STUDY OF RISK FACTORS IN ABDOMINAL WOUND DEHISCENCE FOLLOWING EMERGENCY LAPAROTOMY
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ABSTRACT
BACKGROUND
Abdominal wound dehiscence is a common complication following emergency laparotomy. 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. The chances of postoperative wound dehiscence can be predicated and can be prevented to some extent by identifying the risk factors responsible for wound dehiscence.

MATERIALS AND METHODS
A cross-sectional study of all the patients who are admitted in the Department of Surgery, B.R.D. Medical College, Gorakhpur, undergoing emergency laparotomy during a period of one year.

RESULTS
Anaemia was a common preoperative comorbidity taking up to 69% of all clinical comorbidities that were associated with wound dehiscence in this study. Chest infection (21%) uraemia (8%) and jaundice (2%) also contributed. None of the patients was on steroid therapy, radiotherapy or cytotoxic treatment.

CONCLUSION
Wound dehiscence following emergency laparotomy has multifactorial cause. These includes certain indications of laparotomy (e.g. perforation, peritonitis), intraoperative techniques and postoperative comorbidities and factors. The common causes in our study was anaemia, postoperative infections, coughing and poor nutritional status.

KEYWORDS
Wound Dehiscence, Septicaemia, Peritonitis, Electrolyte Imbalance, Lung Atelectasis.

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BACKGROUND
Wound and their management are fundamental to the practice of surgery. Any surgical intervention will result in a wound. The surgeon’s task is to minimise the adverse effect of the wound, remove or repair damaged structures and harness the process of wound healing to restore function. Gurlyik G et al concluded that wound dehiscence is an acute wound failure. It has an incidence of 2 percent and an associated mortality of 25%. No single cause is responsible for wound dehiscence and as a rule a combination of factors are operating. If the support system fails before the functional and structural integrity is regained, then the wound edges break apart. Many such factors like anaemia, jaundice, uraemia, diabetes, hypoalbuminaemia, chronic obstructive pulmonary diseases, advanced malignancy, steroid use, obesity, wound infection and emergency surgery have been defined as concluded by Burger JW et al. Some factors like jaundice, obesity, anaemia, emergency surgery and diabetes have recently been challenged.

Wound infection is the most important single factor in the development of abdominal wound dehiscence and development of subsequent incisional hernia. Empirically, the ancients recognised that foreign bodies and dead tissue must be removed from wounds. 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." Study by Lodhi FB et al showed that control of bacteria by asepsis, antiseptics and antimicrobials heralded a new era in wound management.

Wound dehiscence often show the surgeon’s fault and its elimination maybe within the jurisdiction of the surgeon. Good knowledge of risk factors is mandatory for prophylaxis. Patients identified as being high risk may benefit from close observation and early intervention.
Acute wound failure maybe occult or overt, partial or complete. Overt wound failure follows early removal of sutures leading to evisceration. Occult dehiscence occurs with disruption of musculoaponeurotic layer beneath intact skin sutures.

Incidence of wound dehiscence following laparotomy in 1979 to be 2.5% in 4538 patients by Freddy Pennickx FM et al. This did not show major change in 2002 with abdominal wound dehiscence carrying 2.15% incidence who are leading the world like USA.

Although, in the incidence of abdominal wound dehiscence in international literature is between 1.1-2.8%, the few studies emerging from Pakistan by Khan MN S et al have shown the incidence between 2.7 to 8.3%. This makes the problem of wound dehiscence more common and grave in Asian subcontinent setting as compared to West as shown by Mathur, Afzal et al reported incidence of abdominal wound dehiscence to be 8.13%. Incidence in elective laparotomy was 1.73% and emergency was 12.45%.

Gabrielle H Van Ramshoort et al developed a risk model, which was validated in population of patients who had undergone operation between January and December 2006. A total of 363 cases and 1089 controls were analysed. Mean presentation of abdominal wound dehiscence was at postoperative day 9 with 90% of all cases presenting before 15th postoperative day. The hospital stay was significantly longer in the patient with a mean of 36 days versus 16 days in control groups. In hospital mortality for two groups were 22% and 9%. Major independent risk factors were age, gender, chronic pulmonary disease, ascites, jaundice, anaemia, emergency surgery, postoperative coughing and wound infection.

