

Evaluation of Effects of Various Co-Morbidities on Abdominal Wound Dehiscence after Midline Laparotomy

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Abstract:

Background: Abdominal wound dehiscence (AWD) is a terminology which is commonly used to explain separation of different layers of an abdominal wound before complete healing has taken place. Other terms used interchangeably are acute laparotomy wound failure and burst abdomen. Wound dehiscence usually occurs when a wound fails to achieve required strength to withstand stresses placed upon it. Postoperative wound healing plays a significant role in facilitating a patient's recovery and rehabilitation. Surgical wound dehiscence (SWD) impacts on mortality and morbidity rates and significantly contributes to prolonged hospital stays and associated psychosocial stressors on individuals and their families.

Materials and Methods: This is a prospective study conducted in the Tertiary care teaching Hospital. Patients who had undergone abdominal surgery (laparotomy) who developed acute fascial wound dehiscence (AFWD) and who had to return to the operating theatre for closure of the fascial dehiscence under general anaesthesia. The medical records were reviewed and the diagnosis of fascial dehiscence was confirmed for all included patients. Each single case was matched to two cases of patients who were admitted in the same year for surgery and who underwent similar surgical intervention, were of the same gender, and were within 5 years of the index patients' age. Patients who developed incisional hernia on follow-up were excluded due to the aetiological overlap between fascial dehiscence and incisional hernia.

Result: Out of these 90 cases 43 patients were female (47.8%) and 47 patients were male (52.2%). The cases were distributed in two groups randomly depending on the technique of midline closure. Out of the total 90 patients, 20 (22.2%) had band obstruction, 15 (16.7%) had sigmoid volvulus 13 (14.4%) had gastric carcinoma, 10 (11.1%) had sigmoid cancer, 1 (1.1%) had mid gut volvulus, 13 (14.4%) had obstructed hernia, 8 (8.9%) had carcinoma of ascending colon, 10 (11.1%) had pyloric stenosis. The other co morbidities which contributed to wound dehiscence were DM, HTN, Pulmonary Disease, Malnutrition and Anaemia. Out of everything DM had a Significant amount of contribution.

Conclusion: We therefore hope that the results of this study will lead to better, evidence-based treatment options for abdominal wound dehiscence and, eventually, a lower incidence of this severe complication.

Keywords: Laparotomy, Surgical Site Infection, Wound Dehiscence.

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Introduction

Abdominal wound dehiscence (AWD) is a terminology which is commonly used to explain separation of different layers of an abdominal wound before complete healing has taken place. Other terms used interchangeably are acute laparotomy wound failure and burst abdomen. [1] Wound dehiscence usually occurs when a wound fails to achieve required strength to withstand stresses placed upon it. Dehiscence occurs when overwhelming forces disrupt sutures, when absorbable sutures dissolve too rapidly or when tight sutures cut through tissues through unnecessary pressure. [2]

Acute wound failure may be partial or complete. In partial dehiscence, only the superficial layers or part of the tissue layers reopen. In complete wound dehiscence, all layers of the wound thickness are separated, revealing the underlying tissue and organs, which may protrude out of the separated wound. [3] It is one amongst the most feared post-operative complications for the surgeons and is of greatest regard because of risk of burst abdomen, the need for immediate intervention, and the possibility of repeat dehiscence, surgical site infection and incisional hernia formation. [4]

Abdominal wound dehiscence is reported to be a severe postoperative complication, with death rates

reported as high as 45%. Incidence as reported in literature peaks from 0.4% to 3.5%. Many risk factors are accountable for wound dehiscence such as surgeries in emergency set up, intra-abdominal bacterial infection, malnutrition, decreased Hb, elderly age >65 years, systemic co-morbidities (uremia, diabetes mellitus) etc. [5] Good knowledge of these risk factors is compulsory 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, the incidence rate and prophylactic measures to prevent or reduce the incidence of wound dehiscence. [6]

Timely and sustained postoperative wound healing plays a significant role in optimising a patient's postoperative recovery and rehabilitation. It has been established that surgical wound dehiscence (SWD) contributes to increased morbidity and mortality rates, and implicit and explicit costs for individuals and health care providers. [7] Explicit costs result from prolonged hospitalisation, the need for community nursing and support services and the use of wound management consumables. [8]

Social costs include delay in return to employment, reduced ability to self-care and limitations on returning to previous social roles in the community including family support. SWD is defined as the rupture or splitting open of a previously closed surgical incision site. According to the Centre for Disease Control (CDC), a SWD can be classified as either superficial or deep. [9]

Factors associated with SWD was conducted in response to an identified increase in SWD referrals to a community nursing service in India, following either a cardiothoracic, orthopaedic, vascular or abdominal surgical procedure. [10] Wound dehiscence is a possible complication following any surgical procedure; however, most studies the occurrence following orthopaedic, abdominal, cardiothoracic and vascular surgery. [11] The studies outline some associations between SWD and patient comorbidities and the type of surgical wound closure. [12] However, the validation of these associations as effective diagnostic predictors for SWD risk has been poorly studied across most surgical domains.

