

Risk factors for surgical opportunity in patients with femoral hernia

A retrospective cohort study

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Abstract

Femoral hernias are extremely easily incarcerated and are recommended for early surgery. In the past, there were a number of definitely diagnosed femoral hernia patients who were not able to undergo elective surgery in a timely fashion, and then, they were obliged to undergo emergency surgery or even to lose the opportunity for surgery. The relevant epidemic factors of femoral hernia were thoroughly investigated in the clinic; however, the impact of these factors on surgical opportunity has not been widely reported. The purpose of this study is to preliminarily evaluate the risk factors affecting the femoral hernia patients' surgical opportunities.

One hundred forty-two consecutive patients who were treated for femoral hernia with COD (course of disease) >1 month were analyzed. Depending on the surgical opportunity, the patients were divided into 2 groups: elective surgery and emergency surgery. A retrospective cohort study was performed in the 2 groups. Univariate and multivariate logistic regression analysis was used to assess the risk factors influencing the timing of femoral hernia surgery.

Of the 163 patients with femoral hernia in our center between 2013 and 2017, 142 had COD > 1 month, including 66 elective and 76 emergency surgeries. Univariate logistic analyses revealed that age, COD, COPD (chronic obstructive pulmonary disease), cirrhosis, and hypertension were risk factors associated with surgical opportunity for femoral hernia; their corresponding odds ratios (ORs) and *P* values were (OR 9.931; *P* = .003), (OR 1.024; *P* = .000), (OR 14.769; *P* = .000), (OR 1.093; *P* = .000), and (OR 3.346; *P* = .007), respectively. On multivariate logistic regression analysis, age, COD, COPD, and cirrhosis were independent risk factors associated with the surgical opportunity of patients with femoral hernia; the corresponding ORs and *P* values were (OR 1.055; *P* = .026), (OR 1.022; *P* = .002), (OR 8.688; *P* = .009), and (OR 11.761; *P* = .005), respectively.

The independent risk factors of patients with femoral hernia surgical opportunity were age, COD, and the comorbidities COPD and cirrhosis. Active treatment of comorbidities in elderly patients with femoral hernia, as well as timely hospitalization, may reduce the frequency of emergency surgery for femoral hernia.

Abbreviations: ASA = American Society of Anesthesiologists, CHD = coronary heart disease, COD = course of disease, COPD = chronic obstructive pulmonary disease, DOCS = duration of clinical symptoms, ORs = odds ratios.

Keywords: femoral hernia, retrospective cohort study, risk factors, surgical opportunity

1. Introduction

The incidence of femoral hernia is low^[1–4]; however, there is a tendency for incarceration. Femoral hernia may be neglected and delayed by patients and doctors.^[5–7] A large proportion of femoral hernia patients undergo emergency surgery, the morbidity and mortality rates of which are considerably higher

than those of elective surgery.^[8–10] Some patients with femoral hernia are diagnosed before their hernia becomes incarcerated but do not receive surgery in a timely fashion. What are the reasons for their inability to elect surgical treatment in time? We hypothesized that age,^[6,11] COD,^[12] and comorbidities^[13] may be risk factors for the surgical opportunity for patients with femoral hernia. Therefore, in this single-center retrospective cohort study, we evaluated the risk factors for elective versus emergency surgery in patients with femoral hernia with a COD > 1 month.

2. Methods

2.1. Patient selection

The medical ethics committee of Ganzhou People's Hospital approved the collection of case data for this clinical retrospective study. Patients were identified using the procedure and diagnosis codes of the International Classification of Diseases, Tenth Revision (ICD-10). Using medical records, we identified consecutive patients with a primary diagnosis of femoral hernia (ICD-10 K41) and COD > 1 month from 2013 to 2017. The patients were divided into elective and emergency surgery groups according to the operative opportunity, and then a retrospective cohort study was conducted.

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2.2. Data extraction

The variables analyzed were sex, age, COD, duration of clinical symptoms (DOCS), and hernia location. Comorbidities, including cirrhosis, atrial fibrillation, diabetes, hypertension, COPD, biliary calculus, coronary heart disease (CHD), kidney stones, malignant tumors, hyperplasia of prostate, renal insufficiency, thrombocytopenia, concomitant hernia, and history of hernia surgery were also analyzed.

2.3. Related concept description

2.3.1. COD. COD is the time from the appearance of femoral hernia until admission.

2.3.2. DOCS. DOCS is the time from the beginning incarceration or pain at the femoral hernia site until admission.

Comorbidities: diagnosis confirmed by auxiliary examination and/or laboratory examination that affected the treatment result.

