aim of the study was to identify and evaluate factors which affect the outcome of patients suffering from acute mesenteric vascular ischaemia.

MATERIALS AND METHODS

Case records of patients diagnosed as acute mesenteric vascular ischaemia at surgery, presenting to the hospital in a single surgical unit in the period from January 2006 to December 2012 were studied retrospectively. A proforma was completed by studying the individual case records elaborately. Duration of onset of symptoms upto admission in hospital, interval between admission to hospital and surgical treatment, diagnostic modalities utilised, nature of surgical treatment, co-morbid factors, complications in the post-operative period and final surgical outcome were studied. The data was tabulated and analysed. As the number of cases was less, elaborate statistical methods could not be applied.

RESULTS

Ten cases were studied retrospectively. (Table 1) Of the 10 cases 6 were male patients and 4 were females. Mean age of the patients was 57.9 years (SD+/- 7.1). (Figure 1) The mean duration from onset of symptoms to admission to hospital was 40.8 hours (SD+/-29.5) (Figure 2), whereas duration between admission to hospital and surgical intervention was 7.6 hours (SD+/- 4.16) (Figure 3). On evaluation of x-ray abdomen every patient had air fluid levels where as ultrasound revealed dilated bowel loops and free fluid in the peritoneal cavity. CT was done in 4 cases which showed thrombosis of the superior mesenteric artery with thickening of the bowel loops. WBC count was found to be high in 9 of the 10 patients with a mean of 13,200/mm3 (SD+/-4736) (Figure 4).

9 of the 10 patients had co-morbid medical conditions with hypertension present in 4 patients, IHD in 1 patient, a combination of IHD and hypertension in 1 patient,

alcoholism in 2 patients and a combination of cocaine alcohol and tobacco addiction in 1 patient. (Figure 5)

At laparotomy, the findings were variable with ischaemic gangrene of different parts of the bowel. (Figure 6) 1 patient had ischaemic gangrene extending from the proximal jejunum to the ascending colon. 4 patients had ischaemic gangrene extending from mid jejunum to mid transverse colon, 1 had ischaemic gangrene extending from mid jejunum to distal transverse colon. 2 patients had ischaemic gangrene extending from distal jejunum to the ascending colon, whereas 1 patient had ischaemic gangrene extending from terminal ileum to ascending colon. Resection anastomosis of the ischaemic segment with proximal stoma was done in 3 cases, whereas resection anastomosis without stoma creation was done in the remaining patients. (Figure 7) Paralytic ileus was one of the commonest complications seen in 5 patients. Of these 5 patients 2 developed wound dehiscence, 2 developed ARDS and 1 developed acute myocardial infarction. (Figure 8) All the 3 patients who developed ARDS expired. The patient who developed an acute myocardial infarction also expired. 5 patients survived giving a survival rate of 50%. None of the patients who survived developed symptoms of short bowel syndrome.

DISCUSSION

Acute mesenteric ischaemia is a catastrophic condition of the abdomen wherein there is abrupt reduction in the blood flow to the intestines of such severity so as to compromise metabolic requirements and potentially threaten the survival of the affected organs. The incidence of acute mesenteric ischaemia may be 1 in every 1000 patients admitted to acute surgical facilities and is likely to increase with time. Various anatomical factors play an important role in this disease. Superior mesenteric artery which is the main arterial supply to the mid gut is the main artery affected in most of the cases. Though there may be a good amount of collateral circulation, but due to the peculiar anatomic configuration of the superior mesenteric artery it is most prone to thrombosis.[1] The site of thrombosis in the superior mesenteric artery may vary. It may be at its origin, after the middle colic is given, or just proximal to the ileo-colic. This explains the specific areas of gangrenous change in superior mesenteric artery thrombosis. The other 2 vessels, the coeliac and inferior mesenteric artery do not exhibit such a phenomenon. A variety of factors predispose to thrombosis. These include atherosclerosis, coronary artery disease, peripheral arterial occlusion, cardiac arrhythmias, congestive cardiac failure and valvular heart diseases. [2] With respect to superior mesenteric artery thrombosis, severe dehydration, plaque formation, fibro muscular dysplasia and Takayasu's disease may play a significant role. Mesenteric venous thrombosis usually affecting the younger age group and may be related to conditions such as hypercoaguability states, traumatic injuries, obstruction of venous outflow and intra-abdominal infections.[3] Amongst the hypercoaguable states, polycythemia is the most common. NOMI (Non-occlusive mesenteric ischaemia) which is the third pattern of mesenteric ischaemia accounts for 20% of cases.[3] Many a times it is under diagnosed because of the severity of concurrent or associated illnesses in this patient population.[4] Drug abuse, namely cocaine is commonly associated with it. In the present study quite a few patients were suffering from various co morbid medical conditions including addictions. (Figure 5)

