



A PROSPECTIVE STUDY OF PREDICTORS FOR POST LAPAROTOMY ABDOMINAL WOUND DEHISCENCE

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ABSTRACT

Introduction: Wound dehiscence or burst abdomen is a very serious post-operative complication which is associated with high morbidity and mortality rates. Despite the advances made in asepsis, antimicrobial drugs, sterilization and operative techniques- post-operative wound dehiscence continues to be a major threat.

Aims And Objectives:

1. To find the incidence of abdominal wound dehiscence following laparotomy in a tertiary care centre of Eastern India.
2. To evaluate the factors implicated and their contribution in abdominal wound dehiscence

Methodology: This prospective single centre observational study was conducted at a tertiary care hospital on 100 consenting patients undergoing both elective and emergency laparotomy. All the cases were followed up on postoperative days 1, 4, 7 and 10 or till discharge and further follow up was continued every 2 weeks till 4 weeks. Patients with wound dehiscence were evaluated by the investigators for the enlisted parameters which were age, sex; BMI; comorbidities like anemia, hypoproteinemia; hypertension, jaundice, increased urea creatinine, habit of smoking; presence of clean or contaminated wound and various other factors like time of surgery, use of steroids, ASA physical status and so on.

Results: We found that wound dehiscence was significantly more in male patients; patients with increased BMI, presence of anemia, hypoproteinemia, increased serum urea creatinine level. It was more in contaminated wound and patients with higher ASA physical status. But time taken for surgery type of surgery has no influence on wound dehiscence in this study.

Conclusion: Post laparotomy wound dehiscence depends on multiple factors.

KEYWORDS : wound dehiscence, laparotomy

INTRODUCTION

An abdominal wound may occur either by trauma⁽¹⁾ or by any surgical intervention for underlying pathology⁽²⁾. In case of surgical laparotomy wound, the incision is made through the various layers of the abdominal wall that sequentially includes the skin, subcutaneous tissue, fascio-aponeurotic plane and peritoneum. This initiates a cascade of mechanisms at the cellular level that helps in healing at the incision site⁽³⁾ by primary or secondary intention.

Healing by primary intention occurs in wounds with apposed margins while that by secondary intention occurs where the wound edges are separated. Phases of wound healing are haemostasis, inflammation, proliferation, epithelization and maturation – remodelling. All the phases occur in orderly and overlapping manner.

Wound dehiscence or burst abdomen is a very serious post-operative complication which is associated with high morbidity and mortality rates. It affects the patients by increasing distress and the risk of mortality; the attendants by increasing the cost of treatment, the surgeon for whom it is a disturbing reality and the hospital resources by increasing the healthcare cost³ due to prolonged hospital stay. It is an end result of multiple causes, some of which may be unavoidable. Incidence of abdominal wound dehiscence varies from 0.2% to 6% with associated mortality of 9% to 44%⁽⁴⁾.

Various factors affecting wound healing and those leading to wound disruption have been studied so far. Patients general profile e.g. age, sex, nutritional status, co morbidities like

Anemia, diabetes, jaundice, renal failure, poor American Society of Anaesthesiology scoring may contribute to wound failure. Intra-operative knot breakage, suture material rupture or suture cut through, emergency or elective nature of surgery, type and duration of surgery, post-operative wound infection or increase intra-abdominal pressure are often contributory factors leading to post-laparotomy wound complications.

Despite the advances made in asepsis, antimicrobial drugs, sterilization and operative techniques- post-operative wound dehiscence continues to be a major threat.

AIMS AND OBJECTIVES

The current study has the following objectives:

1. To find the incidence of abdominal wound dehiscence following laparotomy in a tertiary care centre of Eastern India.
2. To evaluate the factors implicated and their contribution in abdominal wound dehiscence.

MATERIALS AND METHODS

This study was done on 100 consecutive patients of either sex more than age group 12 coming to a tertiary care hospital under going laparotomy (emergency and elective) for different reason. The study duration was about 18 months.

Study Design:

This is a prospective, observational, single centre, hospital based study.

II. Exclusion Criteria:

1. Patients below 12 years of age.

2. Patients unwilling to participate in the study.
3. Patients lost on follow up by 4 weeks post-operative period.
4. Patients undergoing repeat laparotomy due to any reason.
5. Patients undergoing urologic or gynaecological procedure.

