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# Abdominal Wound Dehiscence Following Laparotomy with Emphasis on the Risk Factors at a Tertiary Care Hospital

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***Abstract***
***BACKGROUND AND OBJECTIVES:***
*Wound dehiscence or Burst abdomen following laparotomy is among the most dreaded postoperative complications and is of great concern due to its significant health care cost on patients and hospitals.*
***The objectives of this study:***
*1. To study the occurrence of wound dehiscence following laparotomy and;*
*2. To identify and analyse the risk factors among patients developing wound dehiscence following laparotomy.*
***METHODS:***
*This is a prospective study done on a group of 54 patients who developed wound dehiscence (partial or complete) following laparotomy between November 2017 and June 2019. The relevant history, patient variables, preoperative investigations, intraoperative findings and postoperative wound complications were recorded and analysed.*
***RESULTS****:*
*The incidence of abdominal wound dehiscence was found to be common in middle aged and older population. Males were found to be more prone for developing dehiscence. Patients with surgical wounds classified as dirty and contaminated developed more incidences of wound dehiscence. Emergency surgeries and patients of peritonitis due to hollow viscous perforation had higher incidences wound dehiscence. Pre-existing comorbidities such as diabetes and chronic respiratory illness also influenced wound healing resulting in poor and delayed recovery. Factors such as anaemia, hypoalbuminemia, obesity and smoking were also present in a significant number of patients who developed wound dehiscence.*
***INTERPRETATION AND CONCLUSION:***
*Laparotomy wound dehiscence is a serious postoperative complication, with significant morbidity and mortality. Intraperitoneal bacterial contamination is the most important factor in wound failure along with other factors such as hypoalbuminemia, anaemia, COPD, obesity, diabetes and smoking. All the personnel involved in managing a surgical patient must be comprehensively educated regarding these predisposing factors and ways to mitigate each of them. Routine blood investigations like Haemoglobin, RBS, RFT, LFT, chest x-ray, may help to detect such predisposing factors and should be corrected accordingly whenever possible.*
***Keywords:*** *Wound dehiscence; Wound infection; Laparotomy; Midline incision; Emergency surgery; Peritonitis; Contaminated wound.*

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## I. Introduction

Abdominal wound dehiscence (AWD) refers to the separation of different layers of an abdominal wound before complete healing has taken place. The terms acute laparotomy wound failure and burst abdomen are also used to refer to the same condition.

Abdominal wound dehiscence can be classified as partial or complete depending on the extent of separation. Only the superficial layers of the abdominal wall (skin and subcutaneous fat) separate in Partial dehiscence. Complete dehiscence occurs when disruption of the musculoaponeurotic layer occurs in addition to the superficial layers. This reveals the underlying organs of the abdominal cavity which may protrude out. This

condition is referred to as Burst abdomen. Partial dehiscence may further progress to burst abdomen which needs immediate surgical intervention. Even if the wound heals after partial dehiscence, it increases the risk for repeat dehiscence and incisional hernia formation.

Wound dehiscence happens when the wound fails to achieve the required strength to withstand the stresses placed upon it during the course of its healing. There may be several reasons. Causes include disruption of sutures due to excessive tension placed upon them across the wound, when the used absorbable suture material dissolves before complete healing and when tightly placed sutures cut through the tissue or cause vascular compromise.

Abdominal wound dehiscence is a cause of considerable morbidity and mortality[1]. Historically, wound dehiscence rates of up to 10% were reported; recent studies estimate incidence between 1% and 3%[2,3] and mortality associated with dehiscence has been estimated at 16%[4]. Hence it is one of the most dreaded post-operative complications.

Many risk factors are described in various studies which predispose to wound dehiscence. They include emergency surgeries, intraabdominal bacterial contamination, malnutrition, hypoproteinaemia, anaemia, elderly age, systemic diseases (COPD, diabetes mellitus), wound infection, ascites, obesity, steroid use, prolonged ileus, coughing, and operative time greater than 2.5 hours[3,5,6]. Good knowledge of these risk factors is necessary for prophylaxis.

Mortality and morbidity in the form of increased hospital stay, long term repeated consultations, with extra burden on health care resources can be reduced by highlighting the risk factors for wound dehiscence[7].

AWD has been an age-old problem of surgical units for which no surgical unit has been able to come up with a fool proof plan. However, many surgical departments globally have been able to achieve and keep failure rates well below 1%. Still, the efforts to achieve this level of incidence in all clinical setups needs continuing research. A number of publications have been done in the past several years trying to explain how this problem can be mitigated.