Clinical presentation in acute mesenteric ischaemia is quite deceptive.[5] The onset, duration and progress of symptoms is variable. The presence of co-morbid medical conditions may add to the variability of presentation. In the present study the mean duration of symptoms from onset of symptoms to admission to hospital was 40.8 hours. However there were a few cases where patients presented within 12 hours. (Figure 2) Various explanations have been postulated to explain this phenomenon. Good collateral circulation supplied by the coeliac and inferior mesenteric artery may at times be contributory. The site of the thrombus may play a significant role. If the thrombus is at the site of origin of the superior mesenteric artery then symptoms and signs develop rapidly. However if the thrombus is situated after the origin of the colonic branches, symptoms may be subtle to begin with. This may lead to deception and delay in diagnosis. Presence of co-morbid medical conditions along with their medical treatments may have symptoms simulating mesenteric venous ischaemia. This may again add to the diagnostic confusion resulting in a delay in the diagnosis. In the present study a delay in presentation to hospital was associated with a poor outcome. Therefore, awareness of this condition is of utmost importance especially in the predisposed population and a high index of suspicion is pivotal in the clinical diagnosis of mesenteric vascular ischaemia.

The mean duration between admission to hospital and surgical intervention is another important factor which may influence the outcome in these patients. In the present study this duration was 7.6 hours. (Figure 3) This variable depends highly upon the setup of the institution. If radiological facilities are easily available at hand, a quick diagnosis can be made. Laboratory investigations followed by radiological investigations should be done at the earliest. Amongst the laboratory investigations the total WBC count is a very important investigation. In the present study the mean WBC count was 13220/mm3. (Figure 4) Thrombotic process is always associated with a rise in WBC count. This may perhaps be related to the septic process which sets in after ischaemic injury as occurs in the bowel. Stagnation of bowel contents in the ischaemic segment predisposes to bacterial translocation thereby leading to a septic state. This explains the raised WBC count in patients suffering from acute mesenteric ischaemia. [5]

A plain x-ray abdomen will reveal a state of obstruction by way of air fluid levels. (Table 1) This again depends upon the duration since the onset of the disease process. In the present study all the patients had multiple air fluid levels. This is a typical example of what is traditionally described as adynamic intestinal obstruction. Since the process is adynamic, symptoms are more subtle as compared to dynamic intestinal obstruction. Ultrasound as a diagnostic investigation doesn't reveal much in such cases. In the present study, ultrasound was performed in all the patients and revealed multiple dilated bowel loops and free fluid. (Table 1) CT scan holds the promise in the diagnostic armamentarium for acute mesenteric ischaemia. [6] However, the patient needs to be haemodynamically stable in order to permit CT scans to be done. In patients who present late, haemodynamic instability precludes CT scanning. However in patients who present early without haemodynamic instability CT scan can be safely done. In the present study, CT scan was done in 4 patients, which revealed thrombosis of the superior mesenteric artery accompanied with thickening of the bowel wall. Financial restraints and availability of CT facility may play a significant role in the early availability of this investigation. In the present study 6 patients were not subjected to CT scanning. These patients had a variable amount of variable amount of haemodynamic instability and worsening abdominal signs hence these were subjected to immediate surgical intervention. A high index of suspicion with early CT evaluation can help in the early evaluation of acute mesenteric ischaemia. [7, 8, 9, 10] Co-morbid medical conditions play a significant role in the patho-physiology of acute mesenteric ischaemia. In the present study it was observed that 4 patients had hypertension, 2 had IHD, 2 were alcoholic and 1 had cocaine addiction in addition to alcoholism, COPD and tobacco addiction. (Figure 5) Presence of number of comorbid conditions heightens the severely of the thrombotic process. [11] This in turn has a very strong negative impact on the surgical outcome in these patients. Hypertension is due to cause intimal damage thereby predisposing to thrombosis in most of the vital organs of the body. Ischaemic heart disease can lead to predisposition not only to thrombosis, but can also lead to severe embolic phenomenon with sudden onset of ischaemia. Alcoholism may lead to a state of chronic dehydration perpetuated by inadequate fluid and food intake. This may predispose to a dehydrated state leading to thrombosis. Cocaine addiction can cause the severest of disease at a very young age. The vasoconstricting effect of cocaine is a strong predisposing factor for the initiation of the cascade of events leading to mesenteric vascular ischaemia. [12]

