VASCULAR INJURY ASSOCIATED WITH
LOW-VELOCITY DISLOCATIONS OF THE KNEE

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Complete dislocation of the knee is a relatively rare condition. When it occurs as a result of high-velocity injury, such as in a road traffic accident, associated vascular injury is generally suspected. In low-velocity injuries, however, distal pulses are often maintained throughout, and the possibility of vascular injury may erroneously be discounted. We report four cases of low-velocity dislocation of the knee, only one of which had an overt vascular disruption, but three of which had arterial damage. On the basis of our experiences, we recommend arteriography in all cases of complete dislocation of the knee.

Dislocation of the knee is rare, but is being reported more frequently. Hoover (1961) reported only 14 knee dislocations in over two million admissions to the Mayo Clinic between 1911 and 1960. Alberty, Goodfried and Boyden (1981) reported six cases admitted to the major hospitals in the Portland area between 1971 and 1980. It is likely that the true incidence of dislocation is much higher, as many cases are reduced spontaneously or before hospital admission (Kennedy 1963).

With such major disruption of the joint, considerable surrounding soft-tissue injury is inevitable. Anchored above and below as it crosses the popliteal fossa, the popliteal artery is particularly liable to injury. The collateral circulation to the lower limb, unlike that to the forearm, is very poor, and is insufficient to maintain the viability of the leg. Jones et al. reported vascular injury in nine of their 13 anterior dislocations (Jones, Smith and Bone 1979). Some 80\% of O'Donnell's series had concurrent vascular injury (O'Donnell et al. 1977). In a much larger series, Green and Allen (1977) reported a 32\% vascular injury rate in a total of 245 dislocations of the knee.

Some confusion exists as to the terminology relating to knee dislocations, but such injuries should always be described in terms of the tibial displacement with respect to the femur. These injuries are therefore described as anterior, posterior, medial, lateral and rotatory. Anterior dislocation is by far the most common, and is usually produced by hyperextension of the knee. Kennedy (1963) showed in his cadaver experiments that the posterior capsule ruptured at 30° of hyperextension. This was followed by rupture of the posterior cruciate ligament and forward displacement of the tibia on the femur. An average of 50° of hyperextension produced significant damage to the popliteal vessels.

The much less common posterior dislocation required considerably more force to reproduce. The inherent stability provided by the extensor apparatus is clearly very great. Medial and lateral dislocations without fracture are extremely rare, as an associated tibial plateau fracture is almost invariable.

In cases where distal pulses are absent, there is little debate as to the correct treatment: vascular repair must be performed within six to eight hours if the limb is to be saved. If the site of injury is obvious, arteriography may be dispensed with, and vascular repair undertaken directly. When low-velocity trauma is involved, such as occurs in sports injuries, the distal pulses are often maintained. This paper illustrates that even in the presence of distal pulses there is a very high incidence of significant intimal damage to the popliteal artery after dislocation of the knee.

CASE MATERIAL AND RESULTS

In the three years 1982 to 1985, four cases of complete dislocation of the knee as a result of low-velocity trauma were treated at our two Belfast hospitals. Two of these injuries occurred during Rugby football, one was a trampoline accident, and the fourth was the result of a fall while intoxicated. Three involved anterior dislocation and one lateral dislocation.
Case 1. This anterior dislocation was the result of a trampoline accident, and involved complete disruption of the popliteal artery, as demonstrated by the arteriogram (Fig. 1). As the injury was recognised early, re-vascularisation was undertaken; this was successful and the limb was saved. Three years later, however, the patient has a grossly unstable knee and wears a brace. There has been no recovery of lateral popliteal nerve function.

Case 2. This was a lateral dislocation resulting from a Rugby tackle. Reduction was achieved before arrival at hospital despite a concomitant fracture of the tibial plateau. Pedal pulses were present throughout. Ligamentous repair was undertaken the next day and the patient was immobilised in a plaster cylinder. He returned to theatre on the fifth day because of persistent pain over the anterior aspect of his leg, and was found to have almost complete necrosis of the musculature of the anterior compartment, necessitating extensive debridement. After several reconstructive procedures he regained a useful limb with a stable knee which flexed to beyond 90°.

