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Original Research Article

A prospective study of assessment of prognostic factors in early and late wound dehiscence in midline vertical incision

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ABSTRACT

Background: Wound dehiscence is separation of some or all layers of incision. It may be partial or complete. It is called as complete when all layers of the abdominal wall have been separated with or without evisceration of viscous. The study aims to find out and record the prognostic factors for wound dehiscence in vertical midline laparotomy.
Methods: This was a prospective study in 1400 laparotomies that developed wound dehiscence operated in Gandhi Medical College, Bhopal from august 2017 to august 2019. All the patients with burst abdomen operated during emergency or elective setting by midline vertical laparotomy were included.
Results: Wound dehiscence was most common in 51-60 years age group (26%). Majority patients were males (62%). Emergency laparotomy showed maximum incidence (71%). Bursts were seen mostly during 6th to 10th postoperative day. 78% patients presented as partial wound dehiscence and remaining as complete wound dehiscence. 46% presented as early wound dehiscence (7 days).
Conclusions: Post laparotomy wound dehiscence has multifactor etiology. Respiratory infections, anemia, and hypoproteinaemia are the contributing factors. Improper haemostasis during surgery and poor surgical technique are the predisposing factors.

Keywords: Burst abdomen, Laparotomy, Peritonitis, Postoperative day, Wound dehiscence

INTRODUCTION

Dehiscence of the wound after abdominal surgery is a serious complication that continues to threaten the surgeon as well as patient. Burst abdomen is an unavoidable responsibility of the surgeon who made the wound. Dehiscence is the disruption or breakdown of a wound.[1,2]

When an abdominal wound gape open or disrupts, a condition called burst abdomen or wound dehiscence or wound disruption or postoperative eventration occur.[3] It is defined as disruption of any or all of the layers in a wound. It can be partial or complete. When there is separation of few layers with intact skin or peritoneum it is called as partial dehiscence. Complete when all layers of the abdominal wall have opened apart and this may be associated with evisceration of viscous and exposure of underlying organ and tissues. It occurs due to disruption in the anterior abdominal wall caused by either trauma or any surgical intervention in order to gain access to the underlying pathology.[4]

Interruption in the normal cascade of abdominal wound healing process results in the disruption of the abdominal wound. Incision made passes through various layers of the anterior abdominal wall from skin, subcutaneous tissue, linea Alba and peritoneum. This incision when

made initiates a cascade of mechanisms at cellular level, which aims at achieving healing at incision site.[5] Healing can be primary or secondary. Healing by secondary intention results from extensive loss of cells and tissue as occurs in infarction, inflammatory ulceration, abscess formation etc. It could result in failure of the deeper layers of the abdominal incision to unite resulting in a dramatic "burst abdomen" or evisceration in which dehiscence of the wound occurs suddenly and is associated with protrusion of abdominal contents, usually bowel, through the disrupted wound. It may present as incisional hernia later. The incidence of wound dehiscence is greater certain series of patients with specific predisposing factors. Prognosis of this condition becomes worse with delayed diagnosis and increasing age.

Abdominal wound failure can be divided into acute and chronic. Wound dehiscence is an acute wound failure. Significant wound dehiscence occurs in approximately 1% of all laparotomies.[6] It has an incidence of 2-3 percent and an associated mortality of 25%.[7] In some literatures the mortality rate in wound dehiscence/burst abdomen is reported as high as 45%. Incidence as described in literatures ranges from 0.4% to 3.5%.[4] The reported incidence continues to be 0.2% to 6% with associated mortality of 9% to 44%.[8]

Although disruption can take place any time in the postoperative period, it usually occurs between the fifth and twelfth postoperative days when the strength of wound is weakest. In about half the cases disruption will be heralded by the appearance of a serosanguinous discharge on the dressing.[1,2]

The patient experiences a feeling of something coming out or popping sensation during straining or coughing. Most patients will need to return to the operation theatre for re-suturing. In some patients it may be appropriate to leave the wound open and treat with dressings or vacuum assisted closure pumps.[9] Its presence implies inadequate preoperative treatment, improper postoperative management, wound infection and poor surgical technique. These should be anticipated and appropriate preventive measures taken.

Wound dehiscence increases the cost of care increases hospital stays, nursing and manpower cost in managing the burst abdomen. Many patients in developing countries are nutritionally poor and the presentation of patients with peritonitis is often delayed in the emergency units. This makes the problem of wound dehiscence more common and graver in this study setting as compared to the developed countries. Even after increased knowledge about wound healing, recent advances in perioperative care and suture materials, wound dehiscence continues to be a significant cause which prolongs hospital stay and is responsible for increased patient's morbidity.