2.4. Statistical analysis

Continuous data were compared with the paired 2-tailed *t* test. A separate variance estimation *t* test was used for unequal variances. Categorical data were compared by the χ^2 test, the Pearson Chi-squared tests, or Fisher exact test if the expected cell count was less than 5 for one or more cells. Univariate and multivariate logistic regression analyses were performed to assess the relationship of each studied factor with the patients' surgical opportunity. Factors with *P* value of less than .05 from univariate analyses were entered into multivariate analyses. Binary logistic regression with enter method for the covariates was used to perform multivariate analysis to assess the risk factors of surgical opportunity. All tests were 2-sided, and the significance level was set at 0.05. Statistical analyses were conducted using SPSS ver. 22 (ver. 22.0; IBM Corp., Armonk, NY).

3. Results

3.1. Patient characteristics

Of the 163 patients with femoral hernia in our center from 2013 to 2017, 142 (mean age, 69.3 ± 11.9 years; 53.5% female) had a COD > 1 month (Table 1). Of these 142 patients, 66 (46.5%) and 76 (53.5%) underwent elective and emergency surgeries, respectively (Fig. 1).

No significant difference was detected between male and female patients ($P = .206$) or between patients with left-sided and right-sided hernias ($P = .392$). The age, COD, and ASA classification differed significantly between the emergency and elective surgery groups (Table 1).

The comparisons of cirrhosis, hypertension, COPD, and CHD between the groups were statistically significant. Twelve patients were suggested to improve liver function before undergoing

Table 1

Patient characteristics stratified by elective and emergency.

Variable	Total (n=142)	Elective (n=66)	Emergency (n=76)	P
Average age, y	69.3 ± 11.9	64.1 ± 11.5	73.8 ± 10.3	.000 [†]
Sex				.206
Male	53 (46.5%)	21 (31.8%)	32 (42.1%)	
Female	89 (53.5%)	45 (68.2%)	44 (57.9%)	
COD, m	52.5 ± 84.3	20.1 ± 19.4	80.7 ± 106.3	.000 [‡]
Location of hernia				.392
Left	57 (40.1%)	24 (36.4%)	33 (43.4%)	
Right	85 (59.9%)	42 (63.6%)	43 (56.6%)	
DOCS (Duration of clinical symptoms), d	4.1 ± 8.3	3.6 ± 11.3	4.6 ± 4.5	.505 [‡]
ASA classification				.000 [§]
I	35 (24.6%)	33 (50.0%)	2 (2.6%)	0.000
II	45 (31.7%)	22 (33.8%)	23 (30.3%)	0.721
III	45 (31.7%)	10 (15.2%)	35 (46.1%)	0.000
IV	16 (11.3%)	1 (1.5%)	15 (19.7%)	0.000 [*]
V	1 (0.7%)	0 (0.0%)	1 (1.3%)	1.000 [*]

ASA=American Society of Anesthesiologists, COD=course of disease, DOCS=duration of clinical symptoms.

* Fisher exact tests.

[†] Independent-samples *t* test.

[‡] Separate variance estimation *t* test.

[§] Mann-Whitney test.

^{||} Pearson Chi-square.

elective femoral hernia surgery, but they became incarcerated during the waiting process, and emergency surgery was performed. Fifteen patients lost the opportunity of elective surgery due to poor hypertension control. Twenty patients with chronic obstructive pulmonary dysfunction chose conservative treatment, while after incarceration, they underwent emergency surgery. In addition, 10 patients underwent emergency surgery after incarceration due to CHD or cardiac dysfunction. The data of other coexisting diseases are summarized in Table 2.

The correlation coefficients of patient age with hypertension, COPD, and CHD were 0.392, 0.376, and 0.222, respectively ($P = .000$, $.000$, and $.008$, respectively; Table 3). The incidences of these 3 diseases increased with age. As age increased, the chances of having these 3 codiseases gradually increased.

3.2. Risk factors for the surgical opportunity of patients with femoral hernia

Univariate logistic analyses revealed that age ($P = .000$), COD ($P = .000$), COPD ($P = .000$), cirrhosis ($P = .003$), and hypertension ($P = .007$) were risk factors associated with the surgical opportunity for femoral hernia; their odds ratios (ORs) and 95% confidence intervals (95% CIs) were [1.093 (1.051–1.136)],

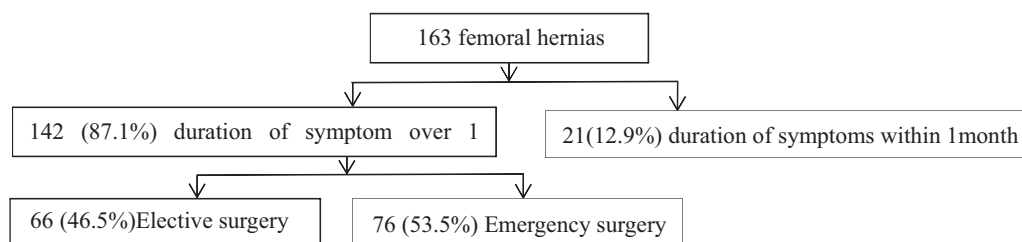


Figure 1. Patient flowchart.

