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Original Research Article

Factors affecting the development of ventral incisional hernia post abdominal surgery: a retrospective cohort study

Ankur Sidhu[1,3]*, Declan Siedler[1,2], Richard Turner[1,2]

[1]Department of Surgery, Royal Hobart Hospital, Tasmania, Australia
[2]School of Medicine, Faculty of Health, University of Tasmania, Australia
[3]Department of Surgery, Austin Hospital, Heidelberg, Victoria, Australia

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***Correspondence:**
Dr. Ankur Sidhu,
E-mail: sidhu.ankur@gmail.com

ABSTRACT

Background: Ventral incisional hernia (VIH) is one of the most common post-operative complications following abdominal surgery. The objective of this study was to evaluate the rate and risk factors associated with development of a ventral incisional hernia (VIH).
Methods: Patients who underwent major abdominal surgery between 2010 and 2012 at a single institution were included in this retrospective cohort study. Data were collected from medical records. The primary outcome was clinical or radiological evidence of incisional hernia; explanatory variables were patient demographics and potential clinico-pathological risk factors for hernia development.
Results: A total of 295 patients who underwent laparotomy were analysed. 45 (15.25%) patients were found to have a ventral incisional hernia on follow-up. The median time to development of hernia was 351 days. There were equal numbers of elective (N=22) and emergency (N=23) operations that developed an incisional hernia. Of the explanatory variables considered diabetes, hypertension (HTN) and body mass index (BMI) had persistent significant positive associations with the development of an incisional hernia. On univariable analysis diabetes (HR = 2.73, p-value = 0.004) and hypertension (HR =2.17, p-value = 0.016) were identified as independent risk factors for hernia development. BMI was also significantly associated with development of an incisional hernia on univariate analysis, but due to missing data this did not reach statistical significance on multivariable analysis.
Conclusions: Although there are several risk factors to development of VIH, diabetes and HTN were associated with development of incisional hernia in our study. BMI also appears to be an important determinant of development of VIH. Further research in this area is likely to identify an at-risk subset of patients, who may benefit from weight loss prior to surgery or prophylactic mesh post-laparotomy.

Keywords: Incisional hernia, Risk factors, Ventral incisional hernia

INTRODUCTION

Ventral incisional hernia (VIH) is one of the most common post-operative complications following abdominal surgery. Patients with symptomatic ventral incision hernia have unsatisfactory cosmetic results and impaired quality of life with serious life-threatening disorders including incarceration and bowel strangulation. Long term follow-up after abdominal surgery reveals an incidence rate of 5-25% for ventral incisional hernias.[1]

Various risk factors for development of VIH have been reported in previous studies. These include patient factors

such as diabetes, COPD, abdominal aortic aneurysm, smoking, high BMI and peri-operative factors such as emergency surgery, duration of surgery, blood transfusion and surgical site infection.[2-5]

Our aim, in this retrospective cohort study, was to ascertain any particular factors that lead to the development of a ventral incisional hernia post laparotomy. Through identification of risk factors, we can modify these risk factors in the perioperative period in order to try to reduce the risk of development of VIH.

METHODS

All patients who underwent elective or emergency laparotomy at the Royal Hobart Hospital between 2010 and 2012 were included in this study. The eligibility criteria for this study included: age of patients had to be greater than 18 years, patients had to have a midline laparotomy. Patients who had their operation via a laparoscopic approach or patients who had a non-midline incision were excluded from this study. Data was collected using the hospital's digital medical records. The primary endpoint was either clinical or radiological evidence of an incisional hernia. The request to access patient information was obtained through the clinical information service at the Royal Hobart Hospital. This study was approved by the Tasmanian Human Research Ethics Committee.

An incisional hernia was diagnosed by either clinical examination or radiological imaging (computer tomography scan or ultrasound).

Pre-operative clinical data collected included age, sex, body mass index (BMI), American Society of Anaesthesiologists (ASA) grade, co-morbidities (diabetes, chronic obstructive pulmonary disease, hypertension, cardiovascular disease, chronic liver disease), smoking status, immunosuppression medications, blood tests (haemoglobin, haematocrit, albumin, creatinine), history of previous surgery.

Intra-operative factors included operative status (elective or emergency), disease process (benign or malignant), duration of operation, blood loss. Post-operative factors included need for transfusion and evidence of surgical site infection. Surgical site infection was recorded if there was evidence of erythema or discharge from the wound during the inpatient stay or at the time of the post-operative clinic appointment.