The extent of ischaemic gangrene observed at laparotomy depends upon the site of the thrombus.[13] In the present study 4 patients had gangrene extending from the distal jejunum to the ascending colon suggesting that the most likely site of the thrombus was distal to the origin of the middle colic. (Figure 6)

4 patients had gangrene extending from the mid jejunum to the mid transverse colon. In these patients the site of the thrombus is most likely to be proximal to the origin of the middle colic artery as a result a significant portion of the jejunum, ileum, ascending colon and transverse colon were affected. In this situation it is most likely that a few jejunal branches may have been spared thereby leaving behind a viable proximal jejunum.

1 patient had gangrene extending from proximal jejunum to the ascending colon suggesting a thrombus to be situated at a point proximal to the middle colic and jejunal branches.

1 patient had gangrene extending from terminal ileum to the ascending colon suggestive of a thrombus to be situated at a point midway between the origin of the middle colic and right colic.

Despite variability in the extent of the thrombosis of the superior mesenteric artery it is observed that the duodenum and the proximal jejunum are usually spared of ischaemia. This perhaps can be explained on the basis of a rich collateral circulation fed by the coeliac axis through the pancreatico-duodenal arcades. It is vary rare to find gangrene of the duodenum distal to the Ampulla of Vater. Gangrenous changes are usually observed in between the junctional areas extending from the proximal or mid jejunum to the mid transverse colon. This possibly can be explained on the basis of poor collateral backup from the coeliac axis and inferior mesenteric artery to these portions. [13] The variation and the site of thrombosis in the superior mesenteric artery continue to be a subject for debate with a number of hypotheses being postulated. However none of the hypothesis has been able to explain the variation. Loss of extensive length of the bowel is associated with poor outcome.

The decision pertaining to the choice of surgical procedure is the biggest dilemma to the operating surgeon. Resection anastomosis of non-viable bowel has to be done until one reaches a segment of distinctly viable bowel. It is dangerous to take the risk of saving a segment of bowel which has doubtful viability. This may lead to a re-exploration adding to the morbidity and even mortality of such patients. Resection anastomosis followed by primary anastomosis was performed in all patients in the present study. (Figure 7) Since the bowel is unprepared there is a high chance of anastomotic dehiscence in such patients. [14] It is undoubtedly a safe practice to perform a proximal diversion by way of creation of a proximal stoma in order to protect the anastomosis performed on a delicately placed bowel by way of poor blood supply and unprepared stagnant lumen. (Figure 7) Creation of a stoma in these cases may again pose a technical challenge to the surgeon. This is because an adequate length of proximal bowel needs to be available for creation of a good functioning stoma. In severe cases of acute mesenteric ischaemia, where the segment of viable proximal bowel is very short, creation of a stoma is not surgically possible. Under such circumstances one cannot create a proximal stoma and therefore patient has to run the risk of anastomotic dehiscence and an enterocutaneous fistula. [15] Mesenteric vascular ischemia may not always be a completed process at the time of surgical intervention. It may be a process in evolution. Whether it is in evolution at the time of surgery is difficult to determine both preoperatively and intra-operatively. It has to be accepted by the surgeon that re-laparotomy may be required in cases where the thrombotic process continues to evolve further. Such patients may require resection of additional segments of gangrenous bowel with creation of a new anastomosis. This in turn may lead to loss of significant length of the small intestine. Though the patient's life may have been saved yet it will add to significant morbidity in the post-operative period by way of development of short bowel syndrome. This is an inevitable sequel to a surgically treated patient of acute mesenteric ischaemia.

