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Dislocated Knee Fracture with Thrombosis of the Popliteal Artery: Two Cases

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Abstract **Case Report**

Dislocation of the knee with thrombosis of the popliteal artery is an extremely rare injury [1, 4]. There are several approaches to its management. The authors report two cases of dislocated knee fracture with thrombosis of the popliteal artery, discussing their clinical presentation and management with a review of the literature.

Keywords: Knee dislocation, popliteal artery, revascularisation.

INTRODUCTION

Knee dislocations are rare but serious lesions, which can affect people of all ages; the prevalence of knee dislocation in the population is 0.02%, which makes it a rare entity and represents 2% of all dislocations [1]. The association of dislocation and thrombosis of the artery is even rarer. They are serious not only because of the multiple ligament ruptures but also because of the vascular complications [1]. There are several approaches to its management. We report two cases of dislocated knee fracture with thrombosis of the popliteal artery and review the literature.

PATIENT AND OBSERVATION

Observation N° 1

This is a 56 year old farmer with no notable medical history, victim of an accident on the public highway, type of (collision between car and tractor) direct point of impact at the level of the left knee; who was admitted to the emergency department for total functional impotence with significant pain and deformity of the knee. Clinical examination revealed a deformed knee (Fig 1), pain with medial displacement, cold lower limb, pale toes, vascular and venous examination: pedal pulses abolished and the patient showed signs of paralysis of the common fibular (loss of flexion and extension of the foot with loss of sensitivity on the lateral side of the leg). Standard radiographs of the knee, front and side, showed an anterointernal dislocation associated with a fracture of the medial tibial plateau. Emergency angiography performed within 4 hours confirmed rupture of the popliteal artery (Fig 2).

Admitted to the operating theatre as an emergency 5 hours after the trauma, the first stage of the operation consisted of closed reduction of the dislocation and fixation using a Hoffman-type external fixator with a tibiofemoral construct for the surgery. The second stage of the operation involved revascularisation by femoropopliteal bypass via the contralateral saphenous vein, with proximal and distal anastomosis via the external Gernez route, and fasciatomy of the three muscle compartments of the leg (Fig 3). Post-operatively, his dislocation was reduced by a Hoffman-type external fixator and his limb revascularised by re-establishing continuity of the popliteal artery. Preventive treatment with a low molecular weight anticoagulant was initiated. Active functional rehabilitation was started 6 weeks after removal of the external fixator.

At 1 year follow-up, the knee was functional but unstable, with atrophy of the lower limb. Functional evaluation of the knee according to the Cofras score was satisfactory.

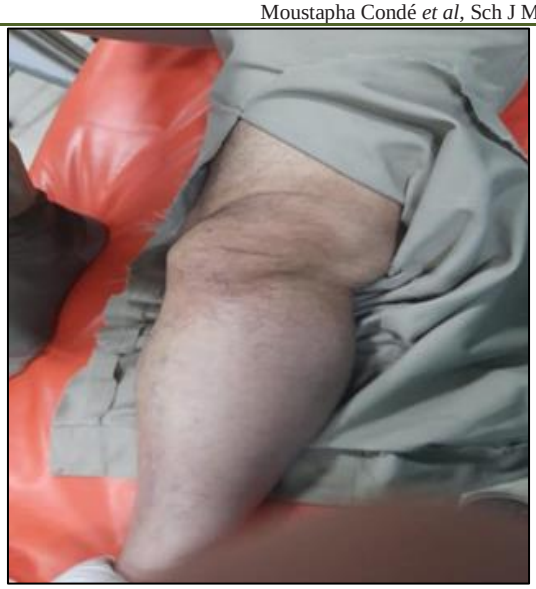

Figure 1: Knee deformaty on the patient1

Figure 2: Image of the dislocation

Figure 3: Image of the reduction the radio standard

Figure 4: Functional evaluation of patient 2, after 2 years

Observation N° 2

This is a 47 year old military patient with no particular pathological history, admitted to the emergency department 5 hours after a closed trauma following a pedestrian type accident on the public highway, hit by a car with a direct point of impact on the left knee causing pain, deformity and total functional impotence of the left knee. Clinical examination revealed a deformed, painful knee, no pedal pulse, and a pale limb. The knee X-ray showed an anterior dislocation (Fig 5). An arterio-scanner of the knee showed thrombosis of the popliteal artery (Fig 6). Admitted to the operating theatre 5 hours after the trauma, the first stage of the operation consisted of closed reduction of the dislocation and fixation using a Hoffman-type external fixator with a tibiofemoral construct for the surgery. The second stage consisted of revascularisation surgery using a femoropopliteal bypass via the contralateral saphenous vein with proximal and distal anastomosis via the external Gernez route for revascularisation surgery and fasciatomy of the three muscle compartments of the leg. The patient was lost to follow-up for 6 months. The spontaneous evolution was marked by an inveterate dislocation of the knee, which led to the indication of a hinged PTG in this patient (Fig 7).

