# The evaluation of risk factors in fascia dehiscence after abdominal surgeries

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**Background:** Despite the advances in surgical techniques and risk control practices in recent years, open wounds following abdominal laparotomy still have a high prevalence. The purpose of this study is to investigate the risk factors of fascia dehiscence (FD) in abdominal surgery patients.

**Methods:** In this observational study, a total of 60 emergency and elective laparotomy patients were enrolled. For all patients, with (treatment) or without (control) wound dehiscence, a checklist was used to extract data from medical records regarding underlying diseases, suturing method, emergency or elective surgical procedure, duration of surgery less than 180 min, intraoperative bleeding, wound closure method, hernia repair, age, sex, smoking history, comorbidities, type of surgery, colostomy placement, wound complications, re-operation, mortality, wound complications including wound infection, wound dehiscence, incisional hernia, and anastomotic leak, and preoperative readiness assessments such as laboratory tests including C-reactive protein (CRP), Albumin (Alb), etc., were completed, and then comparisons were made.

**Results:** Patients were examined in two groups: 14 patients (70%) in wound dehiscence with age 40–60 and 6 patients (30%) in non-wound dehiscence with age 60–75. Eight patients (40%) underwent elective surgery, and 12 patients (60%) underwent emergency surgery ($P = 0.2$). Fourteen patients (70%) experienced mortality ($P < 0.001$) and 13 patients (65%) had Alb less than 3 ($P < 0.001$). Fourteen patients (70%) had drain installation ($P = 0.02$). It was determined that the increase in CRP levels (compared to pre-dehiscence levels) was observed in 17 out of 20 cases, with the highest difference being CRP = 91 and an average increase of 30. None of the patients suspected of anastomotic leakage were confirmed to have it. Dehiscence was typically diagnosed between the 4th and 7th days post-surgery. The colon and rectum were significantly more associated with dehiscence, while the stomach had the lowest association among surgical sites.

**Conclusion:** Based on this study, FD is more common in patients treated in the emergency room than in elective procedures. Mortality occurred more in patients with FD, and there is a significant relationship between FD with albumin less than 3 and drain placement.

**Keywords:** abdominal surgery, fascia dehiscence, fascia, laparotomy, risk factors

## Introduction

Fascial dehiscence (FD), a serious complication of open surgical procedures, is regarded as a significant concern after abdominal surgeries[1–4]. Its prevalence is reported to be 0.4–1.2% in elective laparotomies and up to 12% in emergency laparotomies[5,6]. The mortality rate associated with it exceeds 21%. FD leads to an increase in hospitalization costs, prolonged hospital stays, a

### HIGHLIGHTS

- Despite the advances in surgical techniques and risk control practices in recent years, open wounds following abdominal laparotomy still have a high prevalence.
- We conclude that fascia dehiscence (FD) is more common in patients treated in the emergency room than in elective procedures.
- Mortality occurred more in patients with fascia dehiscence and there is a significant relationship between fascia dehiscence with albumin less than 3 and drain placement.

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higher likelihood of re-operation, and an increase in subsequent medical visits[6].

FD is described as the separation of sutured edges of the abdominal fascia following surgery[7]. Four main mechanisms lead to FD, suture breakage, knot failure, suture loosening, or fascial disruption due to a hematoma. The latter is considered the most common[8–10]. FD can be subclinical, and detectable only through radiology. This form of dehiscence may easily go unnoticed in the early stages but can later lead to incisional hernia[3]. Clinically, wide dehiscence is observable, manifested by leakage from the site or protrusion of abdominal contents through the fascia. Depending on the fascial defect, there is a risk of incarceration or strangulation of abdominal viscera[11].

Wound dehiscence represents a sudden breakdown of a wound, categorized as acute wound failure. It occurs with an incidence rate of 2% and is linked with a mortality rate of 25%[12].

FD typically occurs between days 3 and 7 after surgery[13]. The hospital stay for patients experiencing fascial dehiscence is significantly longer[14], and it is often associated with a considerable increase in mortality after the operation[15,16]. Clinically evident FD often requires emergency surgery. Initial clinical presentations of FD, marked by their discharge, can be mistaken for infection[17,18].

