

# Infected femoral false aneurysm in drug abusers: Tailoring management to individual requirements

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**Background:** *There is much controversy regarding the best management of infected femoral false aneurysm (IFFA), with advocates of mere arterial ligation or reconstruction either routine or selective.*

**Aim of the work:** *To assess the outcome of surgical management of (IFFA) due to local injury in parenteral drug abusers.*

**Patients and methods:** *Eighteen male patients with IFFA were surgically managed and retrospectively reviewed from October 2009 until October 2013. Data analyzed included demographic characteristics, modes of presentation, side and site of involvement, management and outcome. Arterial ligation with excision of pseudoaneurysm was done in (6) cases whereas vascular reconstruction was done in (12) cases.*

**Results:** *Overall amputation rate was 1/18 (5.5%). All patients who had no revascularization experienced late claudications and/or rest pain. Limb salvage without critical ischemia was achieved in all cases having vascular reconstruction. Hemorrhage followed primary CFA repair in one case (1/12, 8.3%) and infection occurred in 2/6 (33.3%) cases of ligation versus 3/12 (25%) cases of reconstruction.*

**Conclusion:** *Revascularization should be selected if pedal Doppler signals are absent after excision of pseudoaneurysm and ligation of the involved arteries, the extra anatomic route is a reasonable approach.*

**Key words:** *False aneurysm, femoral pseudoaneurysm, IFFA, drug abusers.*

## **Introduction:**

Arterial pseudoaneurysms due to self-injection of drugs occur most commonly in the groin with the development of infected femoral false aneurysm (IFFA). This complication of drug abuse is accompanied by systemic sepsis, hemorrhage, limb loss or death.<sup>1</sup> Deep groin infection may extend upwards to the retroperitoneum or down to the thigh and knee, where it may lead to extensive soft tissue necrosis.<sup>2</sup> The first two cases of IFFA in drug abusers were described by Huebl and Read in the 1960s,<sup>3</sup> and nowadays drug addiction is the primary reason for the increasing frequency of infected aneurysms.<sup>4</sup> There is much controversy regarding the best management of IFFA, with advocates of mere ligation or revascularization either routine or selective.<sup>5-7</sup> So the vascular surgeon is forced

to rely on a number of heterogeneous case series.<sup>8-12</sup>

Aim of this study was to assess the outcome of surgical management of infected femoral false aneurysms (IFFA) due to local injury in parenteral drug abusers.

## **Patients and methods:**

**Inclusion criteria:** Eighteen male patients suffering from IFFA as a result of self-injection of drugs in the groin area were included in this retrospective study.

**Exclusion criteria:** Femoral pseudoaneurysms due to trauma, femoral catheterization or developing upon a previous femoral anastomosis were excluded from this study.

Patients were admitted to Vascular Surgery Unit, Tanta University Hospitals

from October 2009 until October 2013. Their age ranged from (20) to (42) years old (mean 33.5 years). All had unilateral IFFA, (10) on the left groin and (8) on the right. Time delay between start of symptoms till presentation ranged from (2-21) days with a mean of (8) days. Femoral artery ligation was performed as the primary treatment in (6) patients while arterial reconstruction was performed in (12) patients.

Outcomes measured: Amputation and mortality rates, postoperative infection, hemorrhage, late claudications and critical limb ischemia.

Diagnosis and preoperative management:

**Table(1)** illustrates the clinical findings upon admission. In most cases the diagnosis was made clinically from a history of drug injections in the groin. Examination of the groin area revealed pulsatile groin swelling with audible bruit in (9) cases, non-pulsating tender swelling in (7) cases and rupture with external hemorrhage in (2) cases **Figure(1)**; spontaneously in one case and due to misdiagnosis as an abscess and trial of surgical drainage outside the hospital in the other.

Examination of the rest of the limb revealed thigh and leg edema in (14) cases, neurological manifestations as medial thigh numbness and pain due to femoral nerve compression or damage detected in (3) patients and did not recover after surgery. Extensive necrotizing fasciitis affecting the groin, parts of the thigh and inguinal region was present in one patient. Pedal pulses were palpable in (16) cases and ankle brachial index (ABI) was recorded.