Figure 5: Inveterate disclocation on the patient 2

Figure 6: Arterio CT Scan

Figure 7: Hinge PTG perfomed on this patient

DISCUSSION

Vascular trauma is on the increase, and trauma to the popliteal artery still has a serious prognosis, with a mortality rate of 5-10% and an amputation rate of 20-30%.

The association of these two lesions is all the more rare, given that the prevalence of knee dislocation in the population is 0.02%, which makes it a rare entity and represents 2% of all dislocations [1].

The diagnosis of dislocation is most often made in an emergency, and is based on: Clinical history, with a study of the mechanism of injury and the severity of the trauma, which may point to the type of dislocation and its potential complications [2].

Examination of the knee: Functionally, the knee is totally impotent and hyperalgesic [1].

Clinically, it shows an increase in volume and/or a sometimes significant deformity: Anterior protrusion of the tibia and filling of the popliteal fossa posteriorly in anterior dislocation; anterior protrusion of the femoral condyles, with the patella often appearing dislocated laterally, or fractured (transpatellar dislocation) in posterior dislocation; classic "bayonet" deformity in lateral or medial dislocation. In some cases, the deformity is not as caricature-like: posterolateral dislocation, which accounts for almost a third of cases, is characterised by a depression of the skin opposite the medial joint space, the "hollowing" of which may become even more pronounced when reduction is attempted ("dimple sign"), leading to fears of irreducibility due to incarceration of the medial condyle ("buttonholled") in an anteromedial capsular breach. Sometimes, the deformity is absent: it is always possible that the dislocation has spontaneously reduced or that it has been reduced at the scene of the accident. "Any enlarged, painful, lax knee following violent trauma must be suspected of dislocation"[2].

Looking for immediate complications: skin examination: wounds and/or bruising, joint opening [2]. A vascular examination: distal staining and warmth, palpation of pulses (although their presence does not rule out vascular damage), haematoma of the popliteal fossa [2].

A neurological examination: tibial nerve and common fibular nerve (this assessment may be made difficult by pain, severe oedema or incipient ischaemia) [2].

A general examination: in the case of polytrauma, which will guide further investigations. The main risk is that a dislocated knee may be overlooked in patients with associated fractures (femur + tibia) or in a patient in a coma [2].

Patients presenting with vascular trauma to the limbs require urgent treatment, the aim of which is to limit blood loss and the duration of ischaemia [2].

The clinical examination is essential, as it allows rapid assessment of the severity and topography of the lesions, leading to an indication for immediate surgical intervention in the presence of signs of acute sensory-motor ischaemia and/or "hard signs" of vascular trauma (pulsed bleeding, expansive haematoma, abolition of a distal pulse, cold and pale limb, thrill, murmur). However, additional tests may be of major importance if there is any doubt about the diagnosis, if there are no obvious signs of arterial trauma, or if there are "soft signs" of vascular trauma (peripheral neurological deficit, moderate haemorrhage, palpable but diminished pulse). In these cases, Doppler ultrasound of the limbs, combined with measurement of the systolic pressure index, can detect vascular trauma with a sensitivity of 95% and a specificity of 99% [2].

A pressure index of less than 1 is indicative of arterial injury in the vast majority of cases (specificity of 97%), and requires diagnostic angiography. The new

generation of multi-bar helical angiography scanners can diagnose proximal vascular trauma with very good sensitivity and specificity. The main limitation of this examination is the poor visualisation of distal axes, particularly after trauma, and the presence of calcifications. Whole-body CT scans can be used to detect associated lesions and guide the therapeutic strategy. Intraoperative arteriography is recommended in the case of distal arterial lesions or lesions requiring endovascular treatment, such as arteriovenous fistulas, dissections or false aneurysms. It should be performed systematically after vascular restoration [2].

