Knee dislocations and their management

A report of 16 cases

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We retrospectively studied the outcome of 16 knee dislocations. 11 patients had surgical treatment, 4 were managed nonoperatively and 1 patient died. In the elderly the outcome was poor, regardless of the type of treatment. Only 3 adolescents obtained excellent results and 2 young adults had good results after surgical repair of the knee. Concurrent arterial and nerve damage increased the morbidity.

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Knee dislocations are uncommon and often devastating if associated with neurovascular damage. In a report from the Mayo Clinic, Hoover (1961) found only 14 knee dislocations in 2 million admissions. Similarly, two large centers reported only 53 and 28 dislocations over 10 and 25 years, respectively (Meyers et al. 1971, Cooper et al. 1992). Only few surgeons are able to treat a handful of cases in a lifetime.

The mechanisms of knee dislocation vary from a high energy trauma exerting an angulatory and rotational deformity on the knee with the tibia or the foot impacted on the ground, to a high torque, low velocity injury on a crushed leg. Such impacts may result in life threatening multisystem injuries, which must be managed with priority (Meyers et al. 1975, Roman et al. 1987, Frassica et al 1991, Almekinder and Llogan 1992).

Surgical vascular complications in association with knee dislocations has been reported in one fifth to two thirds of the cases (Meyers and Harvey 1971, Hoover 1961), i.e., 20 times commoner than in long bone fractures and other dislocations of the lower extremity (Cone 1989). Knee dislocation with concomitant vascular damage not repaired within the first 8 hours may lead to amputation in more than four fifth of the cases (Good and Johnson 1995). Common peroneal nerve injury occurs in less than one third of the cases (Cone 1989, Good and Johnson 1995). We have found no report on concomitant injury of the tibial nerve. Whether early surgical repair decreases the incidence of late complications, such as instability or posttraumatic arthrosis, remains controversial (Meyers et al. 1975, Sisto and Warren 1985, Taylor et al. 1972). We present, in this retrospective study, 16 knee dislocations diagnosed and managed by the same surgical team over 12 years.

Patients and methods

Between 1983 and 1995, 16 knee dislocations in 16 patients, mean age 14 (15–81) years, were managed. The right knee was involved in 4 and the left in 12 cases. The dislocations were closed in 14 and open in 2 patients. One anteromedial open grade IIIa knee dislocation occurred with avulsion flake-fractures of the medial patellar rim and lateral cortex and of the corner of the lateral femoral condyle. The other open dislocation was a lateral bumper injury in an elderly woman with a posteromedial open grade II dislocation of the knee. One patient with closed dislocation had a longitudinal undisplaced intercondylar fracture of the tibia, while in another patient, an avulsion fracture was also observed on the posterolateral cortex of the femoral condyle.

The mechanism of injury were motor vehicle accidents in 11 patients, fall from height in 3 and crush injuries in 2 cases. The dislocation was diagnosed as an isolated injury in 8 patients. Of the 8 patients with multiple trauma, 1 died on the second day from severe head and chest injuries.

Only 2 patients had vascular injuries. One was a 16-year-old boy who sustained a low velocity hyperextension injury to the degree that the patient saw the sole of his foot in front of his face. He presented with the joint reduced but very unstable and with a diffuse popliteal and thigh hematoma with palpable pulses of the posterior tibial artery, but no pulses on the dorsum

