

Determinants of Wound Dehiscence in Abdominal Surgery in Public Sector Hospital

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Objective: The objective of this study was to find an association and prevalence of risk factors and wound dehiscence.

Study design: Cross-sectional Study.

Setting and Duration: Surgical unit IV DHQ hospital, Faisalabad. From January 2002 to June 2003.

Material and Methods: Patients who under went exploratory laparotomy through vertical abdominal incisions with one or more risk factors. The main out come measures found significant were wound infection- sepsis, hypoproteinemia, diabetes mellitus, emergency surgery, steroid use and advancing age.

Results: 430 patients under went laparotomy through vertical incisions during last one and half years. Complete record of all the patients was maintained on Proforma. Trained surgeons with latest recommended protocol closed their wounds by using monofilament nonabsorbable 1 gauge suture taking 1 cm bite from the edge with 1 cm interstitch interval. All risk factors were made measurable on bases of history, examination, and investigations. Patients were closely observed post operatively on day 3, 7, and 10, special attention being paid to development of wound infection or wound dehiscence. Out of 430 patients, 35 patients had acute wound failure. 32 patients had the catastrophe happening in emergency laparotomies where as only 3 cases were noted in elective laparotomies ($P < 0.001$). In sub group of emergency laparotomies incidence was highest in cases of frank peritonitis ($P < 0.001$). In studying risk factors in dehisced cases, 29 patients under going emergency laparotomy had intra-abdominal sepsis as compared to only one patient of the sepsis in elective laparotomy group ($P < 0.001$).

Diabetes, steroid use, and advancing age were found as statistically significant risk factors only in cases of peritonitis and intra-abdominal sepsis.

Conclusion: Wound sepsis is the single most important risk factor for wound dehiscence. All other risk factors contribute to the disaster by aggravating sepsis.

Key words: Wound, dehiscence, laprotomy.

INTRODUCTION

Wounds and their management are fundamental to the practice of surgery. Any surgical intervention will result in a wound. The surgeon's task is to minimize the adverse effects of the wound, remove or repair damaged structures and harness the process of wound healing to restore function¹. General surgeons make various abdominal incisions. Disruption of abdominal surgical wound is one of the common causes of early re-laparotomy. Wound dehiscence is an acute wound failure.² It has an incidence of 2 percent and an associated mortality of 25%.³ No single cause is responsible for wound dehiscence and as a rule a combination of factors is operating. If the support system fails before the functional and structural integrity is regained, then the wound edges break apart. Many such factors like anemia, jaundice, uremia, diabetes, hypoalbuminemia, chronic obstructive pulmonary diseases, advanced malignancy, steroid use, obesity, wound infection and emergency surgery have been defined.^{4,5} Some factors like jaundice, obesity, anemia, emergency surgery and diabetes have recently been challenged.⁶ Wound infection is the most important single factor in the development of burst abdomen and incisional hernia.⁷

Wound healing has been described throughout the recorded history of surgery. Empirically the ancients recognized that foreign bodies and dead tissues must be removed from wounds.⁸ In the sixteenth century Pare discovered that surgical destruction of tissue by pouring boiling oil into acute open wounds, impeded healing and led to sepsis. His observations led to the maxim of all surgeons today –“Do not put anything in a wound you would not put in your own eye”.⁹ The clinician's treatment of tissue must be as atraumatic as possible. Lister, Semmelweis, Ehrlich, Flemming, and Florey realized, with increasing sophistication, that bacteria were pathogens that prevented healing and led to sepsis and death. Control of bacteria by asepsis, antiseptics, and antimicrobials heralded a new era in wound management.¹⁰

Wound dehiscence often reflects an error of judgement on the part of surgeon, and the elimination of postoperative wound dehiscence maybe within the jurisdiction of the operating surgeon.¹¹ The chances of postoperative wound dehiscence can be predicted. Good knowledge of risk factors is mandatory for prophylaxis. Patients identified as being high risk may benefit from close observation and early intervention.