Hence a study was undertaken in the department of general surgery, Gandhi Medical College and Hamidia Hospital Bhopal to study wound dehiscence.

METHODS

This was a prospective observational study conducted in Gandhi Medical College, Bhopal, Madhya Pradesh. 1400 laparotomies with midline vertical incision were done in Hamidia Hospital from august 2017 to august 2019 out of which 100 patients suffered from abdominal wound dehiscence were included in the study. An informed consent was taken. The study was approved by ethics committee. It was a hospital-based study involving observation of patients from admission till discharge or death was carried out.

Inclusion criteria

- Patient more than 18 years of age and either sex
- Patients presenting with abdominal wound dehiscence or burst abdomen after undergoing elective or emergency operation
- Patients who are ready for investigations and treatment for their condition and gave informed consent for the study and surgical procedure.

Exclusion criteria

- Patients less than 18 years of age
- All female patients who developed wound dehiscence after any gynecological procedures
- All patients who refuse investigation and treatment
- Patients getting discharged against medical advice before completion of treatment
- All patients with incisional hernia
- Patients with wound dehiscence on sites other than the abdomen
- Patients who have developed wound dehiscence after second surgery.

Each case was examined clinically and history based on date of admission, clinical history regarding mode of presentation, chief complaints, significant risk factors, investigations, time and type of surgery performed and postoperative events and day of onset of wound dehiscence was taken into account. Various factors were considered like age of the patient, sex, indication for surgery, whether emergency or elective, type of surgery, intraoperative findings, day of burst abdomen, anemia, hypoproteinemia, post-operative wound infection confirmed with culture sensitivity of wound swabs, malnutrition, chronic cough, respiratory infections in post-operative period assessed by history of either cough or dyspnea or both and auscultation of lungs for crepitation and conformed with chest X-ray for pneumonitis or pleural effusion.

Examination of abdomen for any discharge, dehiscence, infection and evisceration was noted. All the patients

with burst abdomen were evaluated by investigations for hemoglobin, serum proteins, blood sugar, urea and creatinine levels in blood, wound swab for culture and sensitivity, also X-ray of chest.

Following which management of these cases at GMC Bhopal based on facility available here was done. A detailed proforma of the etiological factors, risk factors, examination findings and investigations were prepared, all the data thus collected and the results compared with other studies.

As such in the literature there is no definition of early and late wound dehiscence. On the basis of various studies on wound dehiscence cases presenting with abdominal wound dehiscence before or on 7th postoperative day was taken as early and cases presenting after seventh day was taken as late wound dehiscence. The objective of the study was to assess the association and prevalence of prognostic risk factors in causing early and late abdominal wound dehiscence in midline vertical incision, to identify the prognostic factors involved in causing abdominal wound dehiscence and to study incidence of wound dehiscence in elective and emergency operation.

Statistical analysis

Statistical analysis was processed using Microsoft excel software program and SPSS software.

RESULTS

Incidence of wound dehiscence is 7.14% (100/1400). A total 100 patients of abdominal wound dehiscence in different age groups were studied in this study. In this study majority of patients (26.0%) belonged to 51-60 years of age group followed by 19 (19%) patients in 31-40 years of age group and least patients were from more than 70-year age group. Youngest patient was 18 years old and oldest was 80 years. Mean age of patients affected was 42.70 years with SD 16.16. Out of 100 cases (62, 62.0%) were Male and (38, 38.0%) were female.

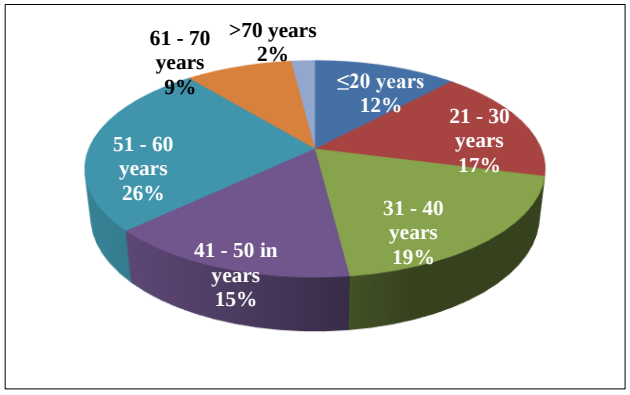

Figure 1: Incidence of abdominal wound dehiscence in different age groups.

