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Original Article

Groin Complications After Femoral Artery Cannulation in Minimally Invasive Cardiac Surgery

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Abstract

Background: Femoral cannulation is commonly used during minimally invasive cardiac surgery. We evaluated the occurrence of postoperative groin complications after femoral cannulation in minimally invasive cardiac surgery.

Methods: This retrospective study included 140 patients who had minimally invasive surgery with femoral cannulation. One hundred twelve patients (80%) had mitral valve surgery, 24 patients (17.1%) had atrial septal defect repair, and four patients (2.9%) had myxoma excision. Their mean age was 41.47± 11.71 years, and 60% were females (n= 84).

Results: Groin complications occurred in 14 patients (10%); seroma developed in 11 patients (7.9%), two had femoral artery hematoma (1.4%), and 1 (0.7%) patient had femoral arterial dissection, which was primarily repaired. There were no differences in the preoperative data between patients with and without groin complications. Patients with groin complications had non-significantly longer cardiopulmonary bypass time (155± 43.6 vs. 129.8± 35.7 min, P= 0.2) and longer hospital stay (13±3.8 vs. 11.6±4.3 days, P= 0.2)

Conclusions: Groin complications are relatively uncommon in minimally invasive procedures and are usually simple to manage.

KEYWORDS

Minimally invasive; Femoral cannulation; Complications

Article History

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Introduction

Minimally invasive cardiac surgery became the standard technique for many procedures. The minimally invasive approach is technically demanding, and further improvements in the method are needed for broader adoption [1-3].

Minimally invasive surgery requires modifications of the cannulation, cardiopulmonary bypass, and myocardial preservation techniques [2]. Different kinds of cannulation techniques are present for minimally invasive cardiac surgery. Femoral cannulation is a widely used approach for minimally invasive surgery [4]. There are growing concerns over complications associated with femoral cannulation, including site-specific and overall morbidity and mortality associated with aortic dissection, stroke, femoral arterial injury, groin seromas, and wound infections. Thus, femoral cannulation may bear a higher risk compared to conventional aorto-atrial cannulation techniques [5]. Therefore, we aimed to evaluate the occurrence of postoperative groin complications related to femoral cannulation in minimally invasive cardiac surgery.

Patients and Methods

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Study design

This retrospective study included all patients who underwent minimally invasive cardiac surgeries with femoral vascular access in the Cardiothoracic Surgery Department between January 2019 and August 2021. Patients who required conversion to the conventional approach were included in the analysis. We excluded patients with severe aortoiliac disease, small femoral arteries, and inferior vena cava (IVC) filters.

The Local Ethical Committee approved the study, and the need for patients' consent was waived.

Data and techniques

The preoperative preparation included thorough history taking and clinical examination. The following data were collected, age, sex, BMI, risk factors (diabetes, hypertension, history of vascular disease, previous femoral procedures). All patients had routine investigations, including full Labs, plain chest X-rays, echocardiography, coronary angiography for ischemic heart disease patients or older patients above 40 years.

A standard anesthesia protocol was followed in all cases, and the incision was through a right thoracotomy. Operative data included the operation type and time, total bypass, cross-clamp time, femoral venous, and arterial cannula size. Postoperative data included the duration of ICU and hospital stay and groin complications.

Statistics analysis

Continuous data were expressed as mean + (SD) and compared with the Student t-test or Mann-Whitney test when appropriate. The qualitative variables were analyzed with the Chi-square test or Fischer's exact test as appropriate. A P value <0.05 was the limit of statistical significance. Analysis was performed by SPSS statistical software version 23 (IBM Corp- College Station- TX- USA). A P-value of less than 0.05 was considered statistically significant.

Results

Preoperative data

The study sample included 140 patients, sixty percent of them were females (n=84). Their age ranged between 9 and 62 years with a mean value of (41.47± 11.71 years), and their body mass index ranged between (18.7- 40.8 Kg/m2) with a mean of (27.12±5.75 Kg/m2).