There is no consensus on the sequence of management of bone and vascular lesions [3]. It is a matter of common sense [3]. Prolonged ischaemia lasting more than 6 hours requires initial revascularisation in order to increase the chances of limb salvage, particularly in the case of complex osteoarticular lesions whose repair is proving difficult and could require long operations, prolonging the duration of the ischaemia. Similarly, the initial reduction and stabilisation of a dislocated fracture is essential before any revascularisation procedure, as it may determine the permeability of the arterial repair. In all cases, the presence of the vascular surgeon during the orthopaedic procedure is essential in order to check that the patient is correctly positioned, that the operating field is not obstructed, particularly if an external fixator is used, and that the arterial reconstruction is intact [3].

Antithrombotic treatment will depend on the associated lesions [3]. However, there is controversy regarding management strategies and recent studies have suggested acute cruciate ligament reconstruction [6]. Patrick et al [5] suggest the initial use of an external fixator in cases of vascular injury, joint fracture and overall instability, with definitive surgery recommended within two weeks. Some studies recommend a sequenced approach, using external fixation at the emergency visit and ligament reconstruction three to six weeks post-injury, with reconstruction of all ligaments using tissue bank grafts. Fabiano Kupczik *et al*., suggest arthroscopic reconstruction of central injuries and repair or reconstruction of peripheral injuries as soon as possible [6].

The management of vascular disorders depends on the severity and age of the ischaemia [1].

Vascular sutures must be performed in healthy tissue. Direct suturing of open wounds is only possible in exceptional cases, and can lead to stenosis and secondary rupture. It should preferably be combined with a venous or prosthetic patch. Resection with end-to-end suture is performed more frequently, provided that the loss of substance is limited and that the suture is performed without tension. In the case of complex lesions or significant loss of substance, arterial bypass surgery is indicated, with saphenous vein grafting remaining the material of choice. Contralateral venous harvesting is recommended and becomes the rule when a venous lesion is associated, in order to preserve the superficial venous return of the traumatised limb. In the absence of a saphenous vein, the use of arm veins or even a prosthesis may enable the limb to be saved as a matter of urgency. Thrombectomy (using a Fogarty catheter) of the frequently thrombosed downstream bed is often necessary before bypass surgery. Associated venous wounds are common, occurring in 40% of cases. The repair must be carried out as a matter of principle in the areas at risk (iliac, femoral and popliteal); the repair procedures are similar to those for arterial lesions. The material used is exclusively venous, and reconstruction of large venous axes requires use of the jugular vein [1].

Nerve injuries, from neuropraxia to total transection, are less frequent, with a rate of 10 to 37%. They mainly affect the lateral popliteal sciatica and are associated with medial or rotatory lateral dislocation. The treatment of these nerve injuries remains controversial [7]. Surgical explorations with primary nerve repair are admittedly unsuccessful. Sedel [7] recommends abstention for 3 months, after which the nerve palsy either disappears (nerve continuity preserved) or persists. In the latter case, surgical exploration with nerve repair is essential.

Primary amputation is a wise decision when the chances of preserving and recovering function of the limb appear to be compromised from the outset: ischaemia no longer present, seen late, major and multiple traumatic lesions (osteoarticular, nerve, vascular and soft tissue). Several scores have been proposed to establish guidelines for indications of primary amputation after open limb trauma. The most widely used is the MESS score (Mangled Extremity Severity Score), with a score of 7 or more having a predictive value of 100% for amputation. None of the different scores used has good specificity for amputation [3].

The factors associated with a high risk of amputation are:

- The duration and severity of ischaemia.
- Associated venous lesions requiring one or more venous ligatures.
- Dislocating osteoarticular and soft tissue lesions responsible for a suppression of collaterality or an infectious risk.
- Associated lesions because of their specific severity and because they require urgent treatment delaying the treatment of arterial lesions [3].

CONCLUSION

Fracture-luxation of the knee with thrombosis of the popliteal artery is rare, and constitutes a genuine vascular emergency, occurring most often in high-energy trauma. It has benefited from considerable progress in

diagnosis and surgical treatment. There is no consensus on the sequence of treatment for bone and vascular lesions, but it is a matter of common sense. The prognosis depends on the time taken for treatment and the technical quality of the vascular repair.

Conflicts of Interest: the authors declare no conflicts of interest.

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