## II. Objectives

1)To study the occurrence of abdominal wound dehiscence following laparotomy at KR Hospital, Mysore and;
2)To identify and analyse the risk factors and comorbidities in the group of patients developing wound dehiscence following laparotomy at KR Hospital, Mysore.

## III. Methodology

This was a prospective study done on 54 patients who developed wound dehiscence (partial or complete) following laparotomy. The clinical history, patient variables, pre-operative investigations, intra-operative findings and post-operative complications were recorded in a specified Proforma.

**Source of data**: All the eligible patients admitted to K R Hospital, Mysore during the period of study were included.

| | |
|---|---|
| Study design: | Prospective observational study |
| Sample size: | 54 |
| Study place: | Department of General Surgery, MMC&RI, Mysore |
| Study period: | 1st November 2017 to 30th June 2019 (20 months) |

**Inclusion criteria**:
1)Age group of 18 years and above and of either sex.
2)Patients with abdominal wound dehiscence after being subjected to any elective or emergency laparotomy.
3)Patients willing to give informed written consent.

**Exclusion criteria**:
1)Patients with severe immunocompromised state.

**Method of collection of data**:

Separation of abdominal wounds along surgical incision with or without protrusion of intra-abdominal contents will be defined as Wound dehiscence. All post laparotomy wounds were examined from third post-operative day till the day of discharge to look for features of wound dehiscence. Patients were also be followed up till the end of first month after surgery in discharged group of patients. Patients who developed surgical wound dehiscence during these periods were defined as the study subjects after taking their informed written consent.

**Statistical analysis**:
After calculating the appropriate sample size as described below, the data were collected from the study group and fed into Microsoft Excel software program. Each variable was analysed and tabulated.

**Sample size estimation:**

The prevalence of wound dehiscence among patients who undergo abdominal surgeries is around 3% according to several studies. Using the sample size formula by Kish Leslie, the minimum sample size of our study is 45. The Inflated sample size of our study is 54.

## IV. Results

A total of 54 patients were included in the study. Results of the study are discussed according to various parameters such as gender, age, indication for the surgery, procedure carried out, whether it was an emergency surgery or an elective surgery, type of incision and surgical wound, presence of co-morbid conditions (such as diabetes and chronic respiratory disease), and presence of suspected predisposing factors (such as obesity, anaemia, hypoalbuminemia and chronic smoking).

**Distribution among the two genders:**Out of 54 patients who developed wound dehiscence, 34(62.9%)were found to be male and 20 (37.1%)were found to be female.

**Distribution in different age group:**Majority of the subjects who developed abdominal wound dehiscence in our study belonged to the age group of 41 to 50 years(19). Patients between the age group of 31 to 40 years(10), 51 to 60 years(11) and patients above the age of 60 years(9) almost had a similar incidence of wound dehiscence. Young patients between the age of 18 and 30 years had the least number of occurrences (5). (Table 1). Mean age of AWD was 48.8 yrs.

| AGE GROUP | NO. OF CASES | PERCENTAGE |
|---|---|---|
| 18 to 30 | 5 | 9.3 |
| 31 to 40 | 10 | 18.5 |
| 41 to 50 | 19 | 35.2 |
| 51 to 60 | 11 | 20.4 |
| 61 and above | 9 | 16.7 |

**Table 1: Distribution of AWD in different age groups**

**Distribution among the different pathologies (indication for surgery)**

More than half of the patients who developed wound dehiscence(28) had peritonitis secondary to hollow viscus perforation. Eight patients who developed wound dehiscence had undergone surgery for intestinal obstruction (secondary to adhesion / band / stricture / hernia) and three patients had undergone surgery for intestinal obstruction secondary to intestinal tuberculosis. Five patients who developed wound dehiscence had appendicular pathologies (appendicitis – 1, appendicular perforation/abscess - 4). Six patients who developed wound dehiscence had undergone major abdominal surgeries in an elective setting for various malignancies. (Table 2).

Among the patients of hollow viscus perforation, duodenal ulcer perforation was the most prevalent pathology(11) followed by gastric perforation(7) and ileal perforation(6). Three cases of traumatic bowel perforations(Jejunal-2, Colonic-1) were also noted. An interesting case of rectal perforation probably secondary to SRUS was also noted. (Table 3)

| DIAGNOSIS | NO. OF CASES | PERCENTAGE |
|---|---|---|
| Hollow viscus perforation | 28 | 51.9 |
| Intestinal obstruction | 8 | 14.8 |
| Appendicular pathologies | 5 | 9.3 |
| Malignancies | 6 | 11.1 |
| Abdominal Tuberculosis | 3 | 5.5 |
| Others | 4 | 7.4 |

