



Intravenous Drug abuse through Femoral Triangle and Femoral Artery Pseudo Aneurysms - A Review

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ABSTRACT

The femoral vein (FV) is frequently used to gain vascular access by habitual drug abusers. The most common life threatening complications of drug abuse includes cellulitis, abscess formation, acute or chronic deep venous thrombosis, infected thrombi in the vein and artery, arteriovenous fistulae, infective endocarditis, and pseudoaneurysm formation. Common femoral artery (CFA) ligation of IFAPs and local drainage with debridement is an effective, safe and simple option in the management of *infected femoral artery pseudo aneurysms* (IFAP). Primary repair with preservation of the native vessel is suggested if infection is limited. This systematic review of published literature was undertaken by undergoing an electronic search. Most of the available literature is in the form of case reports and case series

Keywords: Femoral triangle, Intravenous Drug abuse, Pseudoaneurysm, CFA ligation.

INTRODUCTION

Intravenous drug abuse represents a growing worldwide social and medical problem. Various vascular complications, such as deep venous thrombosis (DVT), infectious pseudoaneurysms, venous gangrene, and arterial embolization, can occur in drug addicts, frequently requiring prompt management¹.

Femoral triangle

The femoral triangle is a hollow in the anterior thigh region. Many large neurovascular structures pass through this area, and can be accessed relatively easily. Thus, it is an area of both anatomical and clinical importance. The femoral triangle contains some of the major neurovascular structures of the lower limb.

The femoral nerve arises from the branches of the second, third and fourth lumbar nerves, traverses the musculus psoas major and locates under the fascia iliaca separated from the femoral vessels, before it passes beneath the inguinal ligament in a groove between musculus iliacus and musculus psoas major. Proximal to the ligament depart the nervus cutaneous femoris lateralis and ramies to musculus iliopsoas. Distal to the ligament, branches go to the quadriceps muscle, the hip and knee-joint, the skin in the anteromedial aspect of the femur and the skin in the medial aspect of the crus.

The contents of the femoral triangle (lateral to medial) are: Femoral nerve innervates the anterior compartment of the thigh, and provides sensory branches for the leg and foot. Femoral artery is responsible for the majority of the arterial supply to the lower limb. The great saphenous vein drains into the femoral vein within the triangle.

Femoral canal - A structure which contains deep lymph nodes and vessels. The femoral artery, vein and canal are contained within a fascial compartment known as the femoral sheath.

A good way of remembering the contents are using the *acronym* NAVEL: N: Nerve. A: Artery.

V: Vein. E: Empty space (this is important as it allows the veins and lymph vessels to distend, so they can cope with different levels of flow). L: Lymph canal².

The femoral nerve is part of the lumbar plexus. It is formed by L2-4 roots and reaches the front of the leg by penetrating the psoas muscle before it exits the pelvis. The femoral nerve leaves the pelvis by passing beneath the medial inguinal ligament to enter the femoral triangle just lateral to the femoral artery and vein. Approximately 4 cm proximal to passing beneath the inguinal ligament, the femoral nerve is covered by a tight fascia, at the iliopsoas groove. The nerve can be compressed anywhere along its course, but it is particularly susceptible within the body of the psoas muscle, at the iliopsoas groove, and at the inguinal ligament.

The main motor component innervates the iliopsoas (a hip flexor) and the quadriceps (a knee extensor). The motor branch to the iliopsoas originates in the pelvis proximal to the inguinal ligament. The sensory branch of the femoral nerve, the saphenous nerve, innervates skin of the medial thigh and the anterior and medial aspects of the calf³.



