

Association of Pre-Operative Risk Factors with Abdominal Wound Dehiscence

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ABSTRACT

Objective: To determine the association of pre-operative risk factors with abdominal wound dehiscence.

Study Design: Quasi-experimental study.

Place and Duration of study: Surgical Unit 1 of Combined Military Hospital, Rawalpindi, Pakistan from, Aug 2019 - Jan 2020.

Methodology: A total of 130 cases and 130 controls with ages 20 to 70 yrs were included. Patients with neurological or psychological disorders or who underwent a laparoscopic procedure were excluded. All surgeries were performed by a single team with the assistance of a researcher. Patients were divided into two groups, i.e., Cases with abdominal wound dehiscence and controls without abdominal wound dehiscence. Patients were evaluated for risk factors, i.e., advanced age, male gender, anemia, emergency surgery, diabetes, and hypertension.

Results: Mean age of patients in case group was 46.69±10.16 years, and in control group was 44.57±10.35 years. Preoperative risk factors for abdominal wound dehiscence in cases and controls were as follows; advanced age (7.69% vs. 3.08%), male gender (37.69% vs. 32.31%), hypertension (40% vs. 21.54%), diabetes (30.77% vs. 20.0%), anemia (83.08% vs. 50.0%) and emergency surgery (70.77% v. 48.46%).

Conclusion: Risk factors like hypertension, diabetes mellitus, anemia and emergency surgery are the major risk factors for abdominal wound dehiscence.

Keywords: Abdominal wound dehiscence, Anemia, hypertension.

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INTRODUCTION

Laparotomy is one of the most common procedures performed in general surgery practice to gain access to the peritoneal cavity to deal with different pathologies. Many incisions can be used for this purpose, but midline laparotomy is the most preferred by the surgeons, may it be for an emergency or elective indication.¹ This approach has many advantages, like it is simple, easier, and quicker to perform, and gives adequate access to all four quadrants with minimal blood loss. But at the same time, it can be associated with major complications like wound dehiscence, which can be a source of post-operative morbidity and even mortality. Other incisions like Kocher, Grid iron and transverse are also frequently used for open cholecystectomy, appendectomy, and ventral hernia repair, respectively.

Many factors can play a role in the causation of this complication. Some can be technical, and others can be associated with the patient in the form of pre-operative risk factors.² A good surgical technique for

closure of surgical incisions is essential to avoid untoward effects. It includes careful tissue handling, use of adequate suture to close the fascia without including muscle layer in the suture line.³ Another important factor in wound closure is to close it as a mass instead of layers. It is generally believed that non-absorbable monofilament sutures (Polypropylene) are preferred over absorbable ones in order to minimize the complications associated with wound closure but it has not shown any significant difference in the incidence of wound dehiscence, incisional hernia formation or surgical site infection when compared with slowly absorbing monofilament suture, such as Polydioxanone.⁴ Moreover, non-absorbable suture is also associated with more post-operative pain and sinus track formation.

When compared elective with emergency laparotomy, the complication of wound dehiscence is strongly associated with the emergency procedure that increases morbidity and mortality post-operatively. The mortality associated with this complication can be as high as 15-45%.^{4,5} This complication also adversely affects the health care system because it leads to prolonged hospital stays, delayed return to work and repeated surgical procedures. Moreover, it also

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negatively effects the mental health of the patient as well as the care givers.

While looking at the etiology of abdominal wound dehiscence post-operatively, many factors can be attributed to it. Some are technical factors like closure technique, like layered or mass closure, type of suture and suturing technique, like continuous or interrupted. But on the other hand, pre-operative factors related to the patient also play their role in this regard, like diabetes, hypertension, jaundice, and anemia.⁵ It was noted that technical factors have been studied by different researchers, but there was scarcity of data related to risk factors associated with the patient.⁶

The limited data that exists on this subject also gives contradictory results like a case control study reported that there are certain preoperative factors which can cause abdominal wound dehiscence, including advanced age, male gender, hypertension, diabetes, anemia and emergency surgery.⁷ While another case control study reported that advanced age, male gender, and diabetes were insignificant risk factors for abdominal wound dehiscence.⁸

The objective of this study was to determine the association of pre-operative risk factors with abdominal wound dehiscence. The study's evidence bridged the gaps between theoretical knowledge and practical perioperative management, reducing morbidity and healthcare burdens.