**Table 2: Distribution of AWD among different underlying pathologies**

| DIAGNOSIS | NO. OF CASES |
|---|---|
| Duodenal ulcer perforation | 11 |
| Gastric perforation | 7 |
| Ileal perforation | 6 |
| Jejunal perforation (traumatic) | 2 |
| Others | 2 |

**Table 3: Distribution of different pathologies among patients of**

**AWD following surgery for perforation peritonitis**

**Distribution of AWD following different procedures:** Majority of the patients who developed wound dehiscence underwent primary closure of the perforated hollow viscus(25) out of which four patients underwent an additional covering stoma. Eight patients underwent resection of the pathology and primary anastomosis out of which four patients underwent an additional covering stoma. Three patients were subjected to adhesiolysis for intestinal obstruction. Four patients had undergone just an intestinal stoma. Six patients had undergone major abdominal surgeries for various gastrointestinal malignancies and four patients had undergone appendectomies.

| PROCEDURE | NO. OF CASES | PERCENTAGE |
|---|---|---|
| Primary closure of perforation (w or w/o stoma) | 25 | 46.3 |
| Resection and Anastomoses (w or w/o stoma) | 8 | 14.8 |
| Major abdominal surgeries for Malignant pathologies | 6 | 11.1 |
| Appendectomy | 4 | 7.4 |
| Stoma creation only | 4 | 7.4 |
| Adhesiolysis | 3 | 5.6 |
| Abscess drainage and lavage | 2 | 3.7 |
| Others | 2 | 3.7 |

**Table 4: AWD following different procedures**

**Prevalence of diabetes mellitus among patients of AWD**

More than one third of the study group(21) had Diabetes mellitus as a comorbid condition prior to abdominal surgery. Most patients in this subgroup had a long history (>1 year) of being diagnosed with diabetes mellitus type II.

**Prevalence of Chronic respiratory illness among patients of AWD**

A significant proportion of patients(16) who were mostly elderly in our study group had chronic respiratory disease of which COPD was the most common one. Asthma was seen in younger patients.

## V. Discussion

This study reviewed a total of 54 patients who developed abdominal wound dehiscence post laparotomy during the period of November 2017 to June 2019. Results of the study indicate several possible predisposing factors for the development of wound dehiscence. Data regarding each of the possible incriminating factor has been compared with the data from several similar landmark studies in the same topic.

**Comparing Sex distribution**

Almost one third of all the patients in our study were males. The incidence of wound dehiscence with respect to males and females was 1.7:1. Several studies have also demonstrated that males have higher likelihood of developing wound dehiscence when compared to females (Table 5).

| Study conducted by: | Male: Female ratio |
|---|---|
| Kenig et al.[8] | 1.95: 1 |
| Ramneesh et al.[9] | 2.85: 1 |
| Spiliotis et al.[17] | 1.50: 1 |
| Ramshorst et al.[7] | 3.00: 1 |
| Poškus et al.[11] | 2.23: 1 |
| Aksamija et al.[10] | 2.33: 1 |
| Our study | 1.70: 1 |

**Table 5: Comparison of sex distribution of AWD among several studies**

There are several reasons postulated for male preponderance in wound dehiscence. They include increased pressure inside the abdominal cavity generated by men, which translates into greater forces exerted on the main wound[18] and lower collagen production in males probably due to difference in oestrogen levels.[19] In our case, it could also be due to predominance of peptic ulcer perforation among study subjects which is more common in males.

**Comparing Age distribution**

The mean age of patients in our study was found to be 48.8 years. Majority of the subjects who developed abdominal wound dehiscence in our study belonged to the age group of 41 to 50 years. Several similar studies show higher incidence of AWD with even older age group of patients as depicted below (Table 6).

| Study conducted by: | Mean age of patients with AWD (in years) |
|---|---|
| Kenig et al.[8] | 66.8 |
| Ramneesh et al.[9] | 41.6 |
| Spiliotis et al.[17] | 69.5 |
| Ramshorst et al.[7] | 65.0 |
| Poškus et al.[11] | 66.7 |
| Guo & DiPietro[26] | 68.6 |
| Aksamija et al.[10] | 62.1 |
| Our study | 48.8 |

**Table 6: Comparison of age distribution of AWD among several studies**

This is well explained in surgical literature as due to fall in collagen production as well as cross linking in the elderly leading to loss of elasticity and strength. This can also be due to age associated decline in vascular and nutritional status. In addition, the potential for intra operative contamination are greater in operations conducted in older patients.