In a study by Jakub Kenig, et al, on 1879 patients undergoing intra-abdominal procedure, the patient developed abdominal wound dehiscence during the postoperative period represented 2.9% of all operation performed. The mean age was 66.8 ± 12.6 year. Abdominal wound dehiscence occurred on average at the 9.8 ± 6.5 postoperative day (median- 8 days). Mortality of the patient in this group was 25%. In addition, more patient were operated on as an emergency procedure 45 (80.4%) vs. 11 patient in elective group. The patient that developed abdominal wound dehiscence had a higher rate of wound infection, circulatory insufficiency and increased length of hospitalisation and were more likely admitted to ICU.

A retrospective observational study, patients from 87 Spanish hospital during 2008-2010, Gili Ortiz et al observed that out of 3,23,894 patients undergone abdominal surgery, 2294 patients developed postoperative abdominal wound dehiscence. Patients had an increase in in-hospital death, excess length of stay and higher cost.

**Aims and Objectives**

1. To know the incidence of abdominal wound dehiscence.

2. Clinical study of risk factors in abdominal wound dehiscence following emergency laparotomy.

3. Determine the outcome of the management.

**MATERIALS AND METHODS**

Study will be conducted in all patients who will be admitted in Department of Surgery, BRD Medical College, undergoing emergency laparotomy during the period of one year from December 2015 to December 2016. This study will be cross-sectional type.

An elaborate study of these cases with regard to date of admission, clinical history regarding mode of presentation, significant risk factors, investigation, time of surgery and type of surgery and postoperatively, study of diagnosis and day of diagnosis of burst abdomen will be done till the patient is discharged from the hospital.

In history, age, details regarding presenting complaints, duration, associated diseases, obesity, chronic cough, smoking and alcoholism will be noted. Data will be collected from clinical examination and appropriate investigation.

Standard midline incision and continuous mass closer technique will be used in each case. In all patients, laparotomy wound be closed with polydioxanone number one suture. An abdominal supported dressing will be used in all patients’ immediately after surgery and during the entire hospitalisation.

Wound will be dressed daily and will be inspected for any discharge/pus. Presence of pus/discharge positive for bacteria on culture will be considered as positive for infection.

Based on outcome, patient with midline wound dehiscence (study group) will be compared with patients without wound dehiscence (control group). Postoperative follow up will be done for at least one month.

**Inclusion Criteria**

Patients of age >10 years and of either sex who have undergone emergency laparotomy and are willing for investigation and treatment.

**Exclusion Criteria**

1. All patients with wound dehiscence who are less than 10 years of age.
2. All patients with incisional hernia.
3. Patients undergoing second laparotomy.
4. All patients who are not willing for investigation and treatment.
5. Patients in immune compromised state on anticancer drugs and on anticoagulation therapy.

**RESULTS**

A total of 64 cases were obtained out of which 8 were excluded from study due to inadequate data. Thus, 58 patients formed the study population. The 58 patients included in this study were fully managed in Nehru Hospital, B.R.D. Medical College, Gorakhpur, from initial surgery till discharge.
Age Group | Number of Patients
--- | ---
11-20 years | 2
21-30 years | 5
31-40 years | 9
41-50 years | 24
51-60 years | 15
61-70 years | 3
**Total** | **58**

*Table 1. Patients Age Distribution*

The age of presenting patients range from 10 years to 70 years. Highest number of patients were in 41-50 years age group followed by 51-60 years age group. The mean age of patients were 45 years.

| Sex       | Number of Patients |
|-----------|--------------------|
| Male      | 43                 |
| Female    | 15                 |
| **Total** | **58**             |

*Table 2. Showing Sex Ratio*

Laparotomy for intestinal perforation carried highest wound failure rate, i.e. 50% (29 out of 58 total affected patients) followed by surgery for intestinal obstruction.

| Indication | No. of Patients |
|------------|-----------------|
| Intestinal obstruction | 18 |
| Perforation peritonitis (does not include perforation due to external injury) | 29 |
| Appendicitis | 2 |
| Pyoperitoneum | 7 |
| Perforation due to external injury | 2 |
| **Total** | **58** |

*Table 3. Showing Indication of Surgery*

The presenting complaints were fever (41%), coughing (29%), fever (26%) and vomiting (2%). None of these complaints occur in isolation. Each patients has at least two of the above complaints.
Clinical evaluation revealed tachycardia was the most frequent finding followed by fever and abdominal distention. Marked dehydration and wasting were present in some patients. Again, none of the findings were in isolation. Most of the patients were having at least two findings.

Graph 5. Showing Clinical Comorbidities

Anaemia (low haemoglobin) was a frequent preoperative comorbidity taking up 69% (40/58) of clinical comorbidities that were associated with wound dehiscence in this study. Chest infection (21%), uraemia (8%) and jaundice (2%) also contributed. None of the patients was on steroid therapy, radiotherapy or cytotoxic treatment.