METHODOLOGY

This Quasi-experimental study was conducted in surgical unit 1 of Combined Military Hospital Rawalpindi, Pakistan, from August 2019 to January 2020 after obtaining permission from the hospital's ethical review board (letter number 501). The sample size of 260 cases was calculated using the WHO calculator. Patients were divided into two groups as shown in the figure. Those who developed abdominal wound dehiscence were labeled as cases, and those who did not develop this complication were labeled as controls. Informed consent was taken from each patient. Demographic information like name, age, gender, BMI, and Surgical procedure were also documented. All surgeries were performed by a single surgical team with the assistance of a researcher.

Inclusion Criteria: All patients aged 20-70 years of both genders who underwent laparotomy for hysterectomy, appendectomy, ventral hernia repair,

cholecystectomy, and colectomy were included in the study.

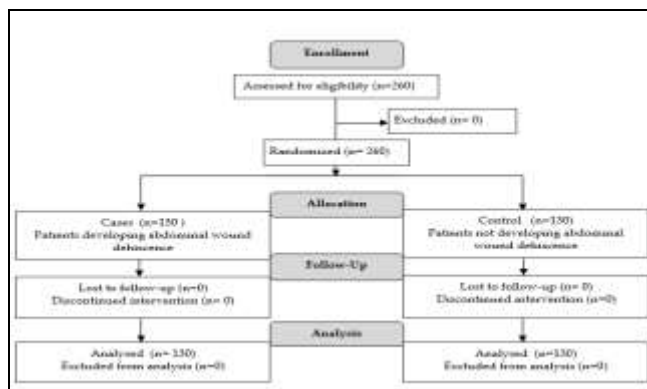


Figure: Patient Flow Diagram for the Assessment of Pre-Operative Risk Factors Associated with Development of Abdominal Wound Dehiscence Post-operatively (n= 260)

Exclusion Criteria: Patients with neurological or psychological disorders with documented medical records, those who had surgeries for more than 90 minutes in duration, as prolonged anesthesia may affect wound healing, and those who underwent laparoscopic procedures were excluded from the study.

Patients were evaluated post-operatively for risk factors, i.e., advanced age, male gender, anemia, emergency surgery, diabetes, and hypertension. Patients with abdominal wound dehiscence were managed as per hospital protocol. All this information was recorded on a specific proforma.

Statistical analysis of the data was performed using the Statistical Package for Social Sciences version 21. Mean and standard deviation were calculated for continuous variables like age, Body Mass Index (BMI), and surgical procedures. Frequency and percentage were calculated for gender and risk factors, like advanced age, male gender, anemia, emergency surgery, diabetes, and hypertension.

RESULTS

The age range in this study was from 20 to 70 years, with a mean age of 45.78±10.21 years. The mean age of patients in the case group was 46.69±10.16 years, and in the control group, it was 44.57±10.35 years. The mean BMI in the case group was 29.03±3.01 kg/m², and in the control group was 28.93±2.99 kg/m. Five procedures were considered in both groups, like hysterectomy, appendectomy, cholecystectomy, colectomy, and ventral hernia repair. The percentage of patients according to operation is shown in Table-I.

Abdominal Wound Dehiscence

Table-I: Percentage of Patients According to Operation (n=260)

| Operation | Cases (n=130) | Controls (n=130) | Total (n=260) |
|-----------------|----------------------|----------------------|----------------------|
| | No. of patients n(%) | No. of patients n(%) | No. of patients n(%) |
| Hysterectomy | 28(21.54%) | 28(21.54%) | 56(21.54%) |
| Appendectomy | 18(13.85%) | 18(13.85%) | 36(13.85%) |
| Hernia repair | 27(20.77%) | 26(20.0%) | 53(20.38%) |
| Cholecystectomy | 49(37.69%) | 51(39.23%) | 100(38.46%) |
| Colectomy | 08(6.15%) | 07(5.38%) | 15(5.77%) |