Case 3. This case illustrated the extent of covert arterial damage to be found in dislocation of the knee. This was a 20-year-old university student who was injured during Rugby training. He was carrying a much heavier individual on his back when he twisted and his knee gave way. He sustained a complete anterior dislocation (Fig. 2). This was reduced and he was immobilised in a plaster cylinder; the foot pulses were present throughout. The next day he complained of pain in his leg and, in view of our experience with our second case, an arteriogram was requested. This showed diminution of flow distal to the knee, with the notched and narrowed appearance of intimal disruption (Fig. 3). When vascular repair was undertaken intimal damage was found over a 5 cm segment directly behind the knee. No ligamentous reconstruction was undertaken, but, one year later, he had a stable knee with flexion to 130°. Lateral popliteal nerve function recovered completely.

Case 4. This anterior dislocation (Fig. 4) was caused by a fall while intoxicated. The patient’s knee was reduced and immobilised in a plaster cylinder. There was no diminution of pedal pulses, but nevertheless an arteriogram was requested. Despite the degree of disruption of the knee evident on the original radiograph, the digital subtraction angiogram was normal in both arterial and venous phases.

Fig. 1

Case 1. Complete disruption of the popliteal artery following dislocation of the knee.

Fig. 2

Fig. 3

Case 3. Figure 2 – Anterior dislocation of the knee. Figure 3 – Arteriogram showing notching and narrowing of the popliteal vessels. At operation, intimal damage was demonstrated over a 5 cm segment behind the knee.

Fig. 4

DISCUSSION

These cases illustrate the serious consequences for the popliteal vessels of dislocation and fracture-dislocation of the knee. In particular, the incidence of covert injury to the popliteal vessels is much higher than was previously thought. The principle of careful expectancy, which works with reasonable success in the upper limb, is not applicable to the lower extremity. Attributing diminished pedal pulsation to “arterial spasm” is to be condemned; indeed, the term arterial spasm should never be used in dealing with injuries of the lower limb.

Significant damage to the popliteal vessels can exist, even in the presence of foot pulses (Welling, Kakkereril and Cranley 1981). Indeed, Chapman (1985) reported two cases of complete popliteal disruption following ligamentous injury without dislocation. The trauma required to dislocate the knee almost invariably damages the popliteal artery. The degree of covert damage which can exist is illustrated by Figure 3, which does not show the total disruption of the intima which was found over a 5 cm length of vessel directly behind the knee.

The policy of expectancy leads to unsatisfactory results such as that seen in our second case where loss of the anterior compartment musculature was almost certainly the result of trauma to the anterior tibial artery. Major vascular disruption is not an inevitable consequence of dislocation of the knee, as the normal arteriogram in Case 4 illustrates. Nevertheless, the association of vascular injury with even low-velocity dislocation is sufficiently high to warrant appropriate investigation. The very minimum required is Doppler examination, but we feel that the small morbidity associated with arteriography is justified when the potentially disastrous consequences of missed vascular disruption are considered.

Occasionally, long-term vascular complications of dislocation are seen. Figures 5 and 6 are the arteriograms of a 52-year-old man who presented with intermittent claudication. Twenty-five years previously he had sustained a dislocation of the knee playing Rugby football. He was a non-smoker, and had no other evidence of peripheral vascular disease. The lower arteriogram shows a short-segment block directly behind the knee, almost certainly due to a degree of intimal damage at the time of injury.

These cases illustrate the often covert nature of vascular injury following low-velocity dislocation of the knee. We strongly advise an arteriogram in the presence of such a dislocation even if foot pulses are present, because of the frequent association with extensive arterial intimal damage. If such a policy is instituted then the appalling morbidity associated with major knee trauma, and the incidence of subsequent amputation, can be greatly reduced.

REFERENCES