**Comparison of underlying pathologies in patients with AWD**

In our study, more than half of the patients who developed wound dehiscence had peritonitis secondary to hollow viscus perforation. Duodenal ulcer perforation was the most common pathology among them. The results are similar to the results in the study conducted by Ramneesh et al.[9] However in several other studies, colorectal surgeries and surgeries involving the large bowel were more commonly associated with post-operative wound dehiscence.[7,8,10,11]

Both the results can be explained due to the fact that intra-abdominal contamination is of higher magnitude in both colorectal surgeries and in cases of peritonitis due to hollow viscus perforation. The preponderance of AWD in cases of perforation peritonitis in our study is simply explained by the fact of higher incidence of perforation peritonitis among our population.

**Comparing the incidence in elective vs. emergency surgery**

An overwhelming majority of the patients who developed wound dehiscence in our study group had undergone emergency surgeries (87%). Several studies corroborate with similar results as depicted below (Table 7).

Patients who undergo emergency surgery are generally in worse condition and nutritional state, and the chance of contamination of the surgical field is higher than in an elective surgery. Moreover, the performance of the surgeon might be affected at night, potentially leading to suboptimal management of the abdominal wall layers.

| Study conducted by: | Percentage of Emergency surgeries among patients with AWD |
|---|---|
| Kenig et al.[8] | 80% |
| Ramneesh et al.9 | 100% |
| Spiliotis et al.[17] | 60% |
| Ramshorst et al.[7] | 46% |
| Our study | 87% |

**Table 7: Comparison of proportion of emergency surgeries in patients with AWD among several studies**

**Type of surgical wound**

Majority (63%) of the surgical incisions in our study group were classified under Class 4 (dirty/infected). Another 22% patients could be classified under Class 3 (contaminated) group. None of the patients underwent clean surgical procedures (Class1). These results were similar to the results obtained by Ramneesh et al wherein 88% of patients with AWD had either contaminated or dirty wounds and there was no patient with a clean surgical wound.[9]

Most laparotomy incisions in the emergency setup are contaminated to some extent from either pre-existing breach in the viscera, breach created during the procedure or due to breaks in the technique. Any contamination of the surgical incision has a high chance of causing surgical site infection which further delays wound healing by local and systemic factors. Local factors mainly include formation of bacterial bio-films whereas systemic factors include all the physiological effects due to a state of sepsis which further lead to a prolonged catabolic state and a state of negative nitrogen balance. Patient morbidity can be decreased by minimizing contamination and by leaving the skin and subcutaneous tissue open to heal by secondary intention or delayed primary closure when contamination is unavoidable.[16]

**Type of incision**

A majority (87%) of our study group had midline laparotomies prior to abdominal wound dehiscence. Due to the nature of prevalent pathologies among our study population, any non-vertical incision was not feasible in a majority of the cases and most patients underwent midline laparotomies.

Literature suggests that horizontal incisions are more favoured to avoid wound dehiscence[12,13,14] and that advantages of midline and paramedian incisions over each other are almost none.[15]

**Anaemia**

A majority of our patients (54%) had pre-existing anaemia at the time of operation. Several studies have shown that anaemia is a major risk factor for developing AWD as depicted below (Table 8).

| Study conducted by: | Prevalence of Anaemia among patients with AWD |
|---|---|
| Aksamija et al.[10] | 43% |
| Ramshorst et al.[7] | 61% |
| Ramneesh et al.[9] | 26% |
| Our study | 87% |

**Table 8: Prevalence of Anaemia in AWD in different studies**

Anaemia is a risk factor that is related to increased perioperative stress, blood transfusions, and decreased tissue oxygenation, all of which can affect the immune system and the wound healing process.

**Hypoalbuminemia**

Majority of the study population who developed wound dehiscence had hypoalbuminemia (61%). Our results compare with similar studies as depicted below (Table 9)

| Study conducted by: | Prevalence of Hypoalbuminemia among patients with AWD |
|---|---|
| Aksamija et al.[10] | 50% |
| Ramshorst et al.[7] | 63% |
| Ramneesh et al.[9] | 24% |
| Our study | 61% |

**Table 9: Prevalence of Hypoalbuminemia in AWD in different studies**

Hypoalbuminemia is an indicator of malnutrition and deficient amino acid pool (especially cysteine, arginine and methionine). It contributes to prolonged inflammatory phase and impairs fibroplasia, proliferation, proteoglycan and collagen synthesis, angiogenesis and wound remodelling.[20]

**Obesity**

A significant proportion of the study group (44%) had high body mass index of 25 or more. In similar studies conducted by Ramneesh et al[9] and Spiliotis et al[17] the prevalence of obesity among patients of AWD were found to be 32% and 33% respectively.

