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Incidence and risk factors of femoral Access-Site hematoma following cardiac catheterization: A six-month observational study from Erbil cardiac center

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Abstract

Femoral access site hematoma is frequent complication following cardiac catheterization. The aim of this study is to find out the incidence of femoral access site hematoma post-cardiac catheterization in Erbil cardiac center and identifying risk factors related to femoral access site hematoma. A prospective observational study implemented in Cardiac center at Erbil city in duration of six months, from May 1, to October 31, 2025 on sample of 400 patients underwent cardiac catheterization. Catheterization procedures were performed by senior Cardiologists or senior house officer Cardiology trainee under supervision of senior Cardiologist. Hematoma was diagnosed by the senior Cardiologist through clinical examination of access site. Incidence of femoral hematoma in studied patients was (9.5%). Significant risk factors of femoral access site hematoma were advanced age, female gender, hypertension, primary percutaneous coronary intervention, history of dual antiplatelet therapy, post-procedural heparin, increased intraprocedural blood pressure and shorter manual pressure time ($p \leq 0.05$). The incidence of femoral access site hematoma following cardiac catheterization in Erbil cardiac center is within acceptable range.

Keywords: Cardiac catheterization, Femoral access site, Hematoma

1. Introduction

Amongst the non-communicable conditions, heart diseases are of the most important problem among people worldwide, especially in poor nations.[1] Elevated prevalence rates of hypertension, obesity, smoking and physical inactivity are responsible of higher heart diseases incidence which leads to about 30% of mortalities in Kurdistan region and Iraq.[2] Heart catheterization, sometimes referred to as coronary angiography or cardiac cath, is a gold standard procedure that entails putting a catheter (thin, flexible tube inserted into the blood channels to reach the cardiac chambers as well as adjacent blood vessels).[3] Cardiac catheterization services in Kurdistan region have been advanced in last decades with better outcomes, however, the catheterization is an invasive procedure accompanied with various complications.[4]

Historically, the femoral artery has been the primary access route for catheter introduction in the diagnosis and treatment of cardiovascular diseases.[5] Nevertheless, the transfemoral method has been linked to a broad range of access-site problems, from small issues that need little care to serious issues that necessitate drastic, lives saving surgical procedures. Femoral hematoma is the most frequent access-site consequence and can vary in size. Retroperitoneal hematoma is one of the most dangerous complications and, if not identified and treated promptly, can result in hemorrhage and fatal outcome.[6] Other problems include arterial occlusions, fistulas, dissection, pseudoaneurysm, nerve injuries, access-site hemorrhage and infection.[7]

Intervention techniques typically result in more femoral access site problems than diagnostic techniques; this is probably due to treatment with anticoagulants and membrane size. According to reports, femoral access site problems in patients having cardiovascular diagnostic and interventional treatments might range from 0-17%.[8] In a study, femoral access site complications were detected in 1.8% of cases underwent diagnostic catheterization and 4% of cases underwent intervention catheterization, while major hemorrhage incidence was reported in 2-6% and access site injury rates needed for intervention or transfusion was ranged between 2.6-6.6%.[9]

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There are two categories of risk factors for vascular problems during cardiac catheterization: factors related to patients and those related to procedure. Advanced age, female sex, low or excess weight, reduced body surface area, history of peripheral vascular diseases, renal failure or higher serum creatinine level and low platelet count are common patients related risk factors.[10] Additionally, other correlations with vascular problems, including myocardial infarction, cardiogenic shock, diabetes mellitus, and hypertension, have been the subject of inconsistent findings in certain research.[11] Bigger artery sheathing, concurrent vein sheathing, longer embedded sheath time, longer procedure timing, additional percutaneous coronary intervention (PCI), the place of the artery puncturing, excessive doses and prolonged duration of anticoagulation therapy, thrombolytics use and prior catheterization at the same site are all instances of procedural related factors.[12] High burden of cases requiring cardiac catheterization with possible complications and scarcity of literature discussing this issue urged us to conduct this study that aimed to find out the incidence of femoral access site hematoma post-cardiac catheterization in Erbil cardiac center and identifying risk factors related to femoral access site hematoma.

Methods

During the course of six months, from May 1, to October 31, 2025, the Cardiac center in Erbil city, Kurdistan region, Iraq, hosted the current study, which was intended as a prospective observational design. The population of study consisted of patients underwent cardiac catheterization. Adult age patients with heart diseases were underwent cardiac catheterization (angiography, elective PCI and primary PCI) were eligible to participate. Patients less than 18 years age and patients underwent temporary pacemaker (femoral vein access) in addition to patients underwent electrophysiological study were excluded. The study protocol received approval from the Kurdistan Higher Council of Medical Specialists Ethics Committee, hospital administration, written informed consent of patients and confidentiality of data. Following their eligibility for inclusion and exclusion criteria, 400 patients underwent cardiac catheterization were chosen.