Parameters Evaluated

1. Age
2. Sex
3. Obesity : BMI <18.5 – underweight
18.5-30 – normal weight
>30 – overweight and obese
4. Anemia: Haemoglobin <10mg/dl – anaemic
5. Hypoalbuminemia: Serum Albumin <3mg%
6. Hypertension: BP >140/90 mmHg
7. Diabetes Mellitus: Fasting blood sugar >127mg/dl
8. Jaundice: Serum bilirubin >3mg/dl
9. Renal Compromise: Serum urea >40mg/dl
Serum Creatinine >2mg/dl
10. Tobacco use / Smoking: Heavy tobacco use ≥ 20 pack years
Number of pack-years = (packs smoked per day) × (years as a smoker) or
11. American Society of Anaesthesiology physical status
12. Wound Contamination: Clean /contaminated/dirty

SURGICAL WOUND CLASSIFICATIONS

I. Clean:

- Uninfected, no inflammation
- Respiratory, GI, GU tracts not entered
- Closed primarily

Examples: Exploratory laparotomy, mastectomy, neck dissection, thyroid surgery, vascular surgery, hernia surgery, splenectomy

II. Clean-contaminated:

- Respiratory, GI, GU tracts entered, controlled
- No unusual contamination

Examples: GB surgery, liver transplant, gastric surgery, bronchi, colon surgery

III: Contaminated:

- Open, fresh, accidental wounds
- Major break in sterile technique
- Gross Spillage from GI tract
- Acute nonpurulent inflammation

Examples: Inflamed appendix, bile spillage in GB surgery, diverticulitis, Rectal surgery, penetrating wounds

IV: Dirty:

- Old traumatic wounds, devitalized tissue
- Existing infection or perforation
- Organisms present BEFORE procedure

Examples: Abscess I&D, perforated bowel, peritonitis, wound debridement, positive cultures pre-operative

13. Duration of Surgery

14. Type of intra abdominal pathology:

15. Type Of Operation: Emergency/Elective

16. Post Operative Straining Factors: Nausea/Vomiting, Cough, Abdominal Distension.

17. Use of Steroids: Use of systemic steroids in the last 12 months prior to surgery.

18. Radiotherapy / Chemotherapy prior to surgery.

19. Immunocompromised State: Seropositive for HIV

STUDY TECHNIQUE

The patients who fulfilled the inclusion and exclusion criteria were subjected to detailed history and clinical examination and preoperative investigations. Abdominal skin was prepared 2-3 hours prior to surgery and laparotomy performed under general anaesthesia, through a vertical midline incision. Laparotomy incision was closed en mass with peritoneum and linea alba in a single layer using looped PDS (polydioxanone) monofilament synthetic absorbable suture number 1. The skin was sutured with Monofilament Nylon suture (2-0). The total duration of the operation from the skin incision to closure was noted.

All the laparotomy cases were followed up on postoperative days 1, 4, 7 and 10 or till discharge and further follow up was continued every 2 weeks till 4 weeks.

Patients with wound dehiscence were evaluated by the investigators for the enlisted parameters.

Analysis Of Data

Data was analysed using appropriate statistical tools [Graph Pad Prism 7].

RESULTS AND ANALYSIS

The present study evaluates 100 consecutive laparotomy cases admitted at a Tertiary Medical College & Hospital . Out of these cases 29 patients had abdominal wound dehiscence post laparotomy. The risk factors implicated in abdominal wound dehiscence have been evaluated and discussed below.

Table1:- Incidence Of Abdominal Wound Dehiscence In Different Age Groups In Wound Dehiscence And Non Dehiscence Group:

Age(years)	Wound dehiscence(yes)	Wound dehiscence(no)	total
11-20	1	4	5
21-30	3	10	13
31-40	5	12	17
41-50	10	19	29
51-60	6	13	19
61-70	4	13	17
total	29	71	100

In this study majority of the wound dehiscence patients belonged to the age group 41-50 years, youngest patient was 15 years and oldest patient was 70 years. The mean age of patient affected was 44.9 years.

Table 2 Relation Of Gender Differentiation Between Dehiscence & Non Dehiscence Groups:

sex	Wound dehiscence (yes)	Wound dehiscence (no)	Statistical significance
Male	20	32	p value0.05 Fisher's exact test0.0463
Female	9	39	
total	29	71	

Wound dehiscence in male gender was significantly more .

3. Incidence Of Wound Dehiscence On The Basis Of BMI Among Dehiscence & Non Dehiscence Groups :

BMI	Wound dehiscence (yes)	Wound dehiscence (no)	Fisher's exact test	Relative risk
<30	11	50	0.0034	1.3907
>30	18	21		
total	29	71		

Out of 29 cases of wound dehiscence 18 patients had BMI above 30 and 11 patients had BMI equal to 30 or below 30. Out of these 18 patients 5 were females having BMI 30.3 or more. Of

the total of 100 patients,39 were found to be obese(BMI >30 or more).Thus showing increased no of dehiscence in patient with increased body weight.