To highlight the risk factors for complications in wound dehiscence we started the study which had helped us to pick up high-risk cases for wound dehiscence and to predict the outcome of our management of abdominal wounds. This will certainly reduce mortality and morbidity in the form of prolonged hospital stay, increased economic burden on health care resources and long term complication of incisional hernia.

Material and Methods

This was a cross sectional study carried out in surgical unit IV, DHQ Hospital, Faisalabad over a span of one and a half years. The subjects were followed after their laprotomies till their wound healed or complication occurred. All the patients undergoing laparotomy through vertical incision with one or more risk factors like age, jaundice, uremia, diabetes, chronic obstructive pulmonary diseases, hypoalbuminemia, obesity, malignancy, emergency procedure, fecal peritonitis and steroid use were included. Patients undergoing exploration through mini laparotomy, transverse incisions and vertical laparotomy through previous scar were excluded. A pretested proforma comprising history, physical examina-

tion and results of certain investigations was used for data collection. After taking informed consent complete record of all the patients was maintained and kept confidential. Trained surgeons with latest recommended protocol closed their abdominal wounds. In midline incision this meant apposition of linea alba with continuous non absorbable monofilament 1 gauge suture and in lateral incision layer by layer closure as far as possible with only tendinous, aponeurotic and fascial structures using appropriate suture material. Suture to wound length was 4:1. The wound was sutured by taking 1cm bites of the fascia (the distance from needle insertion to the wound edge) together with 1cm interstitch interval. All the risk factors were made measurable on bases of history, examination and laboratory investigation. Patients were closely observed post operatively. Special attention was paid to the development of wound infection or wound dehiscence. Abdominal distention and postoperative ileus were noted. Condition of the wounds was inspected on day 10, 20, 40 and recorded on the proforma. We defined wound dehiscence as the fascial layers of abdominal wall have separated apart, and this may or may not be associated with protrusion of a viscus. We defined

wound infection as cellulitis or presence of pus in the wound. This was the end point of the study. Data was analyzed using Z-test. P value less than 0.05 was considered as statistically significant.

Results

A total 430 patients undergoing laparotomy through vertical incision were studied. Out of 430 patients 35 patients had acute wound failure so the incidence of burst abdomen in our study was 8.13% Out of 173 elective laparotomies, three cases of burst abdomen were noted; whereas 32 cases had the disaster occurring in emergency procedures (Table 1). Thus incidence was quite high in emergency laparotomies ($P < 0.001$). In subgroup of emergency laparotomies incidence was highest in cases of frank peritonitis ($P < 0.001$).

In elective laparotomy group, only intra abdominal sepsis ($P < 0.05$) and age above 65 years ($P <$

Table 1: Percentage of wound dehiscence in subgroups.

Sr. No	Subgroup	No. of Cases	Dehiscence	% age
A.	Elective Laparotomy	173	3	1.73%
B.	Emergency Laparotomy	257	32	12.45%
	1. Trauma			
	i) with bowel injuries	93	7	7.32%
	ii) without bowel injuries	62	0	0%
	2. Bowel Obstruction	45	9	20%
	3. Peritonitis	57	16	28.07%

Table 2: Risk factors in dehisced and non-dehisced cases for elective laparotomies.

Sr. No	Risk factor	Non-dehisced cases (n 170)	Dehisced cases (n 3)	Relative Risk	P value
1.	Intra abdominal sepsis	3	1	1.34	0.015
2.	Poor Nutritional status	12	0	1.04	-
3.	Age more than 65 y	17	1	1.06	0.95
4.	Uremia	3	0	1.04	-
5.	Diabetes Mellitus	24	1	1.06	0.95
6.	CLD with Ascities	15	1	1.08	0.174
7.	Jaundice	7	0	1.04	-
8.	Pulmonary Diseases	9	0	1.04	-
9.	Use of Steroids	2	0	1.04	-
10.	Obesity	3	0	0.04	-
11.	Hypoproteinemia	3	3	1.13	-

0.1) were found significant as risk factors for dehiscence (Table 2).