Researchers obtained the information from the patients who were enrolled directly or from their records and filled in prepared questionnaire. The researchers created the survey. The survey asked about the following: the general characteristics of patients (age, gender, body mass index, history of diabetes mellitus, hypertension, smoking, hyperlipidemia and serum creatinin); interventional and procedural characteristics (intervention type, antiplateletes, anticoagulants, intraprocedural drugs, postprocedural drugs, sheath size, side, intraprocedural blood pressure, preoperative blood pressure and manual pressure time after sheath removal), incidence and outcomes of femoral hematoma (femoral access site hematoma incidence, retroperitoneal hematoma by ultrasound, femoral hematoma size, need for intravenous fluid, need for blood or platelets, need for surgery and death outcome). Catheterization procedures were performed by senior Cardiologists or senior house officer Cardiology trainee under supervision of senior Cardiologist. Hematoma was diagnosed by the senior Cardiologist through clinical examination of access site (>3cm palpable hematoma within 24 hours post-cardiac catheterization) and in suspected cases of retroperitonial hematoma ultrasound was used (Radiologist on call). For femoral access site most of the cases 6fr femoral sheath was used. Management of femoral hematoma decision making was done by Cardiology resident on call and responsible senior Cardiologist of the case. To statistically examine the collected data, the Statistical Package of Social Sciences software, version 26, was utilised. Continuous variables were examined using the independent sample t-test, while categorical variables were examined using the chi square or Fisher's exact tests. The study employed a significance threshold of 0.05 or below.

Results

This study included 400 patients underwent cardiac catheterization presented with mean age of (58.3 years); 40.8% of patients were in age group of 50-59 years and male patients were more than females (55% vs. 45%). About half of studied patients were obese and common risk factors were hypertension (60.4%) and diabetes mellitus (48.8%). (*Table 1*)

Table 1. General characteristics of patients

Variable	No.	%
Age mean±SD (58.3±10 years)		
<50 years	76	19
50-59 years	163	40.8
60-69 years	84	21
≥70 years	77	19.3
Gender		
Male	220	55
Female	180	45
Body mass index mean±SD (29.9±5.1 Kg/m^2)		
Normal	75	18.8
Overweight	130	32.5
Obese	195	48.8
Hypertension		
Yes	239	60.4
No	157	39.6
Diabetes mellitus		
Yes	195	48.8
No	205	51.3
Smoking		
Yes	97	24.3
No	303	75.8
Dyslipidemia		
Yes	53	13.3
No	347	86.8
Serum creatinin>1.2 mg/dl		
Yes	8	2
No	392	98
Total	400	100

More than half of patients underwent angiography (51.8%), while (34.2%) elective PCI and (14%) primary PCI. Common antiplatelets used were aspirin & clopidogrel (65%), while only twenty patients taken anticoagulants mainly enoxaparin (2.5%). Intra-procedural heparin was administered to 14% of patients, while 9% of patients were administered by postprocedural heparin with dose of (70-100 IU/Kg). The sheath size was mainly 6 fr (77.5%), commonly on right side (99%).

Mean intraprocedural blood pressure was (132/89 mmHg) and 19% of patients had increased preoperative blood pressure. Mean manual pressure time after sheath removal was (11.9 minutes); 65.5% of patients had pressure time of more than 10 minutes. (*Table 2*)

Table 2: Interventional and procedural characteristics.

Variable	No.	%
Intervention type		
Angiography	207	51.8
Elective PCI	137	34.2
Primary PCI	56	14
Antiplatelets		
No	18	4.5
Aspirin	33	8.3
Aspirin & Clopidogrel	260	65
Aspirin & Ticagrelor	85	21.3
Aspirin & Prasugrel	4	1
Anticoagulants		
No	380	95
Warfarin/INR	5	1.3
Apixaban	5	1.3
Enoxaparin	10	2.5
Intra-procedural drugs		
No	344	86
Heparin	56	14
Postprocedural drugs		
No	364	91
Heparin	36	9
Sheath size		
6 fr	310	77.5
7 fr	90	22.5
Side		
Right	396	99
Left	4	1
Intraprocedural blood pressure mean±SD (132/89±22/14 mmHg)		
Preoperative blood pressure mean±SD (128/76±15/10 mmHg)		
Normal	324	81
Increased	76	19
Manual pressure time after sheath removal mean±SD (11.9±3.1 minutes)		
≤10 minutes	138	34.5
>10 minutes	262	65.5
Total	400	100