Maximum duration of stay was 35 days with minimum of 10 days. Majority patients 46 (46.0%) stayed between 21-30 days in the hospital. The mean duration of stay was 21.9 days with standard deviation 5.78 day.

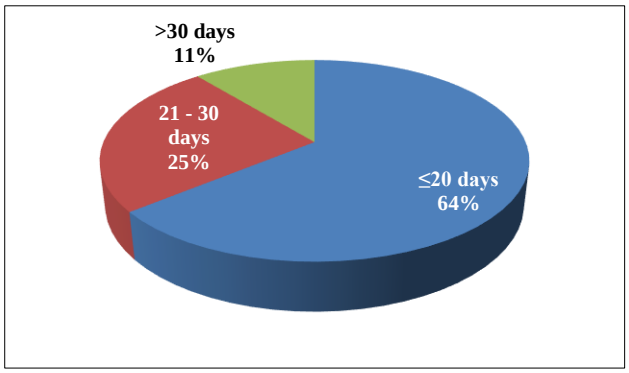

Figure 2: Distribution of duration of stay of studied patients.

Table 1: Distribution of patients with abdominal wound dehiscence according to underlying intraabdominal pathology.

Diagnosis	Frequency (n=100)	Percentage (%)
Appendicular perforation	6	6.0
Cecal perforation	2	2.0
Duodenal ulcer perforation	12	12.0
Gastric perforation	20	20.0
Ileal perforation	17	17.0
Stricture	11	11.0
Jejunal perforation	8	8.0
Malignancy	10	10.0
Mesenteric ischemia and gangrene	3	3.0
Midgut volvulus	1	1.0
Tubercular adhesion	10	10.0

Most common diagnosis was gastric perforation (20, 20.0%) of the patients, followed by ileal perforation (17, 17.0%) and duodenal ulcer perforation (12, 12.0%). Perforation repair was most common procedure in 34 (34.0%) followed by resection and anastomosis 20 (20.0%) and stoma 16 (16.0%).

In the present study out of 100 cases, 71 cases (71%) were operated as emergency surgery and 29 cases (29%) as elective surgery.

A total 44 (44.0%) patients had normal hemoglobin (Hb) level and 56 (56.0%) patients had low hemoglobin level. Mostly 69 (69.0%) patients had normal renal function test whereas 31 (31.0%) had high. Mostly 62 (62.0%) patients had low albumin level whereas 38 (38.0%) patients had normal level of albumin.

Mostly 79 (79.0%) patients had normal serum electrolyte level whereas 21 (21.0%) patients had abnormal level of serum electrolyte.

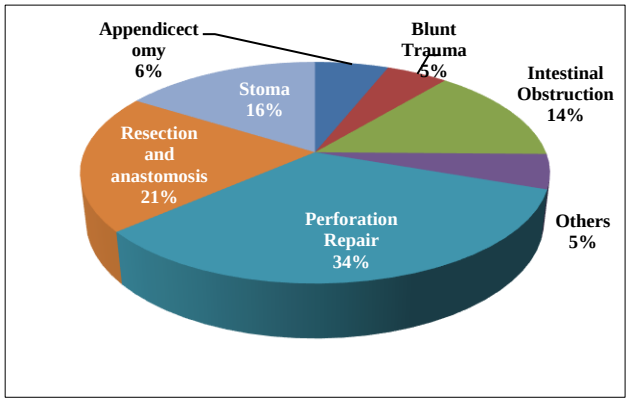

Figure 3: Distribution of procedure done.

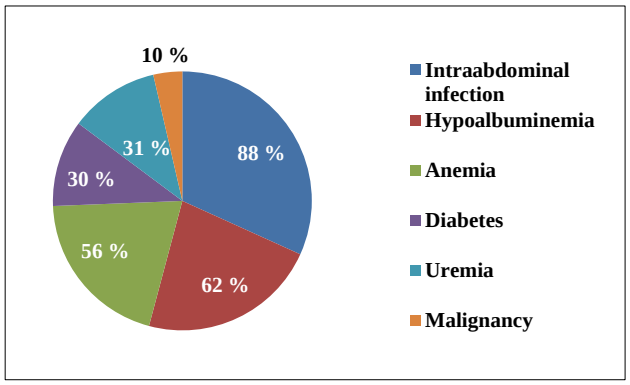

Figure 4: Distribution of preoperative causes.