In emergency laparotomy group, intra abdominal sepsis ($P < 0.01$), poor nutritional status ($P < 0.01$) and use of steroid ($P \leq 0.05$) were found significant as the risk factors. (Table 3).

Common complications seen in the cases of dehiscence (n 35) were wound sepsis in 31 cases, intra abdominal sepsis in 18 cases and bowel fistulae in 16 cases. There were six mortalities (Table4).

Discussion

The discussion on the subject of abdominal wound dehiscence is as old as the history of modern operative surgery. The peri-operative mortality and long term morbidity associated with the condition need medical surgical preventive measures to be taken.

The clinical study of wound healing is complicated considerably by the fact that it is uncommon for any factor to exist in isolation and it may be difficult, indeed, to determine which factor is of greatest importance in a particular case.¹² A fresh wound has no strength of its own and regains artificial support with sutures. Strength of wound is of two types. Intrinsic strength is that which is due to collagen deposition and extrinsic strength is one which is bestowed on the wound by its sutures. Intrinsic strength is zero at first postoperative day and increases gradually with the passage of time. The support of sutures must be maintained for sufficient time so that normal functional and structural continuity is restored.¹³ If the support system fails before the functional structural integrity is regained then the wound edges break apart.

Although the suture failure plays an obvious role, the main problem is upset connective formation in the scar.

In recent years there has been a considerable drop in the incidence of burst abdomen in many reports, a result of spread in popularity of mass closure technique usually combined with the use of non absorbable suture material and with closely placed, wide bites of the abdominal wall.¹⁴ The reported incidence of wound dehiscence varies from 0.2% to 3% of abdominal wounds.¹⁵ Local literature reveals quite high incidence in the range of 3% to 8%.¹⁶ The incidence in our study (8.13%) raises many questions as maximum effort was made to use the technique and suture material as described in studies with the lowest incidence.

Surgeons with any degree of experience recognize that wound healing is not often a problem in healthy young

Table 3: Risk factors in dehiscd and non-dehiscd cases for emergency laparotomies.

Sr. No	Risk factor	Non-dehiscd cases (n 225)	Dehiscd cases (n 32)	Relative Risk	P value
1.	Intra abdominal sepsis	12	29	0.54	0.000
2.	Poor Nutritional status	19	10	0.98	0.000
3.	Age more than 65 y	13	3	1.18	0.324
4.	Uremia	10	3	1.19	0.116
5.	Diabetes Mellitus	30	2	1.18	0.32
6.	CLD with Ascities	10	1	1.26	0.7
7.	Jaundice	0	2	0.6	0.0002
8.	Pulmonary Diseases	33	7	1.09	0.146
9.	Use of Steriods	1	1	2.29	0.112
10.	Obesity	5	0	1.20	0.39
11.	Hypoproteneia	0	27	0.03	0.000

Table 4: Complications in Dehiscd cases.