Incidence of femoral hematoma in studied patients was (9.5%) without positive retroperitoneal hematoma by ultrasound. About half of femoral hematomas had size of less than 5 cm, 31.6% of patients had size of 5-9 cm and 21.1% of them had size of 10 cm and more. More than half of patients with femoral hematoma required intravenous fluids, while 10.5% of them required blood or platelets without need to surgery. No reported cases of death among patients with femoral hematoma. (*Table 3*)

Table 3: Incidence and outcomes of femoral hematoma

Variable	No.	%
Femoral hematoma		
Yes	38	9.5
No	362	90.5
Total	400	100
Retroperitoneal femoral hematoma by US		
No	28	100
Femoral hematoma size		
<5 cm	18	47.4
5-9 cm	12	31.6
≥10 cm	8	21.1
Requiring intravenous fluids		
Yes	22	57.9
No	16	42.1
Blood or platelets		
Yes	4	10.5
No	34	89.5
Surgery		
No	38	100
Death		
No	38	100
Total	38	100

Femoral hematoma incidence was significantly increased with advanced age patients (p<0.001). There was a highly significant association between female gender patients and femoral hematoma incidence (p<0.001). A highly significant association was observed between hypertension and femoral hematoma incidence (p<0.001). On other hand, diabetes mellitus and dyslipidemia were significantly associated with lower incidence of femoral hematoma (p≤0.05). No significant differences were observed between patients with or without femoral hematoma regarding body mass index, smoking and increased serum creatinin level (p>0.05). (*Table 4*)

Table 4: Distribution of general characteristics in regard to femoral hematoma.

Variable	Femoral hematoma				P
	Yes		No		
	No.	%	No.	%	
Age					<0.001 S
<50 years	1	2.6	75	20.7	
50-59 years	5	13.2	158	43.6	
60-69 years	8	21.1	76	21	
≥70 years	24	63.2	53	14.6	
Gender					<0.001 S
Male	7	18.4	213	58.8	
Female	31	81.6	149	41.2	
Body mass index					0.18 NS
Normal	3	7.9	72	19.9	
Overweight	13	34.2	117	32.3	
Obese	22	57.9	173	47.8	

Hypertension					
Yes	33	86.8	206	57.5	<0.001 S
No	5	13.2	152	42.5	
Diabetes mellitus					
Yes	7	18.4	188	51.9	<0.001 S
No	31	81.6	174	48.1	
Smoking					
Yes	14	36.8	83	22.9	0.057 NS
No	24	63.2	279	77.1	
Dyslipidemia					
Yes	0	-	53	14.6	0.01 S
No	38	100	309	85.4	
Serum creatinin>1.2 mg/dl					
Yes	0	-	8	2.2	0.35 NS
No	38	100	354	97.8	

S=Significant, NS=Not significant

There was a highly significant association between primary PCI and higher femoral hematoma incidence (p<0.001). Intake of dual antiplatelet therapy was significantly related to higher femoral hematoma incidence (p=0.005). Post-procedural heparin was significantly related to higher femoral hematoma incidence (p<0.001). Increased intraprocedural blood pressure was significantly associated with higher femoral hematoma incidence (p=0.01). Shorter manual pressure time was significantly related to higher femoral hematoma incidence (p<0.001). No significant differences were observed between patients with or without femoral hematoma regarding anti-coagulants, intra-procedural drugs, sheath size, side and preoperative blood pressure. (*Table 5*)

Table 5: Distribution of interventional and procedural characteristics in regard to femoral hematoma.

Variable	**Femoral hematoma**				**P**
	Yes		**No**		
	No.	**%**	**No.**	**%**	
Intervention type					
Angiography	7	18.4	200	55.2	<0.001 S
Elective PCI	11	28.9	126	34.9	
Primary PCI	20	52.7	36	9.9	
Antiplatelets					
No	6	15.8	12	3.3	
Aspirin	4	10.5	29	8	
Aspirin & Clopidogrel	24	63.2	236	65.2	0.005 S
Aspirin & Ticagrelor	4	10.5	81	22.4	
Aspirin & Prasugrel	0	-	4	1.1	
Anticoagulants					
No	35	92.2	345	95.3	
Warfarin/INR	1	2.6	4	1.1	0.7 NS
Apixaban	1	2.6	4	1.1	
Enoxaparin	1	2.6	9	2.5	
Intraprocedural drugs					
No	30	78.9	314	86.7	0.18 NS
Heparin	8	21.1	48	13.3	
Postprocedural drugs					<0.001 S