Post-operative course in surgically treated cases of acute mesenteric ischaemia is quite stormy. Many times survival may be decided by medical complications developing in the post-operative period. [16]Therefore the presence of comorbid medical conditions goes hand in glove with the thrombotic process in determining the final surgical outcome in these patients. In the present study it was observed that a multitude of complications did develop in almost every patient. (Figure 8) 5 patients developed paralytic ileus. This can be explained on the basis of both vascular compromise and electrolyte imbalance due to resection of extensive segments of the intestine. Utmost effort has to be directed towards optimising haemodynamic stability, judicious use of inotropes, proper choice of antibiotics and excellent supportive care for the respiratory system. Achieving an optimum homeostasis in the postoperative period can help reduce the development of paralytic ileus. Pulmonary complications are the biggest nightmare to the surgeon with respect to operated patients of acute mesenteric ischaemia. Haemodynamic instability, septic shock, electrolyte imbalance and repeated surgeries may contribute to the development of ARDS in these patients. It is therefore a safe practice to house these patients in a good intensive care setup so that they can be closely monitored. Respiratory complications may range from pulmonary oedema, effusion, pneumonitis, pneumonic consolidation and the most lethal of all ARDS. Mortality of patients who develop ARDS is extremely high. In the present study all the 3 patients who developed ARDS expired. 1 patient developed acute myocardial infarction in the post-operative period. It is the same patient who also had cocaine, tobacco and alcohol addiction. This patient also expired. Wound complications were seen in 3 patients. These included partial wound dehiscence. 1 of these 3 patients developed severe septicaemia and expired. The nature and severity of postoperative complications has a significant role in the survival of these patients. It was observed that the patients who had developed paralytic ileus and wound complications survived whereas patients who developed pulmonary and cardiac complications expired. Presence of comorbid medical conditions also seems to have played a significant contributory role in the poor outcome of patients who expired.

CONCLUSION

Presence of co-morbid medical conditions accompanied by abdominal symptoms should raise a high index of suspicion for acute mesenteric ischaemia.

Prompt haemodynamic stabilisation and CT scanning can help in definitive diagnosis.

Prompt surgical intervention with optimum choice of procedure dictated by the intraoperative findings is pivotal to halt the septic process.

Close monitoring of the patients during the post-operative course in the ICU may help prevent development of medical complications.

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Table 1

Results of the study

Sr. No. of patient >	1	2	3	4	5	6	7	8	9	10
Age (yrs)	58	44	55	62	60	62	50	65	55	68
Sex M/F	M	F	M	M	F	M	F	M	F	M
Onset of symptoms (hrs)	96	72	24	48	24	24	12	12	24	72
Interval between admission & surgery(hrs)	24	12	6	4	3	6	3	6	6	6
Investigations										
AXR(air fluid levels) Y/N	P	P	P	P	P	P	P	P	P	P
USG(dilated bowel and free fluid)Y/N	P	P	P	P	P	P	P	P	P	P
CT(abdomen)	SMA thrombosis	-	-	-	-	Bowel thickening with mesenteric fat stranding	SMA thrombosis & thickening of bowel	SMA thrombosis & thickening of bowel	-	-
Total WBC count	14700	19200	3800	20000	7900	13200	12700	13500	1400	13200
Co morbid conditions										
Ischaemic heart disease Y/N	N	N	N	N	N	N	N	Y	N	Y
Alcoholism Y/N	Y	N	Y	N	N	N	N	N	N	N
Hypertension Y/N	N	N	N	Y	Y	Y	N	N	N	Y
Other(addictions) Y/N	Y	N	N	N	N	N	N	N	N	N
Intraoperative findings										
Extent of gangrenous changes	Distal jejunum to Ascending colon	Distal jejunum to Ascending colon	Mid jejunum to Mid transverse colon	Mid jejunum to Mid transverse colon	Mid jejunum to Mid transverse colon	Mid jejunum to Mid transverse colon	Terminal ileum to Ascending colon	Distal jejunum to Ascending colon	Distal jejunum to Ascending colon	Proximal jejunum to Ascending colon
Surgical Procedure performed										
Resection anastomosis Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Proximal bowel exteriorization Y/N	Y	Y	N	N	N	Y	N	N	N	N
Post operative complications										
Paralytic ileus Y/N	N	Y	N	N	N	P	P	P	P	N
ARDS Y/N	N	N	Y	N	Y	N	N	N	N	Y
Wound dehiscence Y/N	N	N	N	Y	N	N	Y	N	Y	N
Other (acute myocardial infarction) Y/N	Y	N	N	N	N	N	N	N	N	N
Final Outcome										
Discharged (D)	-	D	-	-	-	D	D	D	D	-
Expired (E)	E	-	E	E	E	-	-	-	-	E