Table 4 incidence Of Anemia, Hypoproteinemia, Hypertension, Diabetes And Jaundice In Dehiscence And Non Dehiscence Group

Disease	Dehiscence(Yes)	Dehiscence (no)	P value	Relative risk
anemia	yes	22	<0.0001	5.587
	no	7		
Hypoproteinemia	Yes	27	<0.0001	9.776
	no	2		
Hypertension	yes	17	0.0002	3.306
	no	12		
Diabetes	yes	10	0.0284	2.105
	no	19		
Jaundice	yes	4	0.7255	1.295
	no	25		

Different comorbidities has significant association with dehiscence except for jaundice

Table 5 Incidence Of Renal Compromise In Dehiscence And Non Dehiscence Groups:

Serum urea creatinine	Wound dehiscence (Yes)	Wound dehiscence (No)	Chi square test for trend
U>40 Cr>2	15	7	<0.0001
u>40 cr<2	4	11	
U<40 Cr>2	8	27	
U<40 Cr<2	2	26	

Increased Urea Creatinine value has positive association with wound dehiscence.

Table 6. Incidence Of Abdominal Wound Dehiscence In Relation To ASA Score (American Society Of Anaesthesiology Score) And Tobacco Smoking

		Wound dehiscence yes	Wound dehiscence no	Fishers exact test	Relative risk
Smoker	≥ 20 pack years	19	29	0.0292	2.058
	< 20 pack years	10	42		
ASA Physical status	I	33	39	0.0361	
	II	4	21		
	III	2	11		

Cigarette smoker has increased risk of dehiscence as well as poorer the physical status more the chance of dehiscence.

7.Incidence Of Abdominal Wound Dehiscence In Relation To Wound Contamination / Infection:

Types of wound	Wound dehiscence yes	Wound dehiscence	Chi square test
clean	-	48	<0.0001
Clean contaminated	7	21	
Contaminated	22	2	

7 patients with dehiscence i.e. 24.13% patients had clean contaminated wounds. No patient with clean wound developed wound dehiscence.

Table:8 Incidence Of Abdominal Wound Dehiscence In Relation To Time Needed For Surgery And Type Of Surgery

And Post Op Training Factor In Dehiscence And Non Dehiscence Groups:

Factors		Wound dehiscence	Wound dehiscence	Fisher's exact test	Relative risk
Duration	>120min	9	27	0.6471	0.8
	<120 min	20	44		
Type	Emergency	22	38	0.0450	2.095
	Elective	7	33		
Post op straining	Nausea vomiting	6	17	0.1446	
	cough	5	9		
	Abdominal distension	14	21		
	miscellaneous	4	24		

Time needed for surgery or post op straining factors was not associated significantly with wound dehiscence but the chance of dehiscence was more in patients who were operated as emergency cases.

Table 9. Incidence Of Abdominal Wound Dehiscence In Relation To Type Of Intra-abdominal Pathology

Types of intraabdominal pathology	Wound dehiscence yes	Wound dehiscence No	Chi square test
Perforative peritonitis for hollow viscus perforation	15	12	0.0699
Tuberculosis abdomen	3	8	
cholelithiasis	0	13	
CBD exploration	1	3	
Sigmoid volvulus	2	7	
Colorectal carcinoma	2	8	
Small intestinal obstructions	4	9	
Gun shot injury	1	1	
Hemoperitoneum for solid organ/mesenteric injury	1	3	
Stab injury	0	1	
Gastric outlet obstructions	0	3	
miscellaneous	0	3	

Type of surgery has no significant association with wound dehiscence

11. Incidence of abdominal wound dehiscence in relation to Use of Steroid in last 12 Months

In my present study no patients gave history of taking steroids in last 12 months before laparotomy so predicting steroid use as a risk factor for abdominal laparotomy was not possible.

12. Incidence Of Abdominal Wound Dehiscence In Relation To Radio Therapy /Chemotherapy Before Operation

In my present study No patient received Radiotherapy/Chemotherapy before operation. So it could not be assessed as a factor of wound dehiscence.

13. Incidence of abdominal wound dehiscence in relation to immunocompromised state like HIV Infection

In the present study 3 out of 100 patients undergoing laparotomy were HIV Positive but none of them developed wound dehiscence.

DISCUSSION

This study reviewed a total of 29 wound dehiscence patients out of an enrolled 100 consecutive patients admitted at our institute who underwent laparotomy for various reasons. The various risk factors evaluated are discussed as follows.