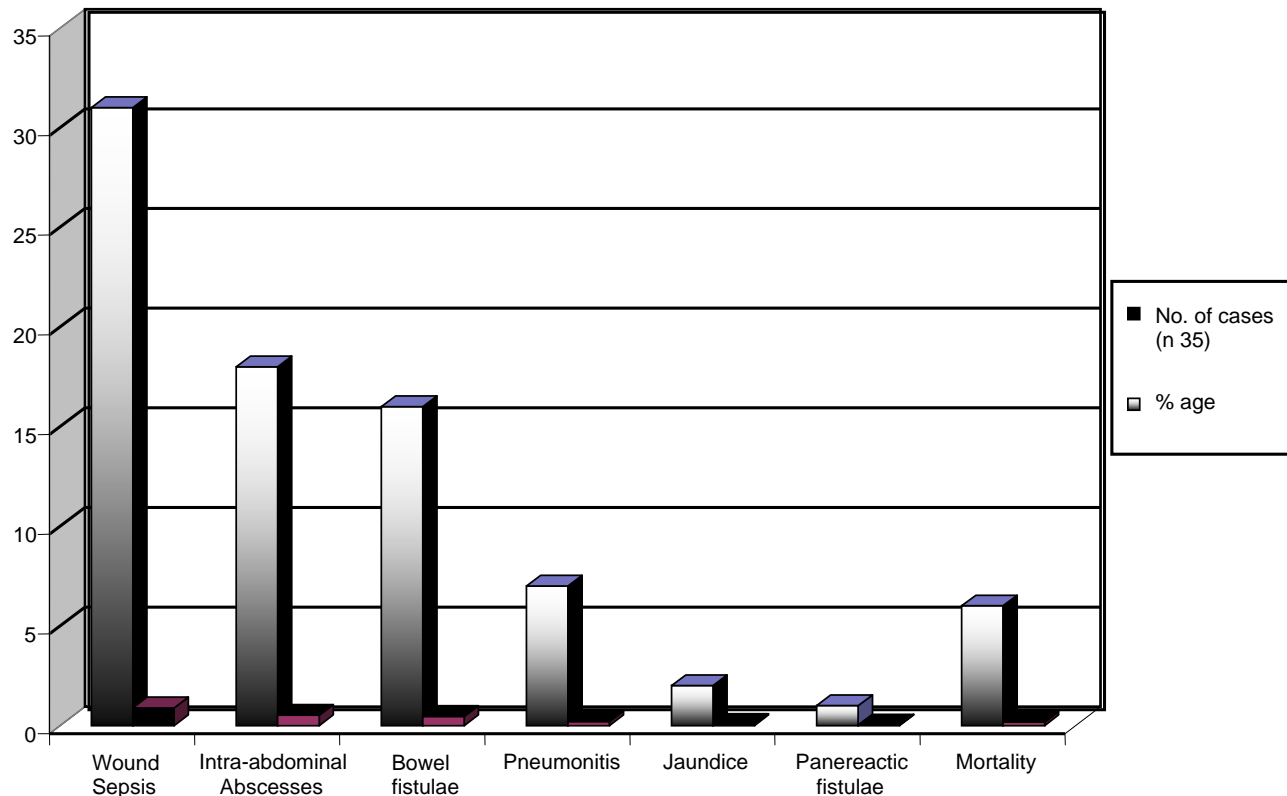
Complication	No. of cases (n 35)	% age
Wound Sepsis	31	88.57%
Intra-abdominal Abscesses	18	51.42%
Bowel fistulae	16	45.57%
Pneumonitis	7	20%
Jaundice	2	5.71%
Panereactic fistulae	1	2.85%
Mortality	6	17.14%

patient under going routine elective abdominal surgery. The incidence in elective vertical incision is 1.73%, quite comparable with other international studies. Local sepsis is the single most important factor delaying collagen synthesis and increasing collagenolysis resulting in development of burst abdomen and incisional hernia.¹⁷ History of wound infection of previous surgery can be sought in majority of patients presenting for incisional hernia repair.¹⁸

Our study has the maximum incidence of wound infection in cases of peritonitis. This is the subgroup of patients with highest incidence of burst abdomen (n 16).

Intra abdominal sepsis itself leads to infection spreading to fascial layers of anterior abdominal wall. The infection exaggerates the normal inflammatory response, the first phase of normal wound healing. This exaggeration results in inflammatory phase to be prolonged and healing never starts. The cellular, molecular and bio-chemical events in uncontrolled inflammation are due to leucocytes-macrophages over activity. There is intense enzymatic activity with breaking and removal of devitalized tissue as well as destruction

Complication in Dehisced Cases



of proliferating cells and capillaries.¹⁸ The neovascularization delivers metabolites such as amino acids and oxygen for repair but inflammatory cells take their tools and use the nutrients to destroy collagen being laid for repair.

Sepsis leads to generalized derangement in metabolic profile of the patient that can manifest in the form of uremia, jaundice, hyper catabolic state with negative nitrogen balance and pulmonary complications with hypoxemia.