Figure 1

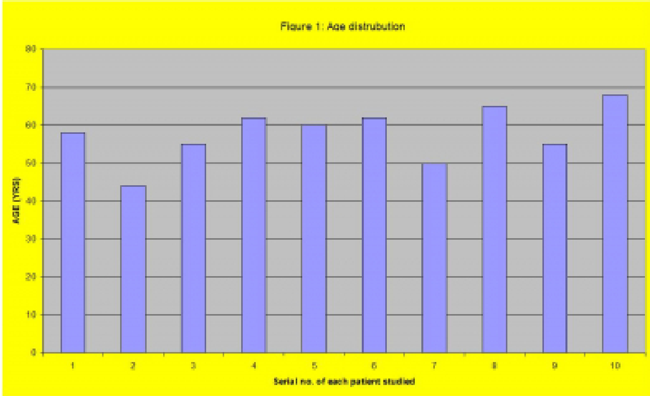


Figure 2

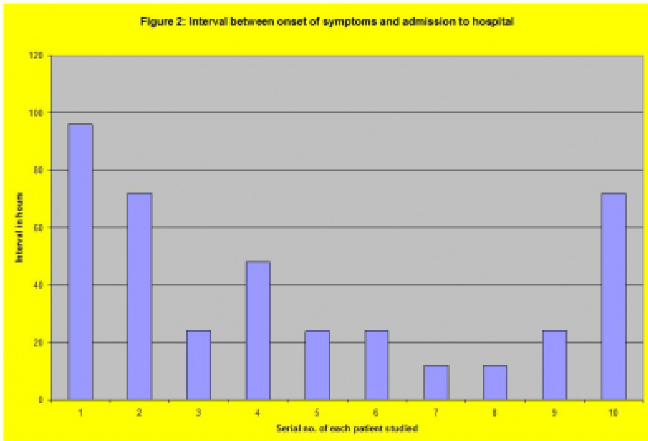


Figure 3

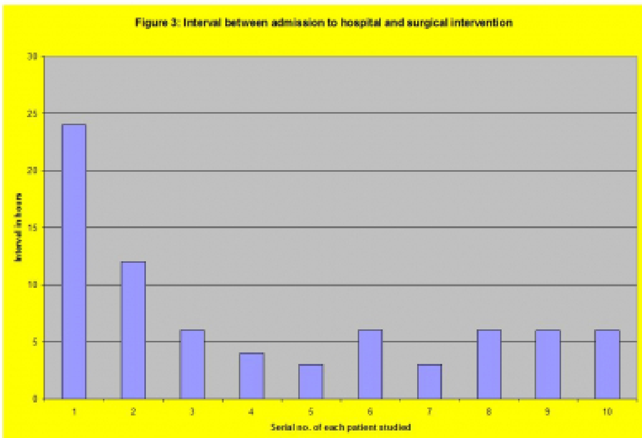


Figure 4

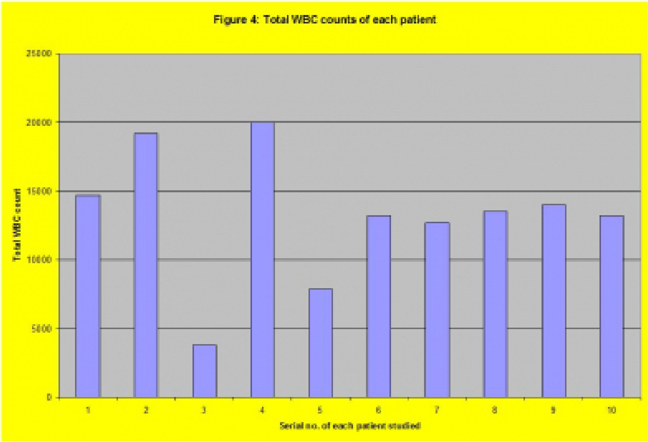


Figure 5