Interrupted emergency laparotomy wound closure has been shown to reduce the rate of wound dehiscence compared to continuous wound closure in cases of peritonitis. Additionally, the use of interrupted sutures along with intra-abdominal mesh implantation in burst abdomen repair can decrease the incidence of BAR and the necessity for additional revision surgeries[19]. While the continuous method of abdominal closure is faster due to the utilization of only two terminal knots, this disparity holds statistical significance. These findings align with previous studies conducted on elective surgeries, indicating comparable outcomes[20].

In more severe cases, fascial dehiscence may be diagnosed through a computed tomography (CT) scan. There is still uncertainty about which patient-related factors constitute definite risk factors for fascial dehiscence[20].

This study aims to assess the frequency of risk factors associated with FD among patients undergoing abdominal surgery.

## Methods

This study was conducted as a case-control study, in the hospitals affiliated with Qazvin University of Medical Sciences (Rajaii and Vali-e-Asr). Demographic information and other variables, including age, sex, BMI, Anastomotic Leakage, wound infection, medical history, drug use, smoking, albumin, hemoglobin, underlying disease, disease outcome, surgical complication, surgery duration less than 180 min, intraoperative bleeding, colostomy placement, and C-reactive protein (CRP), were collected from all participants in the study. Sixty patients (40 individuals in the control group) who underwent abdominal incisions were included in the study based on availability and sample size.

All patients aged 40–75 who underwent abdominal incisions for vascular procedures or laparotomies with drainage or lavage, total colectomy procedures, subtotal colectomy, hemicolectomy, gastrectomy, etc., through primary or secondary laparotomies or emergency laparotomies during the years 2019–2020 were included in the study.

Exclusion criteria: include the lack of primary closure of the abdominal wall, patients with initial abdominal problems, and the recurrence of incisional hernia, as well as wound infection due to reasons other than COVID-19 and other infectious diseases (the potential inflammatory cascade produced by the coronavirus may lead to multi-organ failure)[21].

Patients who were documented to have only one suture in the surgical report (3.5) were excluded as such a low ratio cannot be considered clinically acceptable.

Fascial dehiscence in 20 patients was confirmed through clinical observation if it was evident or following a repeat surgery due to emergency conditions. Confirmation was also preferred through ultrasound or CT scan.

For all patients, with or without fascial dehiscence, a checklist was used to extract data from medical records regarding underlying diseases (chronic obstructive pulmonary disease, diabetes, cardiovascular diseases), suture technique (specific ratio 1:3.5 ≤ or unspecified ratio), emergency or elective surgical approach, surgery duration less than 180 min, intraoperative bleeding, blood transfusion during surgery, fascial closure method, mesh placement, age, sex, smoking history, concurrent illnesses, high BMI, type of surgery, colostomy placement, wound complication surgery, re-operation, and mortality. Wound complications included wound infection, wound dehiscence, incisional hernia, and anastomotic leak. Additionally, preoperative assessments, laboratory tests such as CRP, Alb, etc., were completed, followed by comparisons.

### The study population and sampling method

The studied disease is not among the common diseases. Sampling was done through an available (convenient) method. Based on the study by Makela et al.[22] and the prevalence of hypoalbuminemia, a sample size of 20 individuals in each group was calculated. To increase the study's power, we increased the control group to 40 individuals. Using univariate statistical methods, significant variables were first identified, and then logistic regression modeling was employed.

$$n = 2 \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \overline{p}\,\overline{q}}{(p_1 - p_2)^2}$$

$\alpha = 0.05$, $\beta = 0.2$, $p1 = 0.2$, $p2 = 0.64$, $Z1$-$a/2 = 1.961150826$, $Z1$-$B = 0.841623031$, $P = 0.42$, $n = 20$

### Data analysis

The data were analyzed using SPSS software version 26. For the description of qualitative variables, the number and percentage were used, and for quantitative variables, the mean and standard deviation were used if the distribution of the variables was normal. In case of non-normality, the median and interquartile range (IQR) were utilized.

Quantitative variables between the two groups were analyzed using the independent $t$-test, and qualitative variables between the two groups were analyzed using the $\chi^2$ test. Using univariate statistical methods, significant variables were first identified, and then logistic regression modeling was employed, followed by the necessary analyses. Ultimately, all these tests were evaluated at a significance level of 0.05.

(Using univariate statistical methods, significant variables were first identified, and then logistic regression modeling was employed); however, there is no tables representation these two statistical analysis of the variables.

This study was approved by the Research Ethics Board of Qazvin University of Medical Sciences, Qazvin, Iran (IR.QUMS.REC.1400.265).