Among preoperative causes preexisting intrabdominal infection due to perforation peritonitis was the most important cause followed by comorbidities like diabetes mellitus, uremia, cancer cachexia, anemia, uremia and low albumin level.in the postoperative causes surgical site infection was the dominant factor followed respiratory complication like cough, dyspnea and vomiting.

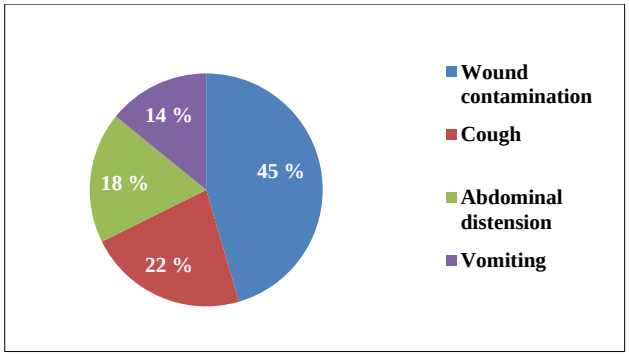

Figure 5: Distribution of postoperative causes.

Mean day of wound dehiscence of patients was 8.4 with SD 2.52 days. Partial dehiscence was reported in 78 (78.0%) patients whereas complete dehiscence was found in 22 (22.0%) patients.

Management of the patient was done by secondary suturing or tension suturing. Secondary suturing was done on 85 (85%) of patients whereas tension suturing was done on only 15 (15.0%) patients.

Complete dehiscence was seen in 22 patients and partial dehiscence in 78 patients. 7 (7%) mortality was seen in this observation and 93 (93%) were found alive.

Table 2: Distribution of patients on the basis of their day of wound dehiscence (in days).

Day of wound dehiscence (in days)	Frequency (n=100)	Percentage
≤10	83	83.0
11-15	16	16.0
>15	1	1.0
Mean±SD (min-max)	8.43±2.52 (5-16)	
Early wound dehiscence (≤7 days)	46	46.0
Late wound dehiscence (>7 days)	54	54.0

Table 3: Correlation between possible risk factor and early and late wound dehiscence.

Variables		Day of wound dehiscence		Total (n=100) (%)	p value
		Early (≤7 days) (n=46) (%)	Late (>7 days) (n=54) (%)		
Gender	Female	16 (34.8)	22 (40.7)	38 (38.0)	0.343
	Male	30 (65.2)	32 (59.3)	62 (62.0)	
Duration of stay (days)	≤20	27 (58.7)	24 (44.4)	51 (51.0)	0.221
	21-30	17 (37.0)	29 (53.7)	46 (46.0)	
	>30	2 (4.3)	1 (1.9)	3 (3.0)	

Correlation between gender, duration of stay and with early and late wound dehiscence was found to be statistically non-significant (p>0.05).

Correlation between procedure done with early and late wound dehiscence was found to be statistically non-significant (p>0.05) and it was found significant with

type of surgery (p<0.05). Correlation between reparative procedure done with early and late wound dehiscence was found to be statistically significant whereas its correlation with outcome was found to be statistically non-significant (p>0.05).

Table 4: Possible indicator for early and late wound dehiscence and their correlation.

Variables		Day of wound dehiscence		Total (n=100) (%)	p value
		Early (≤ 7 days) (n=46) (%)	Late (>7 days) (n=54) (%)		
Procedure done	Appendectomy	3 (6.5)	3 (5.6)	6 (6.0)	0.106
	Blunt trauma	3 (6.5)	2 (3.7)	5 (5.0)	
	Intestinal obstruction	8 (17.4)	6 (11.1)	14 (14.0)	
	Others	5 (10.9)	0 (0.0)	5 (5.0)	
	Perforation repair	10 (21.7)	23 (42.6)	33 (33.0)	
	Resection and anastomosis	8 (17.4)	12 (22.2)	21 (21.0)	
	Stoma	8 (17.4)	8 (14.8)	16 (16.0)	
Timing of surgery	Elective surgery	18 (39.1)	11 (20.4)	29 (29.0)	0.034
	Emergency	28 (60.9)	43 (79.6)	71 (71.0)	

Table 5: Management of wound dehiscence and outcome and correlation with early and late wound dehiscence.