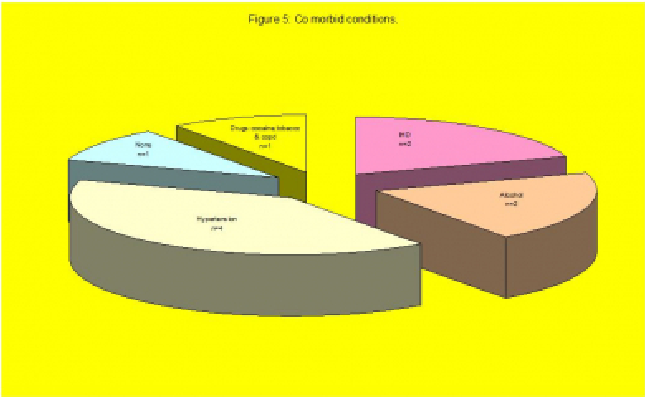


Figure 6

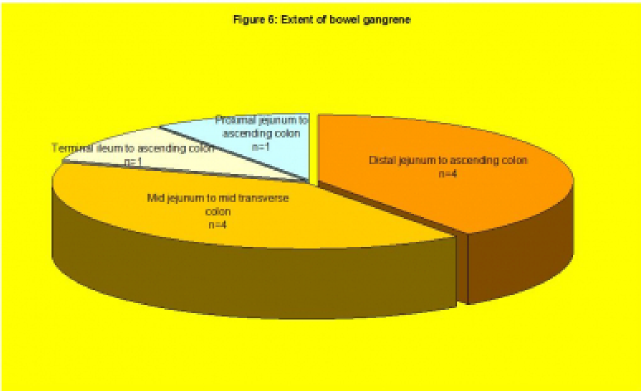


Figure 7

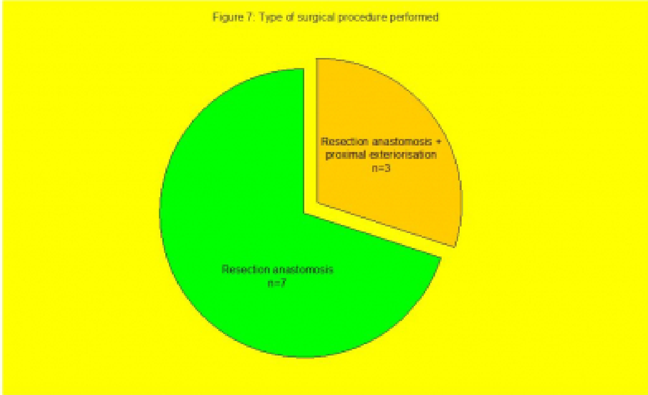
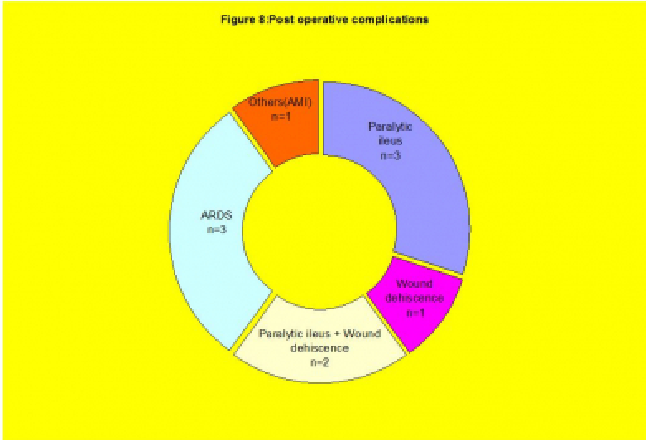


Figure 8



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