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Original Research Article

KIMS 14: a new scoring system to predict abdominal wound dehiscence following emergency laparotomy

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ABSTRACT

Background: Abdominal wound dehiscence is a common complication of emergency laparotomy in Indian setup. Wound dehiscence carries with it a substantial morbidity and mortality. Hence, we have developed a scoring system which can predict wound dehiscence following emergency laparotomy and prophylytic measures can be taken preoperatively to prevent this. Objectives were to identify independent risk factors for abdominal wound dehiscence and to develop a scoring system to recognize high risk patients.
Methods: An observational, longitudinal, analytical and retrospective study was done from July 2014 to January 2017 in KIMS Hubli, Karnataka, India, where the sample studied were patients who underwent midline laparotomy during the study period. 30 cases of abdominal wound dehiscence were taken and 60 controls.
Results: 30 cases of abdominal wound dehiscence following emergency laparotomy were reported and compared with 60 selected controls. Age, gender duration of symptoms hypotension, anemia hyperbilirubinemia, hypoproteinemia, uremia, duration of surgery, contaminated wounds, COPD/chest infections were statistically significant. Multivariate binary logistic regression showed Hypoproteinemia, uremia duration of surgery contaminated wounds and chest infection/COPD as independent significant risk factor and a scoring system was developed using these variables.
Conclusions: The scoring system developed can identify the high-risk patients and necessary measures can be taken to prevent this complication.

Keywords: Abdominal wound dehiscence, Emergency laparotomy, Scoring system

INTRODUCTION

Abdominal wound dehiscence is a known complication of emergency laparotomy in Indian setup.[1] Wound dehiscence carries with it a substantial morbidity and mortality. Many patients in India have a poor nutritional status and the presentation of patient with peritonitis is often delayed. This makes the problem of wound infection and dehiscence more common and graver in our setting as compared to the west. The wound dehiscence rate reported in the international literature varies from 1% - 2.6%.[2-5] In those cases mostly between the sixth and eighth day after operation an abdominal wound bursts open and viscera are extruded.[6,7] In addition there is an increase in the cost of the care both in terms of increased hospital stay, nursing and manpower cost in managing the burst abdomen and its complication.[8-12] The disruption of the wound tends to occur a few days beforehand when the sutures opposing the deep layers tear through or even become untied. An incisional hernia starts as a symptomless partial disruption of the deep layers during the immediate or early postoperative period,

even this passes unnoticed if the skin wound remains intact after the skin sutures have been removed. The mortality rate following wound dehiscence has ranged from 9%-43%, with a recent review reporting a mortality rate of 16%.[13] Laparotomy wound dehiscence is a term used to describe separation of the layers of a laparotomy wound before complete healing takes place. Other terms used interchangeably are acute laparotomy wound failure and Burst abdomen. It has been a puzzle that hasn't solved by any surgical unit (i.e. no unit has reported 0% failure). However, most hospitals have achieved and maintained failure rates well below 1%. Several important risk factors for wound dehiscence are, Age (>65 years), hypo-albuminemia, wound infection, ascites, obesity, steroid use, COPD, pneumonia, cerebrovascular accident with residual deficit, anemia (haematocrit <30), prolonged ileus, post-operative coughing, emergency operation and operative time greater than 2.5 hours. In about 20%-45% of cases, evisceration becomes a significant risk factor, which is associated with death during the peri-operative period.[14,15]

METHODS

Source of data

The study entitled "KIMS 14: A new scoring system to predict abdominal wound dehiscence following emergency laparotomy" was conducted in the Department of General Surgery, KIMS Hubli, Karnataka, India from July 2014 to January 2017.

Study type

This was a prospective, observational longitudinal and analytical study.

Inclusion and exclusions criteria

Inclusion criteria being, patients of age >18 years and of either sex who have undergone emergency laparotomy and are willing for investigation and treatment. All patients with Incisional hernia, Female patients who developed wound dehiscence after any gynaecological procedures and patients who refuse investigations and treatment were excluded.

Sample size

30 patients who developed wound dehiscence following emergency laparotomy were taken as cases. The ratio of cases to control in our study was 1:2. Controls (60) were not matched for age sex or type of surgery.

Statistical analysis

Comparison of cases and controls was done using chi-square test and the Mann Whitney U-test respectively for categorical and continuous data. Multivariate stepwise logistic regression with backwards elimination test was used to recognize chief unfettered risk factors of abdominal wound dehiscence.

The ensuing regression coefficients for the major variables were used as their weights to calculate a risk score for abdominal wound dehiscence. Patient data confidentiality was maintained throughout the study.