Groin complications occurred in 14 patients (10%); seroma developed in 11 patients (7.9%), two had femoral artery hematoma (1.4%), and 1 (0.7%) patient had femoral arterial dissection, which was primarily repaired. There were no differences in the preoperative data between patients with and without groin complications. (Table 1)

Table 1: Comparison of the preoperative data between patients with and without femoral complications. Continuous data were presented as mean and standard deviation, and categorical data as frequencies and percentages.

	Total (n= 140)	Complications (n= 14)	No complications (n= 126)	p-value
Age (years) (mean and SD)	41.47±11.71	39.93±11.61	41.64±11.75	0.61
Male	56 (40%)	6 (41.9%)	50 (39.7%)	0.82
BMI (Kg/m2) (mean and SD)	27.12±5.75	24.91±4.21	27.37±5.85	0.13
Diabetes mellitus	7 (5%)	1 (7.1%)	6 (4.8%)	0.70
Hypertension	32 (22.9%)	3 (21.4%)	29 (23%)	0.89
History of Deep venous thrombosis	3 (2.1%)	0	3 (2.4%)	>0.99
Stroke	3 (2.1%)	1 (7.1%)	2 (1.6%)	>0.99
Coronary stent	3 (2.1%)	0	3 (2.4%)	>0.99
Vertebrobasilar insufficiency	4 (2.9%)	1 (7.1%)	3 (2.4%)	>0.99
Previous femoral procedure				
Cardiac catheterization	54 (38.5%)	5 (35.7%)	49 (38.9%)	0.16
Mitral balloon valvotomy	12 (8.5%)	3 (21.4%)	9 (7.1%)	

Operative and postoperative data

One hundred twelve patients (80%) had minimally invasive mitral valve surgery, while 24 patients (17.1%) had a minimally invasive atrial septal defect and four patients (2.9%) had minimally invasive myxoma removal. There were no differences between groups as regards the size of the arterial and venous cannula. The patients with groin complications had longer operative, cross-clamp, and bypass time. However, the difference between the patients with groin complications and those without complications was non-significant. (Table 2)

Patients with groin complications had less ICU stay (4.14± 2.6 days), yet they had a longer hospital stay (11.71±4.95 days). All of these results were non-significant.

Discussion

Minimally invasive surgery is increasingly used in cardiac surgeries and confers many advantages over the conventional approach. These advantages are derived largely from the reduced trauma to the chest wall tissues and, hence, a better postoperative outcome [6].

A point of substantial criticism of minimally invasive procedures is the commonly used femoral arterial cannulation with associated post-surgical complications [7]. The current study assessed the occurrence of groin complications after femoral cannulation in minimally invasive cardiac surgeries. Out of 140 cases, 10% (14) of patients developed groin complications. This study revealed that age and BMI were not significantly associated with postoperative groin complications. This finding agrees with Saadat and colleagues' results, who found that age has no significant influence on complications of femoral cannulation. They also noticed that BMI was not a significant risk factor for groin complications [7].

Table 2: Operative and postoperative data between patients with and without femoral complications. Continuous data were presented as mean and standard deviation, and categorical data as frequencies and percentages.