Research Registry UIN: researchregistry9904

The methods were reported in accordance with STROCC 2021 guideline[23].

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## Results

In this case-control study, 60 patients who underwent elective or emergency laparotomies were included and examined according to the research criteria. These patients comprised 20 individuals with FD (case group) and 40 patients without FD (control group). Days of diagnosing FD in the 20 patients of the FD group: one patient on the third day, 17 patients between days 4 and 7, and two cases on the ninth day. Sixty patients with midline incisions, including 20 with FD, underwent surgery with the same method of fascial closure using loop sutures.

Out of the FD group, 15 patients required re-operation. Interestingly, among 30 patients with upper midline incisions, only two experienced FD, suggesting a potential association between the type of surgical incision and this complication.

Age categorization revealed that 70% of patients with fasciitis were in the 60–40 age group, while 30% were in the 75–60 age group.

In the control group, 19 patients (47.5%) were in the 60–40 age range, and 21 patients (52.5%) were in the 75–60 age range. The comparison of age groups in the two experimental and control groups did not show significant differences ($P = 0.09$).

In the examination of the gender variable; in both groups, 55% of the patients were male, and 45% were female. This variable was also not significant in the two groups ($P = 1$).

Three patients (15%) in the case group and 8 patients (20%) in the control group had a CRP greater than 10 at the time of admission, and the comparison of it in the two groups did not show a significant difference ($P = 0.6$).

In 17 out of 20 patients with fasciitis, an increase in CRP (C-reactive protein) compared to the initial CRP was observed. The highest level of CRP increase was 91, and the lowest increase was 21. The maximum difference in CRP elevation compared to the initial CRP was 70, with an average increase of 30.

Nine patients (22.5%) from the control group and 3 patients (15%) from the case group had hemoglobin levels less than 10 (anemia), and the comparison of it in the two groups did not show a significant difference ($P = 0.4$).

Only 1 case (2.5%) in the control group and 2 cases (10%) in the case group had a platelet count (Pr) less than 6, and the comparison of it in the two groups did not show a significant difference ($P = 0.2$).

Ten patients (25%) in the control group and 3 patients (15%) in the case group were cigarette smokers, and the comparison of it in the two groups did not show a significant difference ($P = 0.3$).

In the control group, elective surgery was performed on 55% and emergency surgery on 45%, compared to the case group where 40% underwent elective surgery and 60% had emergency surgery ($P = 0.2$).

The history of abdominal surgery showed no significant difference between the control group (20%) and the case group (25%) ($P = 0.6$). Similarly, the history of cancer did not significantly differ between the control group (50%) and the case group (40%) ($P = 0.4$).

There was no significant difference in the immunocompromised or corticosteroid use between the control group (25%) and the case group (40%) ($P = 0.2$). Similarly, the use of Pack Cell injection did not significantly differ between the control group (25%) and the case group (10%) ($P = 0.1$).

A significant difference in mortality rates was observed between the control group (15%) and the case group (70%) ($p \leq$ 0.001). The history of diabetes did not significantly differ between the control group (12.5%) and the case group (10%) ($P = 0.7$), nor did the presence of chronic respiratory disease ($P = 0.6$).

Four patients out of 40 patients in the non-fascial dehiscence group, as well as four patients out of 20 patients with FD, underwent surgery for more than 3 hours, and the comparison between the two groups was not significant ($P = 0.2$).

In the control group, only one case, and in the case group, only two cases, lost more than 200 ml of blood, and the comparison between the two groups was not significant ($P = 0.2$).

In the group without FD, 40% had hernia repair (16 cases), while in the FD group, 70% had hernia repair (14 cases), showing a significant difference ($P = 0.02$). Stoma presence did not significantly differ between the groups, with 25% (10 cases) in the non-dehiscence group and 35% (7 cases) in the dehiscence group ($P = 0.4$). The use of staplers ($P = 0.2$) and the occurrence of anastomosis ($P = 0.2$) showed no significant differences between the groups.

In the control group, 22 patients and in the case group, 7 patients had preoperative preparation ($P = 0.14$). In the control group, 2 patients (5%) and in the case group, 13 patients (65%) had albumin levels less than 3, and the comparison between the two groups was significant ($P \leq 0.001$).

In the group without FD, surgical midline incisions involved 10 small intestine operations and 30 colon and rectum operations. In the FD group, there were 5 small intestine operations and 15 colon and rectum operations, with no significant difference observed between the two groups (Table 1).