The associated patients' conditions related to IFFA are shown in **Table(2)**. Color duplex ultrasound was performed for (16) patients prior to surgery (excluding the (2) cases presented with hemorrhage). CT angiograms were obtained in (8) cases to confirm the diagnosis and to plan the operative procedures **Figure(2)**.

In all patients blood and tissue cultures were drawn, hepatitis markers, HIV testing, complete blood count and tests for coagulation efficiency were done. All patients

received empirical preoperative intravenous antibiotics, which were continued throughout the operative procedure and (4-6) weeks postoperative and modified according to culture results.

Surgical technique: In all cases a supra-inguinal incision was designed above and parallel to the inguinal ligament so that the external iliac artery (EIA) was the proximal vascular control. Pseudoaneurysm was then exposed through a vertical incision in the groin area, with local debridement of the infected area to apparently clean margins together with excision of the false aneurysm **Figure(4)**. In the seven patients who had lateral extra-anatomical PTFE bypass, a third incision was made in the medial thigh, below the lower limit of the IFFA, to expose the superficial femoral artery (SFA) in a clean area. The involved arterial segments in the study cases are shown in **Table(3)**.

Choice of ligation or reconstruction: Reconstruction was considered when i) pedal Doppler signals were absent after ligation or test clamping of CFA or EIA, ii) triple ligation was necessary, iii) ischemic signs appeared. Reconstruction method was judged by i) the extent of sepsis; extra-anatomic route was preferred whenever widespread sepsis was present, ii) extent of arterial damage; whether primary repair or patch can be done safely or not iii) availability of conduit material; the autologous was preferred whenever suitable otherwise PTFE was chosen.

Ligation was done in (6) cases; CFA only and SFA only each in one case and triple ligation in (4) cases without reconstruction due to necrotizing fasciitis in one case, septicemia in another and hemorrhage, shock with no available conduit material in (2) cases. Reconstruction methods (n=12) were, (7) lateral extraanatomic PTFE bypass, (2) in-situ GSV interposition graft, (2) direct arterial repair and one venous patch.

Post-operative follow up: All patients with (IFFA) undergoing ligation and excision were given heparin for one week to prevent thrombosis of the collateral circulation, and they were kept on an antiplatelet thereafter. Ankle/brachial indices (ABI) were obtained

before discharge from the hospital. The mean duration of follow up was 18.5 months (range, 1-34 months).

### Results:

The local or systemic associated conditions, related to drug abuse are presented in **Table (2)**, in six cases DVT diagnosed by duplex necessitated post-operative treatment with oral anticoagulation for 3-6 months and prohibited the use of superficial veins of this limb as bypass material. One patient presented with septicemia was treated according to the general protocol with post-operative admission to the intensive care unit for further management. He improved gradually over (3) weeks and was discharged after (29) days. The mean duration of hospitalization was (21) days (range 10–55 days). There was no peri-operative deaths.

Post-operative outcome **Table(4)**: Arterial ligation (n=6) resulted in late intermittent claudications (Fontaine stage IIa–IIb) in (4/6) cases (66.7%), rest pain in (1/6) case (16.7%) at 4-10 months of follow up. Above-knee amputation in (1/6) case (16.7%) who presented with necrotizing fasciitis and underwent triple ligation. However, no further arterial intervention was done for the ischemic patients due to improvement under medical treatment in (3) cases and patients' refusal in the other (2). Groin wound infection was observed in (2/6) cases (33.3%) and resolved with further debridement and culture-specific antibiotics.

Arterial reconstruction (n=12) was not associated with any claudication, rest pain or amputation. Infection was present in (3/12) cases (25%), (2) groin infections and one superficial inguinal wound infection, all resolved with dressings, antibiotics and debridement of groin wounds. Hemorrhage followed primary CFA repair on the second post-operative day in (1/12) case (8.3%), he was transferred to the operating theatre, resuscitated, and the anastomosis was repaired.

Overall amputation rate was (1/18, 5.5%). The mean post-reconstruction (ABI) was (0.82), while the mean post-ligation (ABI)

was (0.57).