The incision site over the abdomen in obese patients will be composed of large amount of subcutaneous fat which during postoperative period has a high risk of fat necrosis and seroma formation.[21] The time of surgery is usually prolonged among obese patients. Obesity itself is usually associated with other co-morbid conditions like diabetes, hypertension, herniation etc. which can all, contribute to poor wound strength and healing.[21,22]

**Diabetes**

More than one third of the study group (39%) had Diabetes mellitus as a comorbid condition prior to abdominal surgery. The significantly higher prevalence of diabetes in our population compared to other study groups (Table 10) can be attributed to higher prevalence of diabetes in our population among older adults.

| Study conducted by: | Prevalence of Diabetes Mellitus among patients with AWD |
|---|---|
| Aksamija et al.[10] | 14% |
| Ramshorst et al.[7] | 9% |
| Ramneesh et al.[9] | 8% |
| Kenig et al.[8] | 14% |
| Our study | 39% |

**Table 10: Prevalence of Diabetes Mellitus in AWD in different studies**

Marhoffer et al. reported diminished activity of granulocytes in diabetic patients[23] thus predisposing to infection. In a series of studies of collagen formation in diabetes, Goodson and Hunt[24] have shown that obesity, insulin resistance, hyperglycaemia interfere with collagen synthesis and thus impair wound healing.

**Chronic Respiratory Disease**

A significant proportion of patients (29.6%) who were mostly elderly in our study group had chronic respiratory disease of which COPD was the most common one. Asthma was seen in younger patients. In the studies conducted by Kenig et al. and Spiliotis et al., the prevalence of COPD among patients of AWD was 18% and 66% respectively.[8,17]

The high incidence of dehiscence in this patient population could be a result of coughing, hypoxemia, use of corticosteroids, and poor nutritional status, all of which are all risk factors for wound dehiscence.[7] Perioperative optimization of these patients may help to improve outcomes and decrease health-care costs among these patient population.[25]

## VI. Conclusion

On the basis of the data generated in this study, and also with the data from other similar studies it can be concluded that abdominal wound dehiscence has multiple predisposing factors.

They include patient factors like male gender, middle aged and elderly population, high BMI, diabetes mellitus, chronic respiratory illness, anaemia, hypoalbuminemia, and the habit of smoking. Patients who undergo emergency laparotomies, patients with gross intraperitoneal contamination, and those whose wounds are classified as dirty and contaminated are at a high risk for developing wound dehiscence. Peritonitis secondary to hollow viscus perforation, intestinal obstruction due to various causes and major abdominal malignancies are the commonest pathologies seen among patients with wound dehiscence.

Many of the factors identified as being important for the rate of wound complications are not possible to correct preoperatively such as age, BMI, etc. However certain factors such as nutrition, anaemic status can be improved preoperatively in elective surgeries and should be taken care of. Also, co-morbid conditions such as diabetes, hypertension and chronic respiratory illness should be optimised before the patient is being posted for an elective surgery. Routine blood investigations like Haemoglobin, RBS, RFT, LFT, chest x-ray, may help to detect such predisposing factors and should be corrected accordingly whenever possible.

Surgeon factors like inappropriate incisions, wrong suturing technique and inadequate aseptic precautions should be mitigated as much as possible. Also, appropriate antibiotic prophylaxis, adherence to principles of gentle tissue handling, optimal use of suture material or electrocautery, avoidance of stoma close to the main wound, irrigation of the wound during closure to remove debris, and meticulous haemostasis reduces the incidence of wound dehiscence.

All the personnel involved in managing a surgical patient must be comprehensively educated regarding all these predisposing factors and ways to mitigate each of those factors.

## VII. Summary

- Abdominal wound dehiscence (AWD) is more common in males than in females with a ratio of 1.7: 1
- The mean age of patients with abdominal wound dehiscence in our study was found to be 48.8 years. Patients between 41 to 50 years of age made up the most common age group who developed abdominal wound dehiscence.
- Incidence of abdominal wound dehiscence is more common in patients of peritonitis secondary to hollow viscus perforation with duodenal ulcer perforation being the commonest pathology.
- Patients with surgical incisions which are classified as dirty and contaminated show more tendency towards developing wound dehiscence.
- Majority of Midline laparotomies especially done under emergency basis have a high risk of developing wound dehiscence. Also, emergency surgeries in general have a higher incidence of wound dehiscence than elective surgeries (6.7: 1)
- High Body mass index (>25), Hypoalbuminemia, Anaemia, Diabetes Mellitus, Chronic respiratory disease and Smoking also predispose to abdominal wound dehiscence.

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