Table-II: Association of Pre-operative Risk Factors with Abdominal Wound Dehiscence (n=260)

| Factors | | Cases (n=130) | Controls (n=130) | p-value | Odds Ratio |
|-------------------|-----|---------------|------------------|---------|------------|
| | | n(%) | n(%) | | |
| Advanced age | Yes | 10(7.69%) | 04(3.08%) | 0.111 | 2.63 |
| | No | 120(92.31%) | 126(96.92%) | | |
| Male gender | Yes | 49(37.69%) | 42(32.31%) | 0.363 | 1.27 |
| | No | 81(62.31%) | 88(67.69%) | | |
| Hypertension | Yes | 52(40.0%) | 28(21.54%) | 0.001 | 2.43 |
| | No | 78(60.0%) | 102(78.46%) | | |
| Diabetes Mellitus | Yes | 40(30.77%) | 26(20.0%) | 0.047 | 1.78 |
| | No | 90(69.23%) | 104(80.0%) | | |
| Anemia | Yes | 108(83.08%) | 65(50.0%) | 0.001 | 4.91 |
| | No | 22(16.92%) | 65(50.0%) | | |
| Emergency Surgery | Yes | 92(70.77%) | 63(48.46%) | 0.001 | 2.57 |
| | No | 38(29.23%) | 67(51.54%) | | |

The parameter of Preoperative factors for abdominal wound dehiscence were advanced age, male gender, hypertension, diabetes, anemia, and emergency surgery, as shown in Table-II.

Ten out of 130 cases had advanced age who developed abdominal wound dehiscence with a *p*-value of 0.111 and Odds Ratio of 2.63. Forty-nine out of 130 cases were male patients who developed abdominal wound dehiscence, with a *p*-value of 0.363 and an Odds Ratio of 1.27. Fifty-two out of 130 cases had hypertension who developed abdominal wound dehiscence, with a *p*-value of 0.001 and OR of 2.43. Forty out of 130 cases were diabetics who developed abdominal wound dehiscence with a *p*-value of 0.047 and an OR of 1.78. One hundred and eight out of 130 cases were anemics who developed abdominal wound dehiscence with a *p*-value of 0.001 and OR of 4.91. Ninety two out of 130 cases underwent emergency surgery who developed abdominal wound dehiscence with a *p*-value of 0.001 and OR of 2.57.

It was also noted that no complete healing of wound after 7 days of procedure and patient again admitted in surgical wards, more than 60 years of age was considered as advanced age, blood pressure of $\geq 140/90$ mmHg with documented record was considered hypertension, blood sugar random >186 mg/dl was considered diabetes, hemoglobin level <10 g/dl was considered as anemia and emergency

surgery was defined if patient underwent surgery in emergency.

DISCUSSION

The study's findings indicated that hypertension, diabetes mellitus, anemia, and emergency surgery are significant factors, as shown by the *p*-value. In contrast, advanced age and male gender were determined to be insignificant. Midline incision is most frequently employed to gain access to the peritoneal cavity, both in elective and emergency settings. Many complications are associated with abdominal incisions, like surgical site infection, incisional hernia formation, scar disfigurement, but facial dehiscence, also called burst abdomen, is one of the dreadful postoperative complications that not only increases the morbidity but is also associated with high mortality rates, sometimes ranging up to 45%.⁹⁻¹¹ The overall incidence of this complication ranges from 0.4% to 3.5%.¹²⁻¹⁵ The most severe outcome associated with this complication is evisceration, which needs immediate intervention. Other untoward effects of wound dehiscence include a high incidence of incisional hernia, prolonged hospital stay, and subsequent reoperations.

Efforts have been made for a long time to address factors like suture selection, suturing techniques, and improved perioperative care, but despite all this, the incidence of this complication has not significantly

changed over the past decades. It means that other factors also come into play, like risk factors associated with the patients that surely outweigh the advantages of improved surgical technique. In the quest to define the risk factors associated with abdominal wound dehiscence, many studies have been performed in the past which often presented conflicting results.

Association of pre-operative risk factors with abdominal wound dehiscence is accepted by some researchers, whereas others give contradictory results. A case-control study reported that there are certain preoperative factors that can cause abdominal wound dehiscence, including advanced age, male gender, hypertension, diabetes, anemia, and emergency surgery.⁷ Another case control study reported that advanced age, male gender, and diabetes were insignificant risk factors for abdominal wound dehiscence.⁸ These findings are in keeping with the findings of our study in terms of advanced age and male gender.