Graph 6. Showing Preoperative Investigations

In the preoperative investigations, 40 (69%) of the patients had low haemoglobin, i.e. haemoglobin less than 10 gm/dL. 21 patients were in septicaemia. 6 of 58 patients were in uraemia at the time of operation.

Approximately, 45% of patients were in electrolyte imbalance at the time of presentation. Most frequent finding was hyponatraemia. 25% were having deranged liver enzymes.

Graph 7. Showing the Day of Wound Dehiscence

Majority of patients (71%) had wound disruption occurring between 6th to 10th postoperative day. There were only 2 patients (3%) who had dehiscence after 15th postoperative day.

Graph 8. Showing Postoperative Factors

The possible leading cause of wound dehiscence in this study was wound infection (40 patients). Pus and serosanguineous exudates (28 patients) was the leading indicator of impending dehiscence. All patients received analgesic and antibiotic postoperatively. Nasogastric tube put in all patients. Single or multiple abdominal drains were put in all patients.

All patients were treated conservatively. Wound is allowed to heal by secondary intention. Secondary suturing under local anaesthesia done in selected cases.

On examination of wound, there was (in order of decreasing frequency) pus formation, cut fascial margins, haematomas and poor closure technique were present. Daily dressing with saline-soaked gauze was done. Antibiotic provided as per pus culture and sensitivity reports and some postoperative blood transfusion and amino acid transfusion done.
The average hospitalisation duration was 19 days with range of 11-42 days. There were 3 deaths-

1. 70-year-old male who was operated for perforation of the stomach.
2. 47-year-old male who was operated for intestinal obstruction. At the time of presentation, he had overwhelming sepsis.
3. 42-year-old female who operated for pyoperitoneum, she had haemoglobin of 4.1 gm/dL.

**DISCUSSION**

This study reviewed 58 patients who has post laparotomy wound dehiscence from December 2015 to December 2016. Out of 64 patients who had post laparotomy wound dehiscence were excluded from study due to inadequate data. Thus, only 58 patients were included in study giving wound failure rate of 8.2% (58/707).

Total number of laparotomies done in this period was 715, out of which 47 has died. This gives the case mortality of 6.57% (47/715). However, 3 out of 58 patients died in our study group. Therefore, mortality in study group was 5.17%.

This study has analysed possible causes of wound dehiscence, the management of these patients preoperatively, intraoperatively and postoperatively and evaluated outcome of each case.

Abdominal wound dehiscence rate of 8.2% much higher than the recent studies of similar aspect.

Incidence of wound dehiscence following laparotomy in 1979 to be 2.5% by Freddy Pennickx.

Study concluded in Pakistan18,19,20 have shown incidence between 2.7% to 8.3%, probably due to many patients having poor nutritional status and presentation is often delayed in emergency. This makes problem of wound dehiscence more grave in Asian subcontinent.

Azaf et al22 reported incidence of wound dehiscence in elective laparotomy was 1.73% and in emergency laparotomy was 12.45%.

The possible explanation of such big discrepancy maybe due to the fact that majority of patients were done as emergency operation. Emergency surgery is a risk factor to wound dehiscence. Being a lifesaving procedure, there is hardly any time to stabilise the patient and also chronic health status may not be an immediate priority.

The mean age was 44 years with a range of 10-70 years.

Incidence of abdominal wound dehiscence in males was 9.5% (43/58).

Incidence of abdominal wound dehiscence in females was 5.3% (15/58).

Male-to-female ratio was 3:1 (43 males and 15 females).

The youngest patient was a 14-year-old girl operated for pyoperitoneum and the oldest patients was of 70 years old operated for intestinal obstruction.

Highest numbers of patients were 41-50 years age group, which is explained by the fact that this is the age group in which peptic ulcer disease is more prevalent, so as intestinal obstruction.

In our study, all patients were operated as emergency. Most of the surgeries were performed by senior residents.

As mentioned in the results, the seniority of the operating surgeon could not be considered as a significant variable due to the regular practice where the assisting surgeon close the incision.

Madsen G and Fischer L stated that emergency surgery did not influence the outcome as related to wound dehiscence and subsequent incisional hernia.26 This is so because surgical principles should not vary whether one is dealing with an emergency or an elective procedure.