Regrettably there is little clinical observation on wound healing in uremia patients. The research studies suggesting increased incidence of burst abdomen in uremia are all carried out on animals.¹⁸

In our study only one patient with uremia developed burst abdomen ($p > 0.1$). Six patients of dehiscence had acute uremia associated with sepsis whereas 23 patients had uremia with no evidence of dehiscence or sepsis. Thus uremia is secondary to sepsis with little or no contribution to wound dehiscence.

Jaundice has long been described as risk factor for dehiscence. Recently it had been challenged as a contributor to the catastrophe particularly if the mass closure technique is used.¹⁹ In our study the patient who had burst abdomen with jaundice also had intra-abdominal sepsis. Thus jaundice maybe an associated finding in patients of burst abdomen with no contribution to the actual disaster.

Many researches had studied the affects of nutritional status in surgical patients.²⁰ Various studies have demonstrated impairment of wound healing response in patients with protein energy malnutrition.²¹ There are also alterations in plasma amino acids and plasma proteins with short term starvation. The sulphur containing amino acids such as methionine and cysteine are important in the wound healing process. Normal wound healing is more dependent on adequate recent food intake and fresh protein losses.²² Tumour necrotic factor (TNF) released during sepsis results in cachexia and loss of appetite resulting in poor food intake. TNF also leads to hyper catabolism, negative nitrogen balance and Immunosuppression. Negative nitrogen balance and Immunosuppression further aggravate the sepsis making the situation more grievous. Thus patients enter into vicious cycle of sepsis – protein energy malnutrition – sepsis. In our study subgroup of patients with peritonitis had protein energy malnutrition as one to the significant risk factor for wound dehiscence ($P 0.037$).

Various studies have described emergency surgery as a risk factor for wound dehiscence.²³ Similar results were found in our study ($p < 0.001$). Use of steroids has long been debated as the cause of wound dehiscence.²⁴ In our study steroid use was found as a statistically significant risk factor in cases of emergency laparotomy ($P \leq 0.05$). Steroid use leads to immunosuppression which further aggravates the

intra-abdominal sepsis already playing the major role in wound failure.

Advancing age is a known risk factor for wound dehiscence. In our study age more than 65 years was found as a statistically significant risk factor ($P < 0.1$) in patients undergoing elective laparotomies.

Diabetes mellitus is another important risk factor for wound failure ultimately causing incisional hernia.²⁵ In our study diabetes was found a statistically significant risk factor ($P \leq 0.05$) in emergency laparotomy group. Diabetes mellitus can lead to the disaster by altering immune response and nutritional status. It also increases the susceptibility to wound infection.

Wound dehiscence is associated with a high mortality in the range of 15 to 20%.²⁶ Patients who develop sudden massive evisceration may go into shock and this may end in mortality. But this is a rare event. Mortality in conjunction with burst abdomen has always been attributed to the complications seen in these cases. Many such complications (actually the risk factors for dehiscence) like wound sepsis intra-abdominal abscesses, and bowel fistulae have been defined in international literature.²⁷ In our study most common complications seen in cases of dehiscence (n 35) were wound sepsis in 31 cases, intra-abdominal abscesses in 18 cases and bowel fistulae in 16 cases. There were 6 mortalities in cases of dehiscence (17.14%). Highest mortality was in subgroup of patients with peritonitis (n 4) resulting from sepsis.

In short, abdominal dehiscence is a preventable condition in which many risk factors play their role and lead to life threatening complications. Health education, health promotion, early diagnosis and early intervention must be instituted in such cases to prevent mortality.

Conclusions

Prevention is the best way of managing this condition. Our study ends in following conclusions:

1. Wound sepsis associated with intra-abdominal abscess is the single most important risk factor for wound dehiscence.
2. Other risk factors contribute to wound dehiscence by aggravating sepsis.
3. Lack of health education and specialized surgical care in remote areas result in delayed presentation.
4. Wound dehiscence should be treated on its merits and its occurrence should be considered a red flag indicating anastomotic leak, fistulae formation or intra-abdominal abscess. Early intervention should be instituted in such cases to prevent mortality.
5. Important guidelines of care should be standardized, published, observed and followed so that people working in the less ideal surgical centres can also benefit from this.

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