Pseudoaneurysm

An aneurysm is defined as a dilatation of an artery greater than 1.5 times its normal diameter⁴. It can be classified as true and false (pseudo) aneurysm. When all three layers of the arterial wall in the aneurysm sac present, it is called true aneurysm. In pseudo aneurysm, only a single layer of fibrous tissue is present in the wall of the sac. Aneurysm can be grouped according to their shape like fusiform, saccular, dissecting or on the basis of etiology like atherosclerotic, traumatic, mycotic, syphilitic, collagen vascular disorder (Marfan's syndrome). Pseudo-aneurysms of femoral artery are rare⁵. Incidence of pseudo-aneurysm is on rise due to increase in endovascular procedures, hemodialysis and intravenous drug abuse. Drug abuse is a global social and health problem. Recently, there has been an increase in the incidence of major vascular complications such as infection of the femoral region vessels due to intravenous (IV) drug use. Approximately 75% of all admissions for accidental intra-arterial drug injections involve the lower limb; hence, the most common site of infected pseudoaneurysm is the inguinal region^{6, 7}. Infected pseudoaneurysm of the femoral artery represents a devastating complication of intravenous drug abuse, especially in the event of rupture. Operative strategy depends upon the extent of arterial injury and the coexistence of infection or sepsis. Options range from simple common femoral artery (CFA) ligation to complex arterial reconstruction with autologous grafts (arterial, venous, or homografts)⁸.

In patients presenting with a pseudoaneurysm of the femoral artery due to parental drug abuse, some authors advocate excision without revascularisation as a viable option. In one series of 18 patients Padberg et al undertook debridement and primary ligation in six patients, all had a Doppler ultrasound signal present at the ankle post ligation, none required amputation. Two patients did however return to theatre due to haemorrhage. In contrast, of the 12 other patients in the series who were treated with revascularization, three ultimately required amputation and there were 13 returns to theatre to deal with haemorrhage and infection⁹.

Venous Thrombosis

Venous thrombosis and septic thrombophlebitis are common complications in intravenous drug abusers and may lead to endocarditis on septic pulmonary emboli on both¹⁰.

Femoral Mononeuropathy

Femoral mononeuropathy can occur secondary to direct trauma, drug abuse, compression, stretch injury, or ischemia. The condition causes weakness predominantly of the quadriceps, which results in difficulty with ambulation. Femoral nerve compression may result in debilitating pain, requiring medical therapy and surgical intervention¹¹.

Most patients with a femoral mononeuropathy, however, can be treated conservatively with physical therapy, avoidance of excessive hip abduction and external rotation, and knee bracing to prevent buckling of the knee³. In femoral neuropathy, the iliopsoas is involved if the lesion is in the pelvis (above the inguinal ligament). The adductor magnus and brevis, which share lumbar innervation with the quadriceps and iliopsoas, are spared, since they are innervated primarily by the obturator and sciatic nerves. The femoral nerve is predisposed to compression within the psoas muscle. This commonly is associated with hemorrhage into this muscle due to haemophilia, anticoagulation therapy, or trauma. Direct trauma to the femoral nerve can occur as a result of penetrating wounds or fractures of the hip or pelvis. Intrapelvic masses may also cause compression of the femoral nerve. In addition, compression of the femoral nerve can be due to aortic or iliac aneurysms or tumors¹².

Lithotomy positioning during delivery or in gynecologic/urologic procedures also has been associated with compressive femoral neuropathy. In this position, the sharp flexion of the hip can compress the nerve at the inguinal ligament. Excessive hip abduction and external rotation cause additional stretch on the nerve¹³⁻¹⁵.

Arteriovenous Fistula

Peripheral vascular system AVFs resulting from drug abuse can present with septicemia of unknown origin, acute high-output heart failure, or features similar to deep venous thrombosis. AVF in these patients is usually the result of a mycotic aneurysm rupture into the adjacent vein or inadvertent substance injection simultaneously into the artery and vein leading to a fistula. This is known as the "groin hit" and results when IV drug abusers resort to groin injection for accessing the femoral vein, this practice may result in accidental arterial puncture, particularly when the vein is sclerosed or thrombosed. Arteriography and Digital Subtraction Angiography (DSA) are currently used for diagnosis¹⁶.

Femoral Nerve Dysfunction

Dysfunction is a loss of movement or sensation in parts of the legs due to nerve damage. More common causes of femoral nerve dysfunction are: Direct injury (trauma), prolonged pressure on the nerve, Compression or entrapment of the nerve by nearby parts of the body or disease-related structures (such as a tumor), prolonged pressure on the nerve decreases blood flow in the area. This can lead to further complications.

The femoral nerve can be also be damaged if you have: A broken pelvis bone, a catheter placed into the femoral artery in the groin, Diabetes which can cause widespread nerve damage and internal bleeding in the pelvis or belly area (abdomen).