A study analyzed the association of pre-operative comorbidities with abdominal wound dehiscence.¹⁶ Study population included predominantly male patients (70%) with majority of the patients having age group of 71-80 years. Of the total patients who developed wound dehiscence, 68% had comorbidities like anemia, hypertension, malignancy and diabetes. Out of these co-morbidities, hypertension was the most significant one. The findings of this research are consistent with our work.

A Pakistani study was carried out by Waqar *et al.*, in which frequency of patients were analyzed to find the association of pre-operative risk factors with abdominal wound dehiscence secondary to midline laparotomies.¹⁷ It was found that a significant number of patients had deranged liver function tests, low albumin levels, raised bilirubin levels and deranged renal profile. All these pre-operative biochemical abnormalities were found to be associated with the complication in question. It also supports the results of our study in terms of importance of pre-operative factors that can cause post-operative complications like burst abdomen.

Another study conducted by Verma *et al.*, 50 patients were analyzed, and it was found that a significant number of these patients had risk factors like intra-abdominal infection, anemia, hypo-albuminemia, uremia, diabetes mellitus and jaundice.¹⁸ All these factors had association with post-operative

complications and such findings also support the results of our study.

Soni *et al.*, conducted a study to determine the major risk factors that can play their role in the causation of a burst abdomen.¹⁹ Along with the biochemical abnormalities, it was found that malnutrition was one of the major risk factors in this regard. Others included wound infection, anemia, abdominal distension, and pre-operative immunocompromised status. Likewise, in another study conducted by Sinha *et al.*, in Oula University Hospital, 48 patients developed abdominal wound dehiscence, and it was found that the major pre-operative risk factor was hypoalbuminemia because 65% of these patients had low albumin levels pre-operatively. Other than that, malnutrition, anemia, and chronic lung disease were also found to have an association with this complication.²⁰ In another study carried out by Grantcharov, it was found that pre-operative anemia was the major risk factor that led to burst abdomen in 43.8% of patients who underwent laparotomy because their pre-operative hemoglobin was less than 10 g/dl.²¹ Other risk factors highlighted in this study were malnutrition, diabetes mellitus, hypoproteinemia, and obesity.²¹ The findings of all three studies mentioned above clearly support the importance of pre-operative risk factors and comorbidities that have a direct effect on the outcome of the patient's undergoing laparotomy, and these findings are consistent with the findings of our study.

On searching the literature, it is very commonly observed that anemia is one of the major factors that leads to delayed or poor wound healing and it ultimately causes burst abdomen like Guiney *et al.*, found in their study that 50% of their patients who developed burst abdomen were actually anemic pre-operatively.²² But at the same time, researchers have also concluded in their studies that anemia is not a major factor in the causation of wound dehiscence. Marsh *et al.*, found that anemia that is not complicated by other deficiencies did not contribute significantly to wound dehiscence.²³ Likewise, Heughan *et al.*, conducted a study and concluded that mild or moderate normovolemic anemia with otherwise normal parameter is not a major risk factor to cause abdominal wound dehiscence.²⁴ The findings of these studies are not in keeping with the results of our study in which anemia was found to be a significant pre-operative risk factor. The reason may be that in our study anemia was not studied as an isolated risk factor

rather it was considered in conjunction with other multiple risk factors.

A study was conducted by Shetty *et al.*, in 2013 in which association of diabetes mellitus was studied with wound dehiscence and it was concluded that diabetics undergoing surgery have increased incidence of dehiscence because of poor wound healing and higher infection rate.²⁵ These findings support the results of our study as 30% of the patients who developed complications were diabetic.

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LIMITATIONS OF STUDY

Multiple risk factors were evaluated simultaneously. A single patient may have several risk factors; for example, a patient can be diabetic, hypertensive, and anemic at the same time. This makes it challenging to determine which comorbidity contributed to the complication of abdominal wound dehiscence. In addition, comparing the same age group with and without comorbidities can provide better insight into the impact of risk factors on age-related wound healing.

CONCLUSION

This study concluded that hypertension, diabetes mellitus, anemia, and emergency surgery are the major risk factors for abdominal wound dehiscence. Therefore, the study recommends that proper identification and management of these risk factors should be done to prevent pre- and post-operative complications, thus providing better patient care.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

KKD & SI: Data acquisition, critical review, approval of the final version to be published.

US & N: Conception, study design, drafting the manuscript, approval of the final version to be published.

AUR & HUR: Data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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