However, Chukudebule WO and Okafor EL reported the risk of burst abdomen to be three times greater in “unbooked” patients, i.e. unplanned surgery.27

The commonest presenting symptom was abdominal pain (almost all patients). Pain is a nagging symptom and not many patients will tolerate it and therefore it is the main reason why many patients will seek medical attention. Fever is an indication of infection and 15% of the patients had it. The other symptoms included abdominal distension, vomiting, cough and weight loss.

Clinical evaluation of these patients confirmed the complaints. In this study, 90% of the patients had abdominal distension, 15% were clinically febrile, 80% had tachycardia and were dehydrated.

These variations in symptomatology indicate that presentation was both acute and chronic in nature. However, this wasn’t useful in determining, which patients would have wound dehiscence because many of the patients did not have most of them and still had wound disruption.

However, in surgical practice, it is necessary to stabilise the patient first prior to surgery, thus the physical finding like dehydration, anaemia and low blood pressure should be corrected prior to surgery.

Roe P G outlines the hazards of presenting a patient for surgery with existing fluid deficits. He therefore emphasises the need to resuscitate the patient and correct fluid and electrolyte imbalance before operation.28,29

40 patients were found to be anaemic (haemoglobin below 10 g/dL) as per laboratory findings. In this study, this is considered as one of main contributors to wound failure.

**Graph 9. Showing Days of Hospitalisation**

The average hospitalisation duration was 19 days with range of 11-42 days.
Low haemoglobin means poor oxygen supply to tissues and therefore poor tissue healing and inability to resist infection.

One of the patients who died in this study had low preoperative haemoglobin. Haemoglobin before her death was 4.1 g/dL.

Simon J S and Lorna M W reports that mortality and morbidity are significantly increased in patients who undergo surgery with preoperative haemoglobin of less than 8 g/dL and receive no transfusion of blood.20

Six patients had high urea preoperatively. This may have been due to dehydration because electrolytes were within normal ranges.

Approximately, 45% of patients were in electrolyte imbalance at the time of presentation. Most frequent finding was hyponatraemia. All patients were put to replacement therapy to correct electrolyte before taking to operation theatre.

12 patients were having chest infection, thus requiring ventilator support after surgery. Increased cough in postoperative period make them more susceptible to abdominal wound dehiscence.

One patient had jaundice. The factors is mentioned in the literature review as possible cause, but statistically the numbers are quite low (2%) in this study for any useful inference to be made. No patients were undergoing radiotherapy, cytotoxic or steroid therapy. These factors are known to cause poor tissue healing and were therefore excluded in the study.

No patients in study was found to be HIV +ve. So, it would be difficult to conclude whether HIV infection in isolation affects tissue healing and therefore no inferences were made as relates to HIV infection. The wound complications found in AIDS patients have not been properly defined neither have a direct relationship between leucocyto defect and wound healing have been reported. Jellis J et al,31 reported that, appendicitis, gynaecological pelvic abscesses and primary peritonitis are common in patients with HIV infection. These patients present with difficulties in surgical wound healing.

All patients were operated with midline vertical incision. Midline incisions are preferred in emergency surgery for they offer better access to abdominal cavity including the pelvis and can easily be extended if needed. Vertical incision are known to give way more frequently than any other type of abdominal incision.

All patients who had undergone laparotomy has nasogastric tube and abdominal drains in postoperative period. Nasogastric tube was put to decompress stomach, so as to prevent aspiration and to prevent vomiting and pain.

No drains are needed in clean abdominal operations. But, when infection is present, resection or aspiration of involved tissue should be followed with antibiotic coverage and peritoneal cavity should be drained.

Abdominal drains were put to drain any pus, haemorrhagic fluid, faecal material (in case of anastomotic leak). Tube drains tend to block in thick pus or in presence of debris. Soran A et al in their study on burst abdomens stated that two or more drains increased risk of wound dehiscence and so they advocated to place no drains at all.

After surgery, then mass closure of surgical wound was done. The rectus sheath was the layer of interest in this study, because it maintains the integrity of abdominal wall after surgery. Wound closure done with Polydioxanone (PDS) suture. Layered closure results in significantly more burst abdomen than any other method of closure.

Most (71%) of the wound dehiscence occurred on sixth to tenth postoperative day. This duration is within the period quoted other similar studies. Anielski et al22 reports average time of 6.5 days while Madsen et al reported the sixth postoperative day for wound dehiscence to occur.

The leading postoperative causes of wound dehiscence were wound infection and peritonitis (45 patients). Infection interferes with wound healing, and thus in the presence of the same, there is increased incidence of dehiscence. Most studies do quote wound infection, presence of peritonitis, colonic surgery and pelvic abscess as possible contaminants of the incision leading to dehiscence.