One common risk factor is lying on the back with the thighs and legs flexed and turned ("lithotomy" position) during surgery or diagnostic procedures. Branches of the



femoral nerve can be compressed by tight or heavy waist belts. In some cases, no cause can be found^{17, 18}.

Mycotic Aneurysm

The name mycotic aneurysm was coined by Osler to describe aneurysms associated with bacterial endocarditis¹⁹. Most mycotic aneurysms in intravenous drug abusers are infected false aneurysms (without surrounding adventitia)^{20, 21}. The development of a mycotic aneurysm is believed to be due to the presence of a local infection adjacent to a blood vessel which causes a breakdown of the arterial wall. Serious Complications include rupture of the aneurysm with possible loss of the limb²².

Arterial Occlusion

Intra-arterial injection of drugs, intentionally or accidentally, may result in embolization of particulate material to peripheral vessels of the extremities. These peripheral emboli, possibly in association with superimposed thrombosis, infection, or foreign body reaction may cause vascular obstruction²². The cause of obstruction may be spasm induced by the drug on mixture, intimal damage, thrombus formation, or a combination of these factors. In the presence of clinical evidence of arterial occlusion, angiography is the diagnostic procedure of choice to define the site of obstruction²⁵.

Hematoma

A hematoma may occur after injection in a vein or artery on after the rupture of a mycotic aneurysm^{21,23,24}. On sonograms, a hematoma may range from an echoic to a variably echogenic mass; a hematoma cannot be differentiated from an abscess by its sonographic features alone. Aspiration is often necessary. If the hematoma appears to extend into the retroperitoneal on adduction compartments, CT may be helpful in defining its extent²⁶.

Cellulitis

Cellulitis may be caused by a combination of factors including direct needle trauma, infectious agents, local action of drugs and mixtures, and foreign bodies^{27,28}.

Treatment

The treatment of IFAP from drug abuse is difficult, and there is no consensus as to the ideal surgical procedure. The management options include excision and debridement of the IFAP with routine revascularization, excision and debridement of the IFAP with selective revascularization, and excision and debridement of the IFAP with ligation of the CFA without arterial revascularization. The use of synthetic or autologous conduit is complicated because of the presence of infection and unavailability of autologous conduit from repeated drug abuse or deep venous thrombosis (DVT). Synthetic bypass grafts carry the risk of infection because of the presence of groin infection, even when they are placed deep and away from the infected site, usually in

the form of an obturator bypass graft^{29, 30, 6}. Use of autologous vein is preferable in the presence of sepsis, but because of long-term intravenous drug abuse, autologous vein is frequently unavailable. Some authors have advocated the use of superficial femoral vein³¹. The conventional and most widely accepted surgical treatment is extra-anatomic bypass graft, such as obturator bypass graft along with local drainage, and debridement of the IFAP and infected soft tissues^{28,6}. Even with extra-anatomic bypass grafts, when a prosthetic graft is used, the incidence of graft infection, thrombosis, and amputation can be high^{32, 8}.

Supportive treatment is usually given if the symptoms come on suddenly, if there is only minor sensation or movement changes, no history of trauma to the area, and no sign that nerve function is getting worse.

Other treatments include: Corticosteroids injected into the area to control obvious swelling or inflammation and pain medication, if necessary. Various other medications can reduce the stabbing pains that some people experience. The benefits of medications should be weighed against any possible side effects. Some people might benefit from surgical removal of tumors or other growths that press on the nerve.

Physical therapy may be helpful to maintain muscle strength. Orthopaedic appliances such as braces or splints may help in walking. Your health care provider might recommend vocational counselling, occupational therapy, job changes or retraining, or similar interventions¹⁷.

CONCLUSION

Intra-arterial injection to the femoral artery with other drugs has been described as presenting with an immediate burning pain distal to the site associated with a hyperemic flush. Often the pain is constant, and is exacerbated by movement. The affected limb then becomes cold and mottled, distal pulses however are often palpable. It can also cause swelling which results in a compartment syndrome.

There are relatively few articles in the literature concerning lower limb accidental intra-arterial injection. Most cases have favourable outcomes with limb amputation being avoided. There is no accepted treatment protocol. Most patients respond to a combination of rest, elevation, analgesia and heparinisation. Regional nerve blocks, stellate ganglion blocks, sympathectomies, intra-arterial and intravenous vasodilators, and thrombolytic agents have all been described.¹

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