Table 2
Medical conditions.

Variable	Elective n = 66	Emergency n = 76	P
Cirrhosis	2 (3.0%)	18 (23.7%)	.000 [†]
Atrial fibrillation	2 (3.0%)	4 (5.3%)	.686*
Diabetes	0 (0.0%)	6 (7.9%)	.030*
Hypertension	8 (12.1%)	24 (31.6%)	.006 [†]
COPD	2 (3.0%)	24 (31.6%)	.000 [†]
Biliary calculus	5 (7.6%)	2 (2.6%)	.250*
CHD	0 (0.0%)	12 (15.8%)	.001 [†]
Kidney stone	3 (4.5%)	7 (9.2%)	.339*
Malignant tumor	4 (6.1%)	3 (4.0%)	.706*
Hyperplasia of prostate	0 (0.0%)	4 (5.3%)	.123*
Renal insufficiency	0 (0.0%)	2 (2.6%)	.499*
Thrombocytopenia	0 (0.0%)	4 (5.3%)	.123*
Concomitant hernia	8 (12.1%)	7 (9.2%)	.574 [†]
The history of hernia surgery	6 (9.1%)	6 (7.9%)	.798 [†]

CHD=coronary heart disease, COPD=chronic obstructive pulmonary disease.

* Fisher exact tests.

† Pearson Chi-square.

[1.024 (1.011–1.037)], [14.769 (3.335–65.413)], [9.931 (2.208–44.662)], and [3.346 (1.383–8.095)], respectively. In the multivariate logistic regression analysis (enter), age, COD, COPD, cirrhosis, and hypertension entered the model. We found that age, COD, COPD, and cirrhosis were independent risk factors associated with surgical opportunity of patients with femoral hernia; the ORs and 95% CIs were [1.055 (1.006–1.105)], [1.022 (1.008–1.036)], [8.688 (1.706–44.249)], and [11.761 (2.105–65.718)], respectively (Table 4).

4. Discussion

In this retrospective cohort study of femoral hernia patients with the COD more than 1 month in a single center over 5 years, we

Table 3
Correlations between patient age and comorbidities.

	Age	Hypertension	COPD	CHD	
Age	Pearson correlation	1	0.392*	0.376*	0.222*
	Sig. (2-tailed)		0.000	0.000	0.008
	N	142	142	142	142

CC=correlation coefficient, CHD=coronary heart disease, COPD=chronic obstructive pulmonary disease.

* Correlation is significant at the 0.01 level (2-tailed).

found that age, COD and the comorbidities COPD, cirrhosis, and hypertension were risk factors for surgical opportunity for patients with femoral hernia. Age, COD, COPD, and cirrhosis were independent risk factors that affected the surgery opportunity of femoral hernia. To the best of our knowledge, this has not been reported previously.

The incidence of femoral hernia is low, but the condition is associated with a high risk of incarceration requiring emergency surgery. Therefore, we suggested that patients with femoral hernia undergo elective surgery as soon as possible.^[4,14] However, many patients were incarcerated at presentation. Others were unaware of the existence of a subinguinal mass, and subsequent incarceration resulted in emergency admission and delay in treatment. Indeed, in some patients, a femoral hernia was not detected until a laparotomy was performed for intestinal obstruction.^[7,9,10,14] Therefore, we selected patients who had the opportunity for elective surgery for definite diagnosis of femoral hernia with at least 1 month of COD and analyzed the risk factors for emergency surgery.

Femoral hernias frequently develop in elderly and female patients.^[4,15,16] This observation is in agreement with our findings (average age, 69.3±11.9 years; 53.5% females). Univariate and multivariate logistic regression analyses revealed that age was a risk factor for emergency surgery for femoral

Table 4
Univariate and multivariate analysis of impact of the operative opportunity of patients with femoral hernia over 1 month.