Another indication of impending dehiscence is serosanguineous exudates.

In this study, 12 patients developed a cough. The cough maybe due to endotracheal intubation. However, these symptoms did not occur in isolation and cannot be wholly blamed for wound dehiscence, although they are capable of causing the same.

Three patients had suture removal before the wound gained sufficient strength due to excessive abdominal distension and thus there was complete dehiscence. Six patients had high blood pressure, a possible postoperative factor. Two patients had incisional haematoma while another two had poor incision margins approximation. Other comorbidities included typhoid fever (5), psychosis (3) and thyrotoxicosis (1). All these factors may have contributed in one way or another to the wound failure.

All 58 patients were subjected to conservative management. Conservative management involved dressing of the wound regularly until it healed. Some did require insertion of skin sutures under local anaesthesia.

Dodson M K et al pointed out that superficial skin closure of extrafascial wound dehiscence appear to be superior to deep en bloc closure in terms of time and pain control. These benefits are achieved with minimal risks while allowing timely wound healing of laparotomy wound.33

Of the 58 patients who were managed, 15 were found to have intraabdominal abscess, 25 has wound abscess, 4 has loose suture, 8 has cut fascia margins and 6 has dehisced gut. Some patients were having two or more finding mentioned above.

Those who had loose sutures, damaged suture or cut fascia margins were 12 in total. This presented technical failure where sutures were either poor, stitching was poorly done (too tight or too close to fascia edge or loosely tied).

The purpose of suture is to hold a wound together in good apposition until natural healing process is sufficiently.
well established to make the support from the suture material unnecessary and redundant.

42 patients manage by daily dressing with saline-soaked gauze until the wound healed. Patient was given appropriate antibiotic. Patient was also given abdominal support.

13 patients had tension sutures. This was done in patients with clean and healthy wound. The suture used this time was nylon. Skin was approximated taking bites from 2.5 cm from wound edges. This did not prevented from hernia formation. But, it was done to reduce patient's anxiety. This also led to reduction in hospital stay and early resumption of work. All the patients received antibiotics and analgesics.

Regarding tension suturing, Eden C G recommends use of a strong nylon suture to be inserted in all layers of wound at 3 cm from wound edge and at 3 cm interval without undue tension over polyethylene bars and to be retained for 10 to 14 days.

Niggebrugge A et al suggest that a continuous monofilament, non-absorbable suture should be used to close a laparotomy incision.34

Although, no meshes were used in this study, the work by Paye F and colleagues shows that the use of “prophylactic” absorbable mesh may go a long way in reducing laparotomy wound dehiscence in suspect patients.

The average hospitalisation duration was 19 days with a range of 11 days to 42 days. The patients who stayed the shortest had burst abdomen within two days due to cut fascial margins (too tight sutures) two days after laparotomy.

Three out of 58 patients had died (5%).

The patient who stayed 42 days is a lady (42 years), who had developed pyoperitoneum following dilatation and curettage. She remained in ICU for entire hospitalisation and eventually died. Other two patients died were a 70 year old male who was operated for perforation peritonitis, patient developed chest infection and a 47 year-old male who was operated for intestinal obstruction having overwhelming sepsis at time of admission.

CONCLUSION

- Laparotomy wound dehiscence has multifactorial causes. These included certain indications of laparotomy (e.g. peritonitis), intraoperative technique and postoperative comorbidities and factors.
- The commonest cause in our setup is anaemia, postoperative infection and coughing.
- Most of the people here belong to low socioeconomic status. Hence, nutritional status prior to surgeries is very poor leading to impaired or delayed wound healing.
- Presentation of patient is very late in emergency. Patients often landed up in sepsicaemia, dehydration, dyselectrolytaemia and poor GC.
- Coughing and postoperative chest infection due to lung atelectasis is important predisposing factor of wound infection.

- Early mobilisation and chest physiotherapy is very important to improve pulmonary perfusion and to prevent lung infection.
- Surgical drains and nasogastric tube should be put when sepsis and ileus are expected.
- More technical training is needed for surgeons handling emergency surgeries to minimise technical error.
- Abdominal support is useful in preventing cut through fascial margins and to reduce postoperative pain.
- Not all the patients should be subjected to re-laparotomy unless there is certain definite indication. Those with partial or extrafascial wound dehiscence can be managed conservatively.
- Patients can be managed with daily dressing and secondary suturing if needed. Although, it cannot prevent incisional hernia.
- Hospitalisation period is quite long though within limits of other studies and similar respect.
- It severely affects the patients emotionally and financially.

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