1.Age:

The age-wise distribution in this study showed that the

majority of the wound dehiscence patients belonged to the 4th to 5th decade group with the mean age of affected patients being 44.9 years.

This finding is similar to that showed in the study by Garg et al^[5], where the mean age for wound dehiscence was noted to be 41.61 years. However, other studies by Pavlidis et al^[6], van Ramshorst et al^[7], Makela^[8] and Hanif^[9] showed about 50% increased incidence with advanced age.

2. Sex:

The sex distribution as found in this study was that of male preponderance with 22 out of 29 cases being male (68.96%) and 9 out of 29 cases being female (31.03%) with a male to female ratio of 2.22.

This finding was in concordance with most of the studies like the one by Hampton^[10] and Hanif^[9] where the ratio was 2:1. Mir.N.A.et al^[11] also found male gender to be at more risk probably due to smoking and also men have higher abdominal wall tension than women. Increased intraabdominal pressure results in higher strain on wound edges, predisposing sutures to cut through the muscles and fascia. amongst the wound dehiscence cases.

3. Obesity:

Obesity was found to be statistically significant with a p value of 0.0034 in the wound dehiscence group. This correlation can be attributed to the decreased blood circulation in fatty tissue.

In the study by Khandra HP^[12], 92% of the obese patients compared to 32% of the average patients that complications in abdominal wound healing. Garg et al^[5] found 16 out of 50 patients with wound dehiscence (32%) with a BMI >35.

4. Anemia:

In the current study, Anemia (Hb% < 10 gm%) was observed in 22/29 wound dehiscence cases (75.86%) with a relative risk of 5.587 and a significant p value (p < 0.0001). This finding is similar to that found by NagaMuneiah et al^[13] from Tirupati, wherein about 72% of the wound dehiscence patients had Hb < 10 gm/dl.

5. Hypoproteinemia/Hypoalbuminemia:

Hypoproteinemia was observed to have a relative risk of 9.776 & a p value of < 0.05. Hypoproteinemia has been implicated to be a significant risk factor in the study by Meena et al with a p value of 0.006^[14]. The study by Garg R et al^[5] found hypoalbuminemia (serum albumin < 3gm%) in 12 patients out of 50 patients with wound dehiscence.

6. Hypertension:

Hypertension (BP > 140/90 mm of Hg) was observed in 17 out of 29 cases (58.62%) in this study. This was found to be significant with a p value of 0.0002 and a relative risk of 3.306. This parameter has however been evaluated in very few studies. Mir M A et al^[11] reported hypertension to be significant in univariate analysis but not in multivariate analysis.

7. Diabetes Mellitus:

Diabetes was observed in 10 out of 29 patients with wound dehiscence (34.48%) with a statistically significant p value of 0.0284. The relative risk value was 2.105.

Diabetes mellitus is another risk factor for wound failure ultimately causing incisional hernia^[15]. In the study by Afzal and Bashir^[16], diabetes was found to be a statistically significant risk factor (p < / = 0.05) in emergency laparotomy group. Diabetes can lead to disaster by altering the immune response and nutritional status. It also increases the susceptibility to wound infection.

8. Jaundice:

Jaundice (serum bilirubin > 3mg%) was noted in 4 out of 29

patients with wound dehiscence (13.79%) and the rest 25 patients had normal serum bilirubin levels or was < 3mg%. However, this was not found to be significant with a p value of 0.7255 and a relative risk of 1.295.

Though jaundice has long been described as a risk factor for dehiscence, recently it has been challenged as a contributor to the catastrophe particularly if the mass closure technique is used^[17]. In the study by Afzal and Bashir^[16], the patients who had burst abdomen with jaundice also had intra-abdominal sepsis. Thus jaundice may be an associated finding in patients of burst abdomen with no contribution to the actual disaster.

9. Renal Compromise:

Renal compromise was found to be a statistically significant risk factor with a p value of < 0.0001.

Renal compromise as a significant risk factor has also been noted in the study by Garg et al^[5], wherein 38% (19/50) patients had a raised blood urea level and 8% (4/50) patients had a raised serum creatinine level. Similar findings have also been noted by Ellis et al^[18].

10. Tobacco Use/ Smoking:

It was found that out of 29 patients, 19 patients (65.51%) were heavy smokers who went on to develop wound dehiscence. Among those patients who did not have wound dehiscence, 10/71 (14.08%) were heavy smokers with a p value of 0.0292 and a relative risk of 2.058.

Similar result implicating smoking as a major risk factor has been shown in the study by Mir M A et al^[11] with 46.4% (patients of the wound dehiscence group and 15% patients of the control group were heavy smokers with a p value of < 0.001.