No	22	57.9	342	94.5	
Heparin	16	42.1	20	5.5	
Sheath size					
6 fr	28	73.7	282	77.9	0.5 NS
7 fr	10	26.3	80	22.1	
Side					
Right	38	100	358	98.9	0.5 NS
Left	0	-	4	1.1	
Intraprocedural blood pressure					
Mean±SD	135.6/90.5±16.7/5.6		128/88±16.5/5.8		0.01 S
Preoperative blood pressure					
Normal	31	81.6	293	80.9	0.9 NS
Increased	7	18.4	69	19.1	
Manual pressure time after sheath removal					
≤10 minutes	33	86.8	105	29	<0.001 S
>10 minutes	5	13.2	257	71	

S=Significant, NS=Not significant

Discussion

Studying the incidence and risk factors of femoral access site hematoma post-cardiac catheterization is crucial for formulating prevention and therapeutic strategies.[13]

In present study, incidence of femoral hematoma in patients underwent cardiac catheterization was (9.5%). This incidence rate is lower than rate of (20%) for femoral access site hematoma after cardiac catheterization reported by recent descriptive study conducted in Saudi Arabia.[14] Our study incidence of femoral access site hematoma in patients underwent cardiac catheterization was also lower than results of recent Egyptian study which reported femoral hematoma incidence post-cardiac catheterization of (20%).[15] On other hand, our study incidence rate is close to results of previous study carried out in United States of America which found that 10% of patients underwent cardiac catheterization had femoral access site hematoma,[16] while higher than results of recent single-center observational study implemented in South Korea which revealed that 3.5% of patients had femoral access site hematoma after cardiac catheterization.[17] Generally, our study femoral access site hematoma incidence rate is within reported international range of (0-17%).[8] In our study, no reported case of retroperitoneal hematoma. This finding is better than results of previous prospective cohort study conducted in Iraq which found a rate of (0.03%) for retroperitoneal hematoma following cardiac catheterization.[18] Our study showed that 47.4% of femoral hematomas had size of less than 5 cm, 31.6% of patients had size of 5-9 cm and 21.1% of them had size of 10 cm and more. These findings are close to results of previous Jordanian study which documented predominant femoral hematoma size of less than 5 cm after cardiac catheterization.[19] In our study, more than half of patients with femoral access site hematoma required intravenous fluids, while 10.5% of them required blood or platelets without need to surgery. These findings are similar to results of various literatures.[16, 18]

In current study, femoral access site hematoma incidence was significantly increased with advanced age and female gender patients. Consistently, different authors found higher incidence of femoral access site hematoma in advanced age patients underwent cardiac catheterization due to vessels fragility and female gender patients underwent cardiac catheterization due to smaller vessel size and high bleeding risk in female gender population.[15, 20] Our study found a highly significant association was observed between hypertension and femoral hematoma incidence. This finding coincides with results of recent descriptive study carried out in Egypt.[10] In our study, there was a highly significant

association between primary PCI and higher femoral hematoma incidence. Similarly, recent prospective observational study implemented in Jordan reported higher incidence of femoral access site hematoma in patients underwent primary PCI due to higher anticoagulation use, larger sheath size and urgency situations.[21] In present study, history of dual antiplatelet therapy and post-procedural heparin were significantly related to higher incidence of femoral access site hematoma. It was shown that history of antiplatelets/anticoagulants administration had a notable effect on hematoma development after cardiac catheterization.[22] Our study showed that increased intraprocedural blood pressure was significantly associated with higher femoral hematoma incidence. This finding is parallel to results of different literatures.[15, 19] Present study found that shorter manual pressure time was significantly related to higher femoral hematoma incidence. This finding is consistent with results of recent study implemented in Italy which stated that shorter manual pressure on femoral access site post-cardiac catheterization leads to higher incidence of femoral hematoma.[23]

In conclusion, the incidence of femoral access site hematoma following cardiac catheterization in Erbil cardiac center is within acceptable range and common risk factors of femoral access site hematoma are advanced age, female gender, hypertension, primary PCI, history of dual antiplatelet therapy, post-procedural heparin, increased intraprocedural blood pressure and shorter manual pressure time. This study recommended further multi-centers national studies on incidence and risk factors of femoral access site hematoma following cardiac catheterization.

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Conflict of interest

Declared none.

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