Statistical analysis

Cox proportional hazard model was utilised to determine the association of explanatory variables with incisional hernia. Univariable and multivariable analysis was performed using STATA software (StataCorp LLC, Texas). A p-value of < 0.05 was considered statistically significant.

RESULTS

Between 2010 and 2012, 295 patients underwent elective or emergency laparotomy at the Royal Hobart Hospital. The median length of follow-up was 22.4 months. Out of 295 patients included in the study, 45 (15.25%) patients developed a ventral incisional hernia. The median time to diagnosis of an incisional hernia was 11.7 months.

There was equal proportion of patients who underwent elective (7.5%) and emergency (7.8%) operations that subsequently developed a ventral incisional hernia.

Univariable analysis

In this study, 23 variables were identified that may contribute to the development of an incisional hernia. Out of these, BMI, diabetes and hypertension were associated with development of a ventral incisional hernia on univariable analysis (Table 1).

Table 1: Univariable analysis of risk factors.

Variables	Hazard ratio (95% CI)	p-value
Age	1.01 (0.99 - 1.03)	0.73
Sex	0.75 (0.40 - 1.40)	0.36
ASA score	1.09 (0.70 - 1.71)	0.39
BMI	1.16 (1.00 -1.33)	0.045
Diabetes	2.73 (1.37 - 5.47)	0.004
COPD	1.40 (0.59 - 3.34)	0.45
Hypertension	2.17 (1.16 - 4.08)	0.016
Cardiovascular	1.69 (0.83 - 3.46)	0.15
Liver disease	1.97 (0.70 - 5.55)	0.20
Immunosuppression	0.28 (0.04 - 2.06)	0.21
Smoking	1.19 (0.84 - 1.68)	0.32
Albumin	1.00 (0.96 - 1.05)	0.10
Creatinine	1.00 (0.99 - 1.00)	0.51
Haemoglobin	1.00 (1.00 - 1.01)	0.24
Previous laparotomy	0.63 (0.32 - 1.26)	0.20
Pre-op chemotherapy	0.37 (0.09 -1.54)	0.17
Malignant disease	0.69 (0.37 - 1.27)	0.23
Transfusion	0.77 (0.34 - 1.74)	0.53
Emergency operation	1.04 (0.56 - 1.92)	0.90
Surgical site infection	1.23 (0.52 - 2.91)	0.65
Wound classification	1.03 (0.69 - 1.54)	0.87

Multivariable analysis

On multivariable analysis (Table 2), the significant associations of diabetes and hypertension were eliminated after adjusting for BMI, which of itself did not quite reach statistical significance due to small sample size because of missing data.

Table 2: Multivariable analysis.

Variables	Hazard ratio (95%CI)	p-value
Age	1.059 (0.998 - 1.147)	0.160
Sex	0.866 (0.091 - 8.295)	0.901
Diabetes	2.199 (0.470 - 10.291)	0.317
HTN	0.663 (0.149 - 2.945)	0.589
BMI	1.203 (0.975 - 1.484)	0.085
Wound classification	0.599 (0.071 - 5.088)	0.639

DISCUSSION

This retrospective cohort study included 295 patients, over a three-year period, who underwent a midline laparotomy for an elective or emergency indication. The ventral incisional hernia rate, as determined through clinical examination or radiological imaging, was 15.25%. This rate of incisional hernia post midline laparotomy is similar to the rate quoted in the literature.[1,6] In this series, the median time to development of incisional hernia was 11.7 months. This is similar to previous studies. A randomised prospective study by Richards et al showed that 80% of incisional hernias developed within 6 months of initial operation.[7]

In this study, we looked at multiple variables that have previously been shown to be associated with development of incisional hernia. The main factors associated with development of incisional hernia on univariable analysis were diabetes, hypertension and high BMI. Various other studies have revealed similar results.[8-10] However, on multivariable analysis, these risk factors were not identified to be statistically significant. The most likely reason for this was the relatively small sample size because of missing data, whereby weight and height had not been routinely measured on all patients in the cohort. This was one of the limitations of this study.

Although this study failed to show any statistical significance for different variables analysed in development of incisional hernia, it lends itself to future prospective studies. The data collection of future observational studies should include information on diabetes and hypertension control, such as HbA1c level and systolic blood pressure, as well as systematic measurement of adiposity. Further research can identify individuals whose risk factors can be taken into account when planning surgery. For example, those with increased BMI may benefit from pre-operative weight loss or prophylactic mesh placement at the time of laparotomy.

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