11. American Society Of Anaesthesiology Score:

In the present study, 23 patients out of 29 (79.31%) had ASA score I, 4 patients (13.79%) had ASA score II and 2 patients (6.89%) had ASA score III. The values obtained indicated ASA score to be a statistically significant herald of wound dehiscence cases with a p value of 0.0361.

Garg et al^[5] in their study found that out of 50 patients with wound dehiscence enrolled in their study, 92% had ASA score IE, 6% had ASA score IIE and 1 patient had ASA score IIIE. This finding is corroborated by the present study.

12. Wound Contamination

Wound contamination was found to be a strong predictor of wound dehiscence with a significant p value of < 0.0001. Wound contamination & wound infection remains a foremost important factor for wound dehiscence & an important aetiology of burst abdomen^[20,21].

13. Duration Of Surgery:

The present study evaluated patients on the basis of duration of surgery lasting greater than 120 minutes or less. Out of 29 patients with wound dehiscence, 9 cases (31.03%) had laparotomy lasting > 120 minutes while the rest 20 patients (68.9%) had surgery lasting < 120 minutes. However the p value was 0.6471 which was not found to be statistically significant with a relative risk of 0.8.

The study by Garg et al^[5] showed that 20 % (10/50) of the dehiscence patients had emergency laparotomy lasting > 2 hours. But this was not statistically significant as is corroborated by the present study.

14. Incidence Of Abdominal Wound Dehiscence In Relation To Type Of Intra Abdominal Pathology:

Out of the 29 patients with wound dehiscence in the current

study, 15 (51.72%) had perforative peritonitis due to hollow viscus perforation which constituted the majority of the cases. Tuberculosis was found in 3 (10.34%), small intestinal obstruction in 4 (13.79%), CBD exploration in 1 (3.44%), sigmoid vulvulus in 2 (6.89%), colorectal carcinoma in 2 (6.89%), gunshot injury in 1 (3.44%) & haemoperitoneum due to solid organ/mesentery injury in 1 (3.44%) cases.

We did not find any significant association with wound dehiscence.

15. Type of operation - Emergency/ Elective:

The current study found 22 patients out of 29 (75.865%) had emergency laparotomies and developed wound dehiscence. Rest 7 patients (24.13%) underwent elective laparotomies. Emergency operations were hereby found to be statistically significant as a risk factor for development of wound dehiscence with a p value of 0.0450 & a relative risk of 2.095.

This finding is similar to that found in the study on 107 patients with abdominal wound dehiscence over 7 years at the Department of Surgery, Case Western Reserve University, Cleveland Veterans Affairs Medical Centre, USA by Renvall S et al^[22] wherein patients with intra abdominal infection were more likely to have undergone an emergency operation [74 % with $p < 0.02$].

16. Post Operative Straining Factors:

In this study out of 29 patients with wound dehiscence 6 patients (20.68%) developed post operative nausea & vomiting, 5 patients (17.24%) developed post-op cough and 14 patients (48.279) developed postoperative abdominal distension. Though it was not statistically significant.

17. Use Of Steroid In Last 12 Months:

In the present study, none of the patients had a history of taking steroids in the last 12 months before laparotomy; therefore, predicting steroid use as a risk factor for abdominal laparotomy was not possible.

The use of steroids has been identified as a risk factor in many studies^[6, 23]. It has also been implicated as an important risk factor in the study conducted by Khan et al^[24] at the Nishtar Hospital, Multan.

18. Radiotherapy / Chemotherapy:

In the present study none of the patients received radiotherapy /chemotherapy before laparotomy. Hence these factors could not be assessed as a cause of wound dehiscence.

Anti cancer agents are anti proliferative and adversely affect the healing process, thereby causing delayed wound healing in the laparotomy cases. More studies are required for directly establishing a causal role in wound dehiscence.

19. Immunocompromised State (HIV Infection):

The present study had 3 patients out of the 100 laparotomy cases as seropositive for HIV. None of them had wound dehiscence. Few studies do indicate that these patients may have difficulties in wound healing^[25]. However larger studies with seropositive patients are required for establishing it as a factor for wound dehiscence.

CONCLUSION

The causes of post op wound dehiscence are multifactorial.

Limitations Of This Study:

1. Limited number of patients was included. Larger sample size would have been better.
2. Single centre study. Multi centre study would be statistically more powerful.
3. A number of other factors like type of suture material used,

type of suture given were not evaluated, but have been implicated as significant causative factor in several studies on the same topic.

4. Patients receiving Radiotherapy / Chemotherapy, Immunocompromised patients like HIV infected cases, those who had used steroid in the last 12 months before operation were few or none at all in this study.

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