Materials and Methods

This is a prospective study conducted in the Tertiary care teaching Hospital. Patients who had undergone abdominal surgery (laparotomy) who developed acute fascial wound dehiscence (AFWD) and who had to return to the operating theatre for closure of the fascial dehiscence under general anaesthesia. The medical records were

reviewed and the diagnosis of fascial dehiscence was confirmed for all included patients.

Each single case was matched to two cases of patients who were admitted in the same year for surgery and who underwent similar surgical intervention, were of the same gender, and were within 5 years of the index patients' age. Patients who developed incisional hernia on follow up were excluded due to the aetiological overlap between fascial dehiscence and incisional hernia.

The electronic data base of Hospital was reviewed and the data collected included age, gender, surgical procedure, comorbidity, urgency, diagnosis, malignancy, surgery for sepsis, postoperative complications, smoking, steroid treatment, hospital stay and mortality.

A detailed pre-operative clinical examination and investigations were done for patients who were candidates for undergoing laparotomy. Abdominal skin was prepared 2-3 hours prior to surgery and laparotomy was 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 non absorbable continuous mono filament polypropylene number 1 and skin with interrupted braided silk 2-0.

The total duration of surgery from incision to closure of wound was recorded. In the Post-operative period, record was kept regarding the incidence of nausea, vomiting, urinary retention, cough and abdominal distension on 1st, 2nd, 4th, 7th and 10th day. The wounds were dressed daily and inspected for any discharge. Presence of pus or discharge positive for bacteria on culture was considered as positive for infection. The total hospital stay, any events and final outcome were also recorded. Those patients who developed wound dehiscence were included in the study and the factors contributing to wound dehiscence were analyzed.

Statistical Analysis

Statistical analysis was processed using Excel software programs. Observations are represented as bar diagrams and pie charts.

Results

The total study population was 90 patients that underwent laparotomy with midline incision. Out of these 90 cases 43 patients were female (47.8%) and 47 patients were male (52.2%). The cases were distributed in two groups randomly depending on the technique of midline closure. The study included patients from age of 45 years up to 75 years and above and they were divided into the following groups:

Table 1: Age wise distribution of study population

Age (years)	Number	Percentage (%)
45-50	16	17.77
51-60	23	25.55
61-70	36	40
71-75	15	16.66

Table 2: Distribution of cases according to stitchlength

Case	Number
Study population-short stitch length	44
Study population-long stitch length	46
Total	90

The total study population was divided into two groups and a prospective randomised study was carried out to compare results between the two groups.

In the first group closure was done with short stitch technique i.e., sutures were placed <10 mm from margin of wound and distance between two stitches is also <10 mm, with non-absorbable sutures (polypropylene) and continuous single-layer sutures. The suture length to wound length ratio

(SL:WL) is >4:1 (5:1 or 6:1). In the second group, closure was done with standard long stitch technique i.e., sutures were placed 10mm from wound margin and distance between two sutures is also 10mm, with continuous non absorbable sutures like that of the first group.

The suture length to wound length ratio (SL:WL) here is 4:1. In the short stitch group 44 patients were allocated randomly and in the long stitch group 46 patients were allocated.

Table 3: Case wise distribution of study population

Case	Number	Percentage (%)
Band obstruction	20	22.2
Sigmoid volvulus	15	16.7
Gastric CA	13	14.4
Sigmoid CA	10	11.1
Mid gut volvulus	1	1.1
Obstructedhernia	13	14.4
CA ascending colon	8	8.9
Pyloric stenosis	10	11.1
Total	104	100

Out of the total 90 patients, 20 (22.2%) had band obstruction, 15 (16.7%) had sigmoid volvulus 13 (14.4%) had gastric carcinoma, 10 (11.1%) had sigmoid cancer, 1 (1.1%) had mid gut volvulus, 13 (14.4%) had obstructed hernia, 8 (8.9%) had carcinoma of ascending colon, 10 (11.1%) had pyloric stenosis.