RESULTS

30 cases of abdominal wound dehiscence following emergency laparotomy were reported and compared with 60 selected controls. Abdominal wound dehiscence was reported was reported at a mean of 9th postoperative day (6-15). One patient reported with dehiscence after discharge from hospital after removal of sutures from a local hospital. Hospital stay was prolonged in dehiscence group as compared to the controls (P=0.03). Mortality during the hospital stay was 27% (9) and 8.3% (5), respectively for the two groups of study population (P<0.026) during the hospital stay.

12% (4) out of 30 patients underwent re-exploratory laparotomy followed by tension suturing. None of them developed recurrence. There was no statistically significant difference between the conservatively treated patients and those treated operatively in term of hospital stay and mortality. As our main goal was to predict the wound dehiscence before surgery and prevent it, post op wound infection, ventilator support, post op cough and chest infection et were not taken into consideration. None of the patients in dehiscence group were on steroids, chemotherapy or radiotherapy treatment.

Table 1 shows the results of the univariate analysis. Following variables were significantly more prevalent in cases as compared to those in the control group: old age >60 years (P=0.013) male gender (p = 0.001), hypotension (p≤0.005), duration of symptoms (p = 0.005) chronic pulmonary disease, anemia (p = 0.005), hyperbilirubiemia (p = 0.005), albumin level, (u≤0.005), uremia (= 0.005), operative time (p = 0.005), perforative peritonitis or contaminated wounds (p = 0.005).

Statistically significant variables of univariate analysis were entered in a multivariate stepwise logistic regression to find out significant independent risk factors as shown in Table 2.

Surgery on abdominal wall being clean was chosen as the reference category for the evaluation of type of surgery. Age less than 60 years was taken as reference category for the evaluation of variable "age". hypoproteinemia, uremia, duration of surgery, perforative peritonitis or contaminated wounds and COPD/chest infections seemed to be significant risk factors during multivariate analysis.

Table 1: Univariate variables.

		Controls	Cases	Total	P-value	OR
Age group	<60 years	53 (88.33)	20 (66.67)	73 (81.11)	0.013	3.8
	60 years or more	7 (11.67)	10 (33.33)	17 (18.89)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Gender	Female	31 (51.67)	5 (16.67)	36 (40)	0.001	5.35
	Male	29 (48.33)	25 (83.33)	54 (60)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Duration of symptom	<3 days	51 (85)	10 (33.33)	61 (67.78)	<0.005	11.3
	3 or more days	9 (15)	20 (66.67)	29 (32.22)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Hypotension BP <90mm Hg (Systolic)	Absent	60 (100)	24 (80)	84 (93.33)	<0.005	-
	Present	0 (0)	6 (20)	6 (6.67)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Anemia Hb <10gm%	Absent	35 (58.33)	8 (26.67)	43 (47.78)	0.005	3.85
	Present	25 (41.67)	22 (73.33)	47 (52.22)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Hyperbillirubinemia T. Bilirubin >1.2gm/dl	Absent	55 (91.67)	13 (43.33)	68 (75.56)	<0.005	14.4
	Present	5 (8.33)	17 (56.67)	22 (24.44)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Hypoproteinemia S Albumin <3 gm/dl	Absent	52 (86.67)	8 (26.67)	60 (66.67)	<0.005	17.9
	Present	8 (13.33)	22 (73.33)	30 (33.33)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Uremia Urea >40 mg/dl	Absent	49 (81.67)	8 (26.67)	57 (63.33)	<0.005	12.25
Uremia Urea >40 mg/dl	Absent	49 (81.67)	8 (26.67)	57 (63.33)	<0.005	12.25
	Present	11 (18.33)	22 (73.33)	33 (36.67)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Surgery duration	2 hours or less	44 (73.33)	4 (13.33)	48 (53.33)	<0.005	17.9
	>2 hours	16 (26.67)	26 (86.67)	42 (46.67)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Perforation	Absent	50 (83.33)	5 (16.67)	55 (61.11)	<0.005	25
	Present	10 (16.67)	25 (83.33)	35 (38.89)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Incision	Upper only, transverse	31 (51.67)	14 (46.67)	45 (50)	0.655	1.22
	Upper and lower, lower only	29 (48.33)	16 (53.33)	45 (50)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		
Chest infection/ COPD	Absent	57 (95)	24 (80)	81 (90)	0.025	4.75
	Present	3 (5)	6 (20)	9 (10)		
	Total	**60 (100)**	**30 (100)**	**90 (100)**		

Table 2: Multivariate binary logistic regression (conditional).