Variables		Day of wound dehiscence		Total (n=100) (%)
		Early (≤7 days) (n=46) (%)	Late (>7 days) (n=54) (%)	
Reparative procedure done	Secondary Suturing	34 (73.9)	51 (94.4)	85 (85.0)
	Tension Suturing	12 (26.1)	3 (5.6)	15 (15.0)
Outcome	Alive	42 (91.3)	51 (94.4)	93 (93.0)
	Died	4 (8.7)	3 (5.6)	7 (7.0)

DISCUSSION

In the present study, incidence of wound dehiscence was 7.14%. The higher incidence is in accordance with the study done by Mathur et al. This is due to poor nutritional state of the patients, delayed presentation to the tertiary care hospitals, poor quality of suture material, disease like tuberculosis of the abdomen and higher load of emergency surgeries.[10]

In this study there was a higher male population with a ratio of 1.63:1. Predilection of male gender to burst abdomen can be explained by abdominal breathing, greater physical activity, less elasticity of abdominal wall, higher incidence of peptic ulcer perforation and intestinal obstruction in male gender, consumption of alcohol and smoking which lead to respiratory infections and malignancy.[11]

In a study conducted by RIMS Imphal, out of 1728 laparotomies, 1008 cases of emergency laparotomies and 720 cases of elective laparotomies, 40 cases developed wound dehiscence out of which 65% were males and 35% were females, with male to female ratio of 2:1 with mean age of 31 years.[12] In this study the average age of patients was found to be 42.70 years.

Old age is definitely a risk factor for abdominal wound dehiscence. Age has also been reported as a risk factor in other studies.[13] Advanced age is also associated with nutritional disorders, pulmonary complications, and comorbid conditions like diabetes, malignancy, and other affiliations of age.

In this study 71% of patient underwent emergency surgery and developed abdominal wound dehiscence and 29% had elective laparotomy. Therefore, the effect of emergency surgery might high in this study. It has been reported though, to be a highly significant factor in other studies.[14] In these patients, the urgent need for laparotomy precluded satisfactory preoperative preparation that includes proper bowel preparation thus leading to wound infection. In a study conducted by RIMS Imphal, showed that 65% of the patients who developed abdominal wound dehiscence had undergone surgeries in emergency.[12] This is probably attributed to improper pre-operative preparation, lack of proper sterilization in an emergency setup and the lack of experience on part of surgeon. Emergency surgery is usually done by trainee residents which inculcates into technical errors which are avoided in elective cases.

The lower incidence of burst abdomen in the elective cases is due to the fact that authors have time to correct or control their risk factors such as anemia, diabetes, malnutrition, hypoproteinemia etc. Also, they have no abdominal sepsis.

In this study postoperative day of wound dehiscence was 8.43 day and it ranged from 5th to 16th day. Majority of patients presented with late wound dehiscence (>7 days, 54%) whereas only 46% patients presented with early wound dehiscence (<7 days). Sixth to tenth day after surgery were the usual days of burst abdomen in this study. 83% of the patients presented with wound dehiscence within tenth postoperative day, out of these 46% patients presented as early wound dehiscence and 54% as late wound dehiscence. 16% patients presented between 11th-15th postoperative day and only 1% (1) patient presented after 15th postoperative day.

In this study average duration stay was 21.98 days. Majority 51% patients (51) stayed for up to 20 days followed by 46% (46) patients in between 21-30 days and least 3% (3) patients stayed in the hospital for greater than 30 days. The results were comparable to the study conducted by Sivender et al, were average duration of stay was 26.1 days with range of 23 to 37 days.[5]

A total 22% patients presented with complete wound dehiscence and 78% with partial dehiscence. Certain anatomical factors make vertical midline incision more prone to dehiscence like interference with blood supply, segmental blood supply and nerve supply of rectus abdominis, disruption of transverse fibres which are cut in vertical incision, the pain prevents chest movements thus increasing the likelihood of respiratory infections and cough, this increases the intra-abdominal pressure leading to tension and strain on the fresh wound.

In this study, anemia was seen in 56% of patients. Anemia will increase the incidence of wound dehiscence as decreased hemoglobin leading to increased perioperative stress, and decreased tissue oxygenation, all of which can affect the immune system and the wound healing process.[14,15] Decreased oxygenation of tissues cause impaired angiogenesis and affect wound healing.

Hypoproteinemia albumin <3.5 gm% was observed in 62% of patients. Protein catabolism can result in delay of wound healing. Patients with low albumin levels experience a delay in wound healing and also wound dehiscence because proteins are essential components of collagen, fibrin and extracellular matrix.