Table 4: Co morbid conditions at the time of admission

Conditions	No. of cases	Percentage
Diabetes (DM)	38	36.53
Hypertension (HTN)	23	22.11
Pulmonary disease	11	10.57
Malnutrition	9	8.65
Anemia	16	15.38
CRF	1	0.96
Ascites	3	2.88
Jaundice	2	1.92
Uremia	1	0.96

Malnutrition, DM, HT, pulmonary diseases, anemia etc. are important risk factors for wound dehiscence.

Discussion

In recent years, surgical therapy has become increasingly adjusted to individual patients based

on their specific risk profiles. The goal of this strategy is to affect treatment outcomes positively. Furthermore, informed consent issues are gaining more attention from patient organizations, lawyers, and doctors in the light of juridical procedures. Before obtaining informed consent, patients should

be fully informed about complications that can be expected to occur.

Thus, preoperative risk assessment and information on absolute risk is important for both patients and doctors. Old age is another independent risk factor for abdominal wound dehiscence. Age has also been reported as a risk factor in other studies. [6] The explanation for this might lie in deterioration of the tissue repair mechanism in the elderly. Especially during the first few days of the wound healing process, the immune system plays a key role. Functional changes adversely affect the influx of cells and compounds that are essential for tissue repair. [7] Anemia 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. [8]

One of the interesting risk factors found in this study, is gender. In previous studies, males have been reported to have a higher risk of developing abdominal wound dehiscence. [9] The reason for this disadvantage is not entirely clear. One of the possible confounders may be smoking. Because most smokers from the studied generations tended to be male, the effect of gender may be confounded with the effect of smoking on tissue repair. Unfortunately, smoking has thus far not been investigated as an independent risk factor for abdominal wound dehiscence. Another explanation may be that men build up higher abdominal wall tension than females. An increase in intraabdominal pressure results in higher strain on the wound edges, causing the sutures to cut through the muscles and fascia. This explanation may also apply to ascites and coughing, causing increment in intra-abdominal pressure.

Risk factors that did not have independent effects in our evaluation included hypertension, uremia, and corticosteroid use, although these factors have been described as risk factors by a number of authors. [15] The latter can be explained by the more frequent use of corticosteroids in lung disease patients, which applied to both cases and controls in our study. We found mild significant effect on the occurrence of abdominal wound dehiscence for diabetes mellitus and previous laparotomy. Malignancy, sepsis, and postoperative vomiting have been identified as risk factors by several authors, but no significant effects were found in the present study. [16] This was surprising because it was suspected that the presence of scar tissue, microvascular changes due to hypertension and diabetes, poor tissue perfusion, and poor overall condition of the patient, associated with sepsis and malignancy, would be risk factors. Jaundice, on the other hand, was found to be an independent risk factor. This has not been confirmed by other studies. [17] Most important, Armstrong

investigated jaundice in relation to hematocrit and albumin levels and malignancy. [18] Jaundice was significant in univariate analysis but not in multivariate analysis in that study. The conclusion of that study was that wound healing is affected in jaundiced patients due to the association with low hematocrit and albumin levels and malignancy (i.e., poor nutritional status) and not to raised bilirubin levels. Low protein and albumin levels and deficiencies of several vitamins and minerals such as vitamins A, B1, B2, B6, C and zinc and copper have been associated with poor wound repair. Data on pre-operative albumin levels were available for 83% of patients with abdominal wound dehiscence and 56% of controls.

Also, studies are needed to evaluate other possible factors for which limited retrospective data are available, such as nutritional state. The consequences of the score are also limited by the inclusion of risk factors that occur in the postoperative phase, such as coughing and wound infection. Still, because the model has been shown to be highly predictive, it can be used to identify patients at risk. Preventive measures, e.g., the use of mesh and special suture techniques and materials, aimed at decreasing tension on the wound edges, can be investigated and used in these patient groups. Tohme et al., for example, reported the results of a retrospective study on the preventive use of polyglactin 910 mesh versus retention sutures in patients with at least one suspected risk factor for abdominal wound dehiscence. [19]

Conclusion

In conclusion, various putative risk factors for abdominal wound dehiscence were investigated in the thus far largest study in the general surgical population. Important risk factors for abdominal wound dehiscence have been identified in this case-control study, including age, gender, chronic pulmonary disease, ascites, jaundice, anemia, emergency surgery, type of surgery, coughing, and wound infection.

On the basis of these data, we were able to develop a risk score for abdominal wound dehiscence. From the results of this study, we can also conclude that a number of risk factors for abdominal wound dehiscence can be mitigated during the perioperative period. This implies that the risk of developing abdominal wound dehiscence can be reduced by preventing pneumonia and wound infection, and by applying optimal surgical technique in every patient.

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