Tissue cultures were positive for *Staphylococcus aureus* in (16) patients (88.8%); of them 3 (19%) were resistant to methicillin (MRSA). Mixed cultures were reported in one patient and consisted of *Staph. aureus* with *Candida albicans* and group B streptococcus. Anaerobic organisms were cultured from one patient, who returned microaerophilic streptococcus. Viral markers revealed (4) cases positive for hepatitis C antibodies and other (2) for hepatitis B surface antigen. The mean leukocyte count was (14500) cells / cubic millimeter, (range 9200/mm<sup>3</sup> - 19900/mm<sup>3</sup>).

### Discussion:

Parenteral drug abuse results in a variety of challenging vascular and non-vascular complications. Of these, infected pseudoaneurysms are among the most serious, posing a definite threat to both life and limb.<sup>6</sup> The patient may be immune-compromised from human immunodeficiency virus (HIV), hepatitis, or malnutrition; this makes widespread local and systemic sepsis more likely.<sup>2</sup> Moreover, these patients usually come to the hospital late and often escape from follow-up. Infection makes some recent treatment methods unsuitable, at least until now, as percutaneous thrombin injection, para-aneurysmal saline injection or duplex guided compression. Patients often use superficial vascular grafts as valuable access for drug injection.<sup>6</sup> For these reasons valid comparisons cannot be made between these patients and those who have femoral pseudoaneurysms resulting from trauma, infected femoral grafts, post-catheterization or other reasons. In view of this, the current study has been limited to treatment of femoral pseudoaneurysms arising from substance abuse. Pseudoaneurysm develops as a result of inadvertent intra-arterial or periarterial injection of drugs. Extravasation of blood and subsequent infection of the hematoma causes vessel wall breakdown with the resultant infected pseudoaneurysm.<sup>13</sup>

The diagnosis is usually straightforward with a history of groin injection, followed in

one to (30) days by pain, limb edema and groin swelling with or without expansile pulsation.<sup>5</sup> In fact, one-half of the cases reported here presented with pulsating whereas (38.8%) presented with non-pulsating painful mass, this compares well with results of previous studies.<sup>14,15</sup> In cases presenting as a painful groin swelling alone, it is helpful to try to distinguish a localized abscess, cellulitis or hematoma from an IFFA. Although angiography will show an IFFA and can be useful also in delineating vascular anatomy, some surgeons prefer duplex ultrasound.<sup>7,9</sup> In the current study duplex ultrasound scan was found to be extremely helpful and accurate in confirming clinical diagnosis, in contrast to the findings of Reddy et al<sup>7</sup> and Sandler et al,<sup>16</sup> they did not find ultrasound scan useful, in another study by Gan et al,<sup>5</sup> (23) cases were studied with duplex and four cases were misdiagnosed as abscesses. However these studies were done more than (14) years ago and refinements in technology may explain the superior accuracy of duplex ultrasound scan today. Duplex scan is also useful for imaging the femoral and great saphenous veins for thrombosis, which can be commonly found in this patient population.<sup>9</sup> Evidence of ipsilateral DVT was detected in (33.3%) of patients in the present study. CT Arteriography may support duplex for accurate diagnosis, determination of distal runoff and the involvement of the CFA bifurcation, which would indicate the increased risk of limb loss, if arterial ligation is to be performed.<sup>10</sup> CT angiograms were obtained in (8) cases to confirm the diagnosis in the current study.

Many organisms have been reported to be isolated from IFFA, but the most common is *Staphylococcus aureus* and, indeed, in this series it proved to be the most frequent infecting organism where it represented (88.8%) of cultures; of them (19%) were resistant to methicillin (MRSA). Comparable results were reported in previous case series.<sup>5,9,14</sup>

The optimal surgical management of IFFA has long been debated. However, it has always been agreed upon that the most

important part is adequate local debridement of infected tissues and ensuring healthy arterial margins.<sup>2,4,6,7,10</sup> Revascularization following excision of IFFA is controversial from the aspects of necessity, method, route and timing,<sup>10,13,17,18</sup> the available options are:

- Primary repair with standard vascular techniques.<sup>7,14,19</sup>

- Single or triple ligation and excision of IFFA, followed by: a) Immediate reconstruction either by (i) extra-anatomic bypass (obturator or lateral thigh<sup>18,20-22</sup>) using PTFE, or by (ii) in situ autogenous repair, (vein patch<sup>14,17,23</sup> or bypass).<sup>19,24</sup> b) No arterial reconstruction<sup>8-10,14,17,25</sup> except if pedal Doppler signals are absent after test clamping of EIA<sup>9</sup> or ligation of CFA.<sup>14</sup> c) Selective (delayed) revascularization where the viability of the leg is in danger due to critical ischaemia.<sup>7,20,23,26</sup>