Variables	Regression coefficient (B)	S.E.	Wald	df	Sig.	OR
Hypoproteinemia	5.005	1.63	9.43	1	0.002	149.195
Uremia	4.082	1.517	7.244	1	0.007	59.293
Surgery duration	4.527	1.643	7.595	1	0.006	92.485
Perforation or Contaminated wounds	2.965	1.319	5.053	1	0.025	19.398
Chest Infections/ COPD	4.203	1.975	4.527	1	0.033	66.875

We developed a scoring system for abdominal wound dehiscence following emergency laparotomy. The risk scores, weighing the various factors by using the resulting regression coefficients in the logistic regression analysis, are shown in Table 3. No points are given if risk factors are absent. A higher value of the score predicts a higher risk.

Table 3: Scoring for abdominal wound dehiscence.

Variables	Scores
Hypoproteinemia	5
Uremia	4
Surgery duration	4.5
Perforation or contaminated wounds	3
Chest Infections/ COPD	4
Anemia	1
Age >60 years	1
Total Score	**22.5**

Minimum score=0, maximum score=22.5.

DISCUSSION

Abdominal wound dehiscence is a morbid postoperative complication. The mortality rate following wound dehiscence ranges from 9%-43%.[13] Prevention is therefore an important step in preventing this dreaded complication. It is very important that that patient and patient attenders should be fully informed about this complication following emergency laparotomy. Though age and anemia were not statistically significant and because they are important risk factors they have been added with minimal score of 1. This scoring system helps us to predict the risk of abdominal wound dehiscence following emery laparotomy and preventive measures can be used while closing the abdominal wound.

As discussed before, in our study we have taken variables prior to the surgery and intra operative but not postoperative factors such as wound infections, post op chest infection, ventilator support etc. Hypoproteinemia was the most important risk factor in our study as most of the patient were from a poor socio economic class. Hypoalbuminemia is associated with poor wound healing, decreases collagen synthesis in the surgical wound and anastomosis.[16,17] it hampers the immune responses, such as macrophage activation and granuloma formation. Therefore, in hypoalbuminemic patients, wound infections, remote infections such as pneumonia, septicemia and anastomotic leakage are commonly found.it decelerates neoangiogenesis and wound remodeling.[18,19] Loss of protein from protein-calorie malnutrition leads to decreased wound tensile strength, decreased T-cell function, decreased phagocytic activity and decreased complement and antibody levels, ultimately diminishing body's ability to defend the wound healing against infection. Uremia was second risk factor leading to wound dehiscence. Most of these uremic patients developed uremia secondary to the sepsis and thus uremia along with sepsis proved to be another additive factor for wound dehiscence.[20] This is in contrast to the observation made by Afzal et al. which found uremia not be a significant contributory factor.

Duration of surgery proved to be an important risk for foe dehiscence. Haley el al in his study showed that emergency laparotomy lasting for more than 2 hours second greatest independent predictor of risk after a multivariate analysis.[21]

Intraabdominal sepsis itself leads to infection spreading to the 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 biochemical events in uncontrolled inflammation are due to leucocytes-macrophages over activity. There is intense enzymatic activity as well as destruction of proliferating cells and capillaries. 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. [22]

Patients with chest infection require prolonged ventilator support and repeated coughing causes increase in intraabdominal pressure which results in breakage of the suture, undoing of the knots or pulling through the tissue.[25] In Anurag et al and Makela et al study the chest infection was more than 30% in patients with wound dehiscence.[23] Chronic obstructive pulmonary (COPD) disease increases the risk due to systemic tissue hypoxia. COPD is a frequent disease in elderly and consequently incidence of wound dehiscence is more in elderly.

Anemia is often blamed as an important risk factor in poor wound healing. Low hemoglobin means reduced oxygen supply to tissues and therefore poor tissue healing and inability to resist infection. In present study patients, more than 60 years (66%) developed wound dehiscence and this goes with the study of Rodriguez Hermosa who established that the mean age was 70 years. This may be due to deterioration of the tissue repair mechanism in the elderly especially during the first dew days of wound healing process.[24]

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 elective surgery. Moreover, the performance of the surgeon might be affected at night, which could lead to suboptimal closure of the abdomen at the end of the operation. Hence preventive measures can be taken if the score is more before closing the abdomen such as special suture technique and dressing, aimed at decreasing tension on the wound edges can be investigated and used in high risk patients.

CONCLUSION

This scoring system involving hypoproteinemia, uremia, duration of surgery, contaminated wound, chest infection/COPD with anemia and age as independent risk factors for abdominal wound dehiscence following emergency laparotomy can help us predict patients who are high risk of developing wound abdominal wound dehiscence especially in in our setting where patient usually presents to us in the late stage. And wound dehiscence may further add financial, social and psychological stress on the patients and their family. Thus, by this scoring system we can prevent this dreaded complication by taking preventive measure such as interrupted X sutures, abdominal binders, tension sutures, good post op chest physiotherapy and correction of anemia and nutritional status. "Higher the score, greater the risk of developing wound dehiscence".

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