In the present study 88 patients out of 100 had intra-abdominal infection making it the most common and important preoperative risk factor (88%). It was more common in emergency laparotomy with dirty and contaminated wound. This is in accordance with study conducted by Graham et al, showed that patients with Intra-abdominal infection were more likely to have undergone an emergency operation, wound dehiscence is more common in emergency operations and operations with higher wound classification.[16]

Diabetes (30%) and uremia (31%) were other significant preoperative risk factors in that order. Most patients have more than one risk factors. In the present study almost 31% of the patients have elevated renal parameters. Although renal parameters alone cannot cause dehiscence but co- existence of other factors is necessary to give rise to burst abdomen.

In a study carried out by Sivender et al, out of 50 cases 4 (8%) cases had raised liver enzymes, 31 (62%) patients had hypoalbuminemia, 16 (32%) patients had hyperbilirubinemia and 18 (36%) patients had elevated renal parameters.[13] In present study out of 100 patients about 88% of patients showed intra-abdominal infection. Other risk factors in present study included, hypoalbuminemia 62%, anemia 56%, diabetes mellitus 30% and uremia 31%.

In present study, 90% patients had wound contamination. Cough was present in 44% patients. Abdominal distension 36% and vomiting 28% were the other common post-operative causes. In present study, 60% patients had peritonitis. Edeamtous bowel wall, friable tissue edges and infection predisposes to wound dehiscence. Graham DJ et al pointed that intra-abdominal infection and colonic surgery were a leading cause of wound dehiscence.[17]

Peritonitis results in unavoidable contamination of wound that interferes with the wound healing process and increased bacterial load of the wound. This study showed that abdominal wound dehiscence is more common in patients presenting with peritonitis due to hollow viscous perforation (34%). Amongst which gastric perforation accounted for 20%. Other perforations which included duodenal perforation (12%), ileal perforation (17%), jejunal perforation (8%), cecal perforation (2%) and appendicular perforation (6%). 21 % patients presenting with enteric obstruction underwent resection and anastomosis while remaining few were subjected to adhesiolysis and proximal stoma was made in 16% of the patients. 10% of the patients had underlying malignancy. This study showed that abdominal wound dehiscence is more commonly in patients undergoing perforation repair of bowel (34%) closely followed by resection and anastomosis (21%). 20% of the patients had underlying malignancy.

The basic treatment for repair of the burst abdomen is re-suturing. The goal of surgery is to replace the eviscerated organs into the abdominal cavity and to prevent recurrence and later development of incisional hernia. Critically ill patients are better served by conservative temporary measures and delayed operative closure.[18]

Attempts to close the fascia under tension results in recurrence and possible intra-abdominal hypertension. Definitive surgical repair to restore the integrity of abdominal wall will eventually be required if absorbable mesh is used but not if a biologic prosthesis is used.

In this study majority of the patients were managed by secondary suturing under aseptic condition. Out of 85% (85) patients that were managed by secondary suturing 34% (34) patients presented as early wound dehiscence and 51% (51) presented as late wound dehiscence. Remaining of the 15% (15) patients was managed by tension wire suturing, 12% (12) from the early dehiscence group and 3% (3) from the late dehiscence group.

In this study seven patients died as a result combination of factors including abdominal wound dehiscence 4% (4) from the early wound dehiscence and 3% (3) from late wound dehiscence. Overall mortality rate in this study was 7% which comparable to various other studies like Afzal et al, Poole et al, etc. In some literatures the mortality rate in wound dehiscence/burst abdomen is reported as high as 45%.[19] The reported mortality continues to be in the range of 9 to 44%.[8]

CONCLUSION

Abdominal wound dehiscence causes significant morbidity and mortality. Patients with risk factors require more attention and special care to minimize the risk of occurrence. Abdominal wound dehiscence can be prevented by improving the nutritional status, strict aseptic precautions, avoiding midline incisions, improving patient's respiratory efforts to avoid postoperative cough and by proper surgical technique.

Results of this study were comparable to other previous study. Both complete and partial wound dehiscence were managed by secondary suturing and tension suturing as per the clinical scenario and surgeon's preference.

So finally, authors conclude that prognostic risk factors correlate well with prognosis of the patients, and can be used to individually identify the patients who are more likely to succumb to death.

This study has some limitations in terms general consensus regarding choice of suture material and technique used to manage abdominal wound dehiscence. Number of patients in this study is very modest, so further trials and studies need to be undertaken, from different centers and a meta-analysis of all can lead to a positive side in the management of abdominal wound dehiscence.

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