- Primary amputation if reconstruction in any form is not feasible.<sup>26,27</sup>

In the current study the overall amputation rate was 1/18 (5.5%) in the case of triple ligation with extensive necrotizing fasciitis. All patients who had no revascularization experienced late claudications and/or rest pain, while limb salvage without critical ischemia was achieved in all cases having vascular reconstruction. Hemorrhage followed primary CFA repair in one case (8.3%) and infection occurred in 2/6 (33.3%) cases of ligation versus 3/12 (25%) cases of reconstruction. Likewise, several authors confirmed that severe claudication more often follows triple than single ligation.<sup>6,7,26,28</sup> In the study by Cheng et al (15.3%) of patients with triple ligation IFFA developed severe ischaemia, and (84.6%) of patients exhibited claudication on follow up<sup>28</sup>. Reddy et al<sup>7</sup> reported high rates of limb loss, up to (33%) in triple ligation, while single-vessel ligation resulted in claudication in all patients. Gan et al<sup>5</sup> found that both triple and single ligation with limb observation resulted in (100%) claudication. They did not check for the presence of pedal Doppler signals following trial clamping of the CFA/EIA intraoperatively<sup>4</sup>. On the other hand, Sadeghi et al performed ligation-excision only in (27)



Figure (1): Ruptured IFFA.

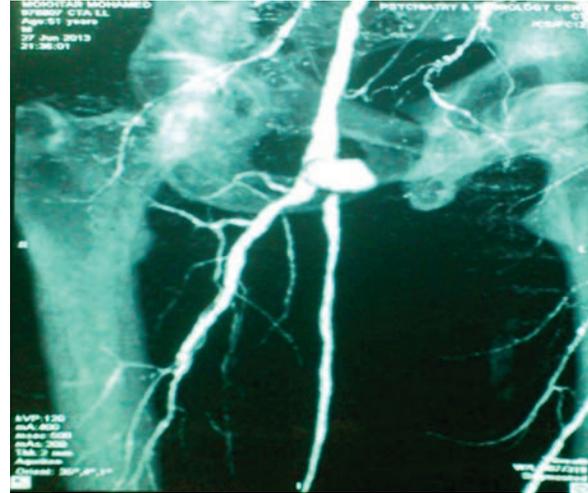


Figure (2): CT angiogram of bifurcation IFFA.



Figure (3): IFFA with leg ulcers.

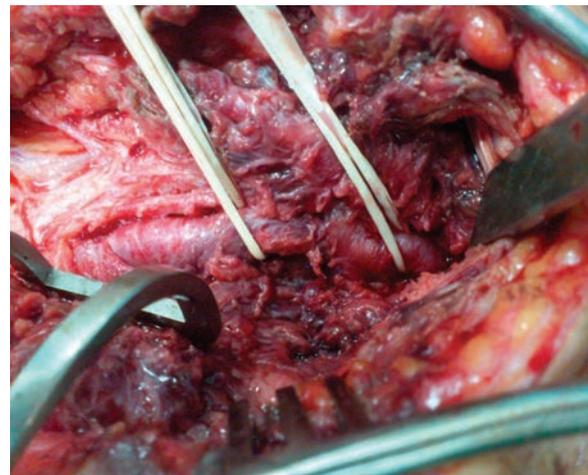


Figure (4): IFFA treated by excision- ligation.

Table (1): Clinical presentation of the study cases:

Clinical presentation		Number	%
a) Groin swelling (n=18)	Pulsatile	9	50
	Non-pulsatile	7	38.9
	Rupture and hemorrhage	2	11.1
b) Rest of the lower limb	Necrotizing fasciitis	1	5.5
	Thigh and leg edema	14	77.8
	Neurological manifestations	3	16.7
	Palpable pedal pulses	16	88.9
	Leg ulcers <b>Figure(3)</b>	2	11.1