## Discussion

Our study compared patients with FD to a control group. FD was more common in males, those aged 40–65, and emergency surgeries, with significant links to higher mortality, lower preoperative hemoglobin, and albumin levels below 3. No significant correlation was found between FD and factors like CRP, anemia, surgery type, or preoperative preparation. Risk factors include surgeon experience, incision type, suture material, infection, and patient health. Wound dehiscence can cause pain, stress, infections, and financial burdens.

In the study by Jakub Kenig and colleagues in 2014, They concluded that both VAMC and Rotterdam scores can be used to predict abdominal wound dehiscence[24]. In numerous studies, advanced age and male gender have been associated with a higher risk[14,20–22].

In Harald Soderback's 2019 study, regression analysis showed that age over 70, male gender, BMI below 30, chronic obstructive pulmonary disease, systemic inflammatory disease, and surgery duration under 180 minutes significantly increased wound dehiscence risk. Diabetes, chronic kidney disease, liver cirrhosis, and distant metastases were not significantly associated. Postoperative mortality risk was 1.24 times higher in patients undergoing wound dehiscence repair compared to the control group[25].

In the present study, although fascia dehiscence was more observed in individuals aged 65–40 years and in males, it was not statistically significant in either case. It was demonstrated that significant risk factors are those leading to decreased healing, such as anemia and hypoalbuminemia. Both contribute to

<table>

**Table 1**

**Frequency of studied variables in patients with and without fascia dehiscence.**

| Variables | The group without fascia dehiscence (control group), n (%) | Group with fascia dehiscence (case group), n (%) | P |
|---|---|---|---|
| | (n = 40) | (n = 20) | |
| Age | | | |
| 40–65 | 19 (47.5) | 14 (70) | 0.09 |
| 65–80 | 21 (52.2) | 6 (30) | |
| Sex | | | |
| Male | 22 (55) | 11 (55) | 1 |
| Female | 18 (45) | 9 (45) | |
| CRP > 10 at the beginning of hospitalization | 8 (20) | 3 (15) | 0.6 |
| Hb <10 (anemia) | 9 (22.5) | 3 (15) | 0.4 |
| Pr < 6 | 1 (2.5) | 2 (10) | 0.2 |
| Smoking | | | |
| Type of surgery | | | |
| Elective | 22 (55) | 8 (40) | 0.2 |
| Emergency | 18 (45) | 12 (60) | |
| History of abdominal surgery | 8 (20) | 5 (25) | 0.6 |
| History of cancer | 20 (50) | 8 (40) | 0.4 |
| Chemotherapy, immunodeficiency and corten use | 10 (25) | 8 (40) | 0.2 |
| Pack cell injection before surgery | 10 (25) | 2 (10) | 0.1 |
| Death | 6 (15) | 14 (70) | < 0.001 |
| Surgery more than 3 h | 4 (10) | 4 (20) | 0.2 |
| Bleeding more than 200 ml | 1 (2.5) | 2 (10) | 0.2 |
| history of diabetes | 5 (12.5) | 2 (10) | 0.7 |
| Chronic lung disease | 1 (2.5) | 1 (5) | 0.6 |
| Stoma | 10 (25) | 7 (35) | 0.4 |
| Drain installation | 16 (40) | 14 (70) | 0.02 |
| Anastomosis | 30 (75) | 12 (60) | 0.2 |
| Using stapler | 7 (17.5) | 6 (30) | 0.2 |
| Preoperative preparation | | | |
| Yes | 22 (55) | 7 (35) | 0.14 |
| No | 18 (45) | 13 (65) | |
| Alb | | | |
| 3 > | 2 (5) | 13 (65) | < 0.001 |
| 3 < | 38 (95) | 7 (35) | |
| Type of surgery | | | |
| Small intestine | 10 (25) | 5 (25) | 1 |
| Colon and rectom | 30 (75) | 15 (75) | |

Alb, albumin; CRP, C-reactive protein; Hb, hemoglobin; Pr, platelet count.

</table>

reduced tissue resilience, diminished oxygen delivery, and impaired wound healing[12,14,23,26]. However, in our study, no correlation was observed between anemia and fascia dehiscence. According to studies, chronic pulmonary disease can lead to an increase in intra-abdominal pressure and consequently elevate the risk of Fascia Dehiscence (FD)[27].