Variable	Univariate logistic regression analysis			Multivariate logistic regression analysis		
	OR	95% CI	P	OR	95% CI	P
Age	1.093	1.051–1.136	.000	1.055	1.006–1.105	.026
Sex	0.642	0.322–1.279	.207			
COD, m	1.024	1.011–1.037	.000	1.022	1.008–1.036	.002
Concomitant hernia	0.736	0.252–2.150	.575			
The history of hernia surgery	0.857	0.263–2.798	.798			
DOCS, d	1.015	0.973–1.060	.486			
Location	0.745	0.379–1.464	.393			
ASA class						
1			.000			
2	17.250	3.689–80.652	.000			
3	57.750	11.766–283.453	.000			
4	247.500	20.792–2946.113	.000			
5			1.000			
Comorbidities						
Atrial fibrillation	1.778	0.315–10.032	.515			
Biliary calculus	0.330	0.062–1.759	.194			
Kidney stone	2.130	0.528–8.596	.288			
Malignant tumor	0.646	0.139–2.997	.577			
COPD	14.769	3.335–65.413	.000	8.688	1.706–44.249	.009
Cirrhosis	9.931	2.208–44.662	.003	11.761	2.105–65.718	.005
Hypertension	3.346	1.383–8.095	.007	0.691	0.192–2.494	.573

ASA=American Society of Anesthesiologists, CI=confidence interval, COD=course of disease, COPD=chronic obstructive pulmonary disease, DOCS=duration of clinical symptoms.

hernia, and most incarcerated femoral hernias occurred in elderly patients.^[8] The risk of incarceration increased with increasing COD in patients with femoral hernia.^[12] Although females constituted the majority of the elective and emergency surgery groups, there was no significant difference in the proportion of females in the two groups. Therefore, sex was not a risk factor for emergency surgery for femoral hernia.

Comorbidities^[17,18] also influenced the rate of emergency surgery in patients with femoral hernia. In this study, age and comorbidities (CHD, hypertension, and COPD) correlated with emergency surgery in femoral hernia patients. The incidences of these 3 diseases all increased with age. However, quite a few patients with femoral hernia in the community tend to neglect the underlying diseases, and the management of femoral hernia^[9] is not related to the treatment of these diseases. Therefore, these patients were in poor control of their underlying diseases and could not achieve the decrease of ASA classification or undergo elective surgery for femoral hernia.

Cardiovascular disease is common among the elderly. In the present study, 10 patients had a history of angina pectoris attacks without formal medical treatment, and 15 patients with poorly controlled hypertension lost opportunities for elective surgical procedures. After incarceration, the patients were obliged to undergo emergency surgery.

Through multivariate logistic regression analysis, we found that COPD was an independent risk factor for emergency surgery of femoral hernia. In 2 previous studies involving patients with COPD, there were no differences in the baseline characteristics between the case and control groups.^[11,19] However, in the present study, age was significantly positively correlated with COPD. Twenty femoral hernia patients with chronic obstructive pulmonary dysfunction chose conservative treatment, while after incarceration, they underwent emergency surgery. Coughing is also a risk factor for abdominal wall hernia.^[16,20]

At present, posthepatic cirrhosis remains a serious problem in China, and patients with cirrhosis are most likely to have umbilical, inguinal, and femoral hernias due to ascites.^[21,22] These patients typically choose waiting for surgery due to abnormal liver function, platelet count, or coagulation function. In the process of waiting, some were forced to undergo emergency surgical treatment due to incarceration.^[5,7] In this emergency group, 12 patients had been suggested to improve liver function and then undergo elective femoral hernia surgery; however, incarceration occurred during the waiting process.

The emergency surgery group had a greater number of comorbidities than did the elective surgery group, and the former tended to be more serious. Therefore, there was a significant difference in the ASA classifications between the elective and emergency surgery groups, as found in previous reports.^[5,23] Grades 2, 3, and 4 were also risk factors for emergency surgery on single-factor regression analysis.

Our study has several limitations. First, it involved a single center and a relatively small number of patients, which may lead to admission rate bias. Second, this was a retrospective study performed using electronic medical records that may have the potential of information bias. Third, some parameters such as body mass index and smoking were not available in the electronic medical records. Therefore, a multicenter, prospective randomized controlled study is required to evaluate the risk factors of elective versus emergency surgery in patients with femoral hernia.

5. Conclusion

Age, COD, and comorbidities, especially COPD and cirrhosis, were associated with emergency (vs elective) surgery in patients with femoral hernia. Active treatment of the comorbidities in elderly patients with femoral hernia, as well as timely hospitalization, may reduce the frequency of emergency surgery for femoral hernia.

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Author contributions

Xiaochun Liu contributed to the study design, data analysis, and the writing and translation of the manuscript. Guofu Zheng, Hailiang Xie, and Teng Zhang contributed to data collection, and Bo Ye and Weiqing Chen revised the manuscript. All authors agreed with the decision to submit the manuscript for publication.

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The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request (<http://links.lww.com/MD/C430>).

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