	Total (n= 140)	Complications (n= 14)	No complications (n= 126)	p-value
Operation				
Minimally invasive mitral valve surgery	112 (80%)	9 (64.3%)	103 (81.7%)	0.2
Minimally invasive atrial septal defect	24 (17.1%)	4 (28.6%)	20 (15.8%)	
Minimally invasive myxoma excision	4 (2.9%)	1 (7.1%)	3 (2.4%)	
Femoral venous cannula size (French)				
21	63 (45%)	6 (42.9%)	57 (45.2%)	0.3
23	49 (35%)	3 (21.4%)	46 (36.5%)	
25	28 (20%)	5 (35.7%)	23 (18.3%)	
Femoral artery cannula size (French)				
16	4 (2.9%)	0	4 (3.2%)	
18	125 (89.3%)	13(92.9%)	112 (88.9%)	0.7
19	4 (2.9%)	1 (7.1%)	3 (2.4%)	
20	7 (5%)	0	7 (5.6%)	
Groin complications	14 (10%)	14	-	
Groin seroma	11 (7.9%)	11 (78.6%)	-	
Femoral artery dissection	1 (0.7%)	1 (7.1%)	-	
Femoral artery hematoma	2 (1.4%)	2 (14.3%)		
Operative time (hours)	5.16±1.24	5.6±0.5	5.1±0.9	0.3
Cardiopulmonary bypass time (min)	130.89±41.3	155±43.6	129.8±35.7	0.2
Cross-clamp time (min)	85.33±36.4	95.5±38.8	83.9±32.2	0.5
Intensive care unit stay (days)	4.21±3.01	2.8±0.5	4.1±3.4	0.6
Hospital stay (days)	10.87±4.68	13±3.8	11.6±4.3	0.2

The current results are consistent with other studies that reported that females were two times more likely to develop groin complications than male patients, and wound healing complications remain associated with the female sex [8]. Other previous studies found a statistically significant post cardiac surgery infection incidence in female patients compared to males [9].

Diabetes is one of the well-known risk factors for postoperative groin complications, especially lymphocele [10]. In contrast, our study showed that diabetic patients did not have more groin complications compared to their non-diabetic counterparts. This result could be explained by the low number of diabetic patients in our study.

Hypertension is considered a risk factor in surgical intervention in the groin region [11]. However, in our study, hypertension was not identified as a significant risk factor for groin complications. This finding also could be explained by the low number of hypertensive patients in our study.

Caution should be exercised when attempting femoral cannulation in patients with severe peripheral vascular disease or aneurysmal vessels, as forcing a cannula into the vessel may lacerate and penetrate its wall [12]. Our results showed that although not statistically significant; patients with previous vascular disease have a higher incidence of developing groin complications.

Several factors independently predict groin complications following peripheral vascular interventions. These complications occurred less frequently in unilateral femoral artery access than bilateral femoral artery access sites [13]. There was a slight increase in the percentage of complications in patients who had previous femoral intervention in our study, yet this difference is insignificant. On the other hand, Salna and colleagues stated that patients undergoing redo groin procedures are at an elevated risk, probably because of the disruption of native tissue planes [10].

Previous studies reported that prolonged cumulative CPB time was significant in predicting mortality, postoperative complications, prolonged ICU stay, and mechanical ventilation [14]. This study showed non-significant statistical differences in cross-clamp, total bypass, and operation times between patients with and without complications.

The current results showed that groin complications were related to patients who underwent mitral valve surgery (64.3%) compared to 28.6% for ASD closure and 7.1% for myxoma removal. However, there was no clear cause for the complication to be isolated in patients with mitral valve surgery only. In our opinion, it was related to the length of operation and total bypass time with other related co-factors.

Femoral access was the chosen access for all of the surgeries in this study. The BMI determines the size of the cannula. The size of the artery or vein determines the minimum and maximum flow over the bypass machine, according to Lamelas and colleagues [15]. This study suggests that the bigger the size of the cannula, the more risk for groin complications, as we found that patients who developed groin complications had cannula diameters 18F and 20F for arterial and 21F, 23F and 25F for venous femoral cannula. Several authors suggested that increasing cannula diameter will improve the maximum blood flow through the circuit but is also more likely to result in vessel and tissue damage, so selecting the appropriate cannula size is very important [16].

Study limitations

This study is a single-center experience starting its minimal invasive experience hence, the small sample size. Another limitation is the retrospective nature of this study. Additionally, there was no comparison group with patients who had conventional cannulation.

Conclusion

Femoral complications are relatively uncommon after minimally invasive cardiac surgery. Most of these complications are mild and can be managed conservatively.

Conflict of interest: Authors declare no conflict of interest.

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