In Bodil Gessler's 2016 study, the prevalence of anastomotic dehiscence was 4.3% (497/11,565). Higher risk factors included male gender, ASA classification III–IV, prescribed medications, bleeding over 300 ml, and unusual large bowel removal. Patients with anastomotic dehiscence experienced prolonged hospital stays by 5.14 days and had higher 30-day and long-term mortality rates[28].

In the study conducted by Roberto Ruggiero and his colleagues in 2011, The variables considered were stapled or hand-sewn anastomosis, protective stoma, and medical conditions[29].

However, in our study, coughing alone did not demonstrate itself as an independent risk factor.

A previous abdominal surgery more than a few months ago was not identified as a risk factor, while recent abdominal surgery was linked to increased risk. This may be due to the repetitive opening and closing of the abdomen, leading to higher risk and fascial dehiscence. Additionally, patients who had recent surgery might have other risk factors like anemia, ongoing steroid use, or recent chemotherapy. This is supported by the data analysis, which did not identify recent laparotomy as an independent risk factor[30].

In the study by Preethi and her colleagues in 2019, Most patients were males aged over 50, with diabetes being a significant risk factor. Thirty patients had an Hb level below 12, and 30 were smokers. Continuous fascia suturing was performed in 40 patients. Fourteen patients experienced wound infection (P < 0.005), and 18 required re-operation[31].

In the study by Rahul Anand Arya and colleagues in 2019, In contrast to some previous studies, this study did not identify age, sex, or diabetes as risk factors. However, it did find two significant associations with wound dehiscence: emergency surgery and the type of fascial closure technique[32].

Furthermore, contrary to the study by Gabriëlle and colleagues, in the present study, preoperative protein and albumin levels did not show a significant correlation with fascia dehiscence[33].

In the study by N. K. Jaiswal and colleagues, conducted in 2018, male patients in their fifth decade have a higher incidence of laparotomy wound dehiscence. Those with secondary peritonitis resulting from duodenal perforation are at greater risk of burst abdomen, impacting wound healing significantly. Anemia and hypoalbuminemia increase the likelihood of burst abdomen. Delayed closure of burst abdomen leads to fewer complications. Proper technique adherence and earnest efforts to mitigate predisposing factors are crucial in treating and preventing this condition[19].

Van Ramshorst and colleagues, as well as Samartsev and colleagues, found no association between previous laparotomy and FD. However, the time interval to the previous laparotomy was not specified[33,34].

Contrary to our study, in many studies, factors such as BMI, smoking, emergency surgery, and surgical site infection were associated with the occurrence of FD[35]. Additionally, in other studies, long-term steroid therapy, preoperative anemia or hypoalbuminemia, and previous laparotomy less than 6 months ago were significantly more prevalent in the FD group[26].

In our study, there was a significant association between fascia dehiscence and patient mortality, consistent with the findings of the JPA Riou study[36].

## Conclusion

Fascia dehiscence is more common among males aged 60–40 years and in emergency surgeries compared to elective procedures. It's associated with higher mortality rates, lower preoperative hemoglobin levels, and albumin levels less than 3. Patients with fascia dehiscence also showed increased CRP levels

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post-occurrence. However, there's no significant correlation between fascia dehiscence and various factors including age, sex, anemia, type of surgery, preoperative preparation, surgical techniques, comorbidities, and lifestyle factors like smoking and protein intake. Based on the findings of this thesis and the results of related articles, it appears that fascia dehiscence may play a significant role in the mortality of patients after laparotomy surgeries. Therefore, conducting further research to find cost-effective solutions to prevent fascia dehiscence is recommended. Additionally, evidence suggesting the potential importance of CRP in diagnosing fascia dehiscence earlier than expected was observed in this thesis. Furthermore, the investigations showed a higher incidence of fascia dehiscence in patients with colonic and rectal pathologies, necessitating further research in this area.

## Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the Qazvin University of Medical Sciences and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Research Ethics Board of Qazvin University of Medical Sciences, Qazvin, Iran (IR. QUMS.REC.1400.265).

## Consent

Written consent was obtained from all the patients.

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No funding was secured for this study.

## Author contribution

L.H.M. and .A.M.: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript. H.P.: designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript. M.H.: coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

## Conflicts of interest disclosure

The authors deny any conflict of interest in any terms or by any means during the study.

## Research registration unique identifying number (UIN)

Research Registry UIN: researchregistry9904.

## Guarantor

Hossein Parsa.

## Data availability statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

## Provenance and peer review

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