IFFAs, infection developed in (18.51%), claudication in (14.8%), and (7.4%) lost their limbs.<sup>29</sup> Similarly, Cheng et al and Lashkarizadeh et al recommended ligation as the safer method, on the basis of their

observations.<sup>26,28</sup>

In order to solve the problem of selecting as to which patient undergoes reconstruction. Arora et al made use of intraoperative Doppler examination of a pedal artery

**Table (2): The associated conditions:**

Associated Condition	Number	%
Ipsilateral deep venous thrombosis	6	33.3
Contralateral limb above knee amputation	1	5.5
Septicemia	1	5.5
Fever and chills	10	55.6

**Table (3): Different treatment methods and involved arterial segment:**

Involved arterial segment	No. (%)	Treatment Method		
		Ligation No.(%)	Recon-struction No.(%)	Reconstruction method
Femoral bifurcation (CFA,SFA &DFA)	10 (55.6)	Triple ligation 4(22.2)	6 (33.3)	-5(27.8%)Lateral PTFE extraanatomic bypass. -1(5.5%)In-situ GSV graft.
CFA alone	5 (27.8)	1 (5.5)	4 (22.2)	-2(11.1%)Direct CFA repair. -1(5.5%)In-situ GSV graft. -1(5.5%)Lateral PTFE extraanatomic bypass.
SFA alone	2 (11.1)	1 (5.5)	1 (5.5)	-1(5.5%)Venous patch.
SFA & DFA	1 (5.5)	0	1 (5.5)	-1(5.5%)Lateral PTFE extraanatomic bypass.
Total	18 (100%)	6 (33.3)	12 (66.7)	

CFA: Common femoral artery    DFA: Deep femoral artery  
PTFE: Poly-tetra-flouro-ethylene    GSV: Great saphenous vein

**Table (4): Post-operative outcomes relative to treatment method:**

Ligation (n=6)			Reconstruction (n=12)	
Outcome	No. (%)	Ligation method	No. (%)	Reconstruction method
Claudication	4/6(66.7)	-2 Triple ligation -2 Single ligation	0	-
Rest pain	1/6(16.7)	Triple ligation	0	-
Amputation	1/6(16.7)	Triple ligation	0	-
Infection	2/6(33.3)	-1 Triple ligation -1 CFA ligation	3/12(25)	- 2 Lateral PTFE extraanatomic bypass -1 In-situ GSV graft
Hemorrhage	0	-	1/12(8.3)	Direct CFA repair

after test-clamping of the EIA or CFA. If Doppler signals were present, common femoral artery would be simply ligated. This approach prevented amputation in all of their patients.<sup>9</sup> However, it must be noted that

audible recognition of the Doppler signal is a qualitative assessment that may not be infallible; with a larger series of patients, occasional inaccurate predictions may occur.<sup>30</sup>

Ligation offers definitive local treatment, removes the threat of hemorrhage, and controls the septic process. It represents the simplest and most straightforward surgical treatment for the IFFA.<sup>14</sup> However, some patients will have ischemic gangrene if immediate collateralization is inadequate. Furthermore, it should be noted that even if a graft is not contaminated at the time of its insertion, it may become so afterwards following puncture with dirty needles.<sup>2</sup> Thus, simple ligation-excision reduces minor complications such as hemorrhage and infection, and predisposes to major complications such as claudication and amputation.

Two series presented poor mean ABI (0.41) in cases with triple ligation,<sup>8,28</sup> but Padberg et al. had two patients able to walk several blocks after triple ligation.<sup>14</sup> An ABI of (0.41) could result in a viable limb, but this is not correlated with limb functionality. It is unclear why claudication and disability should be accepted in young drug addicts who need supplies and sufficient rehabilitation in order to be candidates of regaining a normal life while it is not accepted in old, frail patients of atherosclerotic disease undergoing intervention.

### Conclusion:

The main goals for management of IFFA are to eliminate sepsis, preserve the life and the limb viability and vitality (functionality), so management method should be tailored to individual requirements.

Adequate local debridement of infected tissues and ensuring healthy arterial margins is the primary non-debatable treatment.

To preserve a functional limb it is recommended that in the absence of a distal Doppler signal intraoperatively after clamping of CFA or EIA, revascularization should be elected, the extra-anatomical route is a reasonable approach.

Large multicenter prospective trials with longer follow-up should be performed so as to elucidate the best surgical methods for IFFA.

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