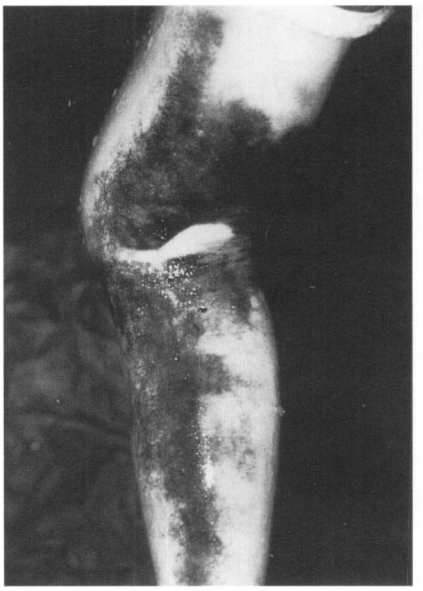
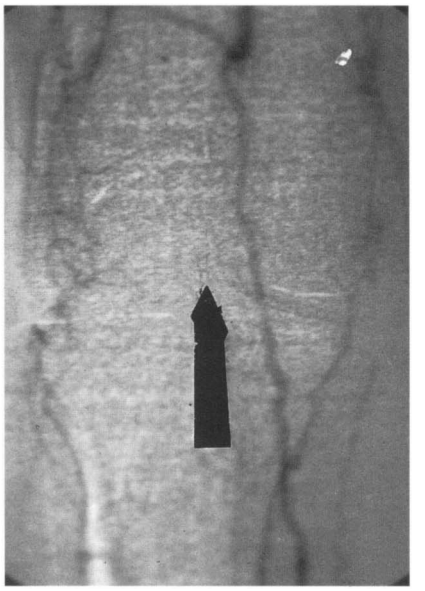


Figure 1. Hematoma in the popliteal fossa and diffuse echymosis towards the thigh in a 16-year-old boy who sustained a low velocity hyperextension injury of the knee.



Digital subtraction angiography revealed rupture of the popliteal artery and filling of the distal segment through a collateral branch, to a degree that pulses were palpable at the ankle level (arrow shows joint level).

of the foot (Figure 1). Angiography revealed a rupture of the popliteal artery, collateral circulation and delayed filling of the posterior tibial artery. The popliteal fossa was explored and both the anterior and the posterior tibial vessels were found ruptured from the popliteal vessels. The common peroneal nerve was ruptured at the level of the fibular head and the tibial nerve was avulsed and damaged extensively, apparently from the popliteal fossa to the lower half of the tibia. 2 long saphenous vein grafts were used, 1 to bridge the popliteal artery with the posterior tibial artery, and 1 to establish flow in one deep vein. The procedure was completed with a 4 compartment fasciotomy. Peroneal nerve injury also occurred in a second patient, with posterolateral dislocation. The multitrauma patient, who died, was found at necropsy to have ruptured both the peroneal nerve and popliteal artery. Thus, 4 nerves (1 tibial and 3 peroneal) were injured in the 16 patients.

12 of the patients were transferred in the emergency unit with their knees dislocated, and 4 presented with the joint reduced. Of the later, 1 with an anterior dislocation was described above, while the other was a low-velocity posteromedial dislocation reduced at the scene of the injury.

With exception of the multitrauma patient who died, 15 dislocations were managed. After initial reduction, they were treated as follows: 4 elderly patients were managed nonoperatively with a long leg cast in 30° of flexion for 45 days followed by physiotherapy. 11 patients were operated on (1–20 days after injury): 8 active individuals who were all under 38 years of age and 3 patients 54, 63 and 65 years of age, respectively. The operative findings were as following: the anterior cruciate ligament (ACL) was ruptured in 7 and avulsed from its insertion in 4 cases. The posterior cruciate ligament (PCL) had a mid-substance rupture in 5 knees, in 5 it was avulsed and in the open anteromedial dislocation it was intact. The posterolateral corner was detached from the femur in 4 cases, including the popliteal tendon with flake fractures in 2. There was peripheral tear of the medial meniscus in 2 cases. All ligaments injuries were repaired through an extended anterior approach and a medial parapatellar arthrotomy. In 4 knees with both cruciate ligaments ruptured. The ACL and PCL were augmented by a semitendinosus and a middle-third bone-patellar tendon-bone graft. The avulsed ligaments and capsule were secured with pull out sutures and in the cases with an avulsed posterolateral corner together with the lateral cortex of the lateral femoral condyle, it was fixed with 2 screws with washers. The knees were held in 20° of flexion and motion started in a hinge brace from the fourth postoperative week.

14 patients, at a follow-up after average 4 (2–12) years, were examined clinically and radiographically. Clinical evaluation included: range of motion, varus or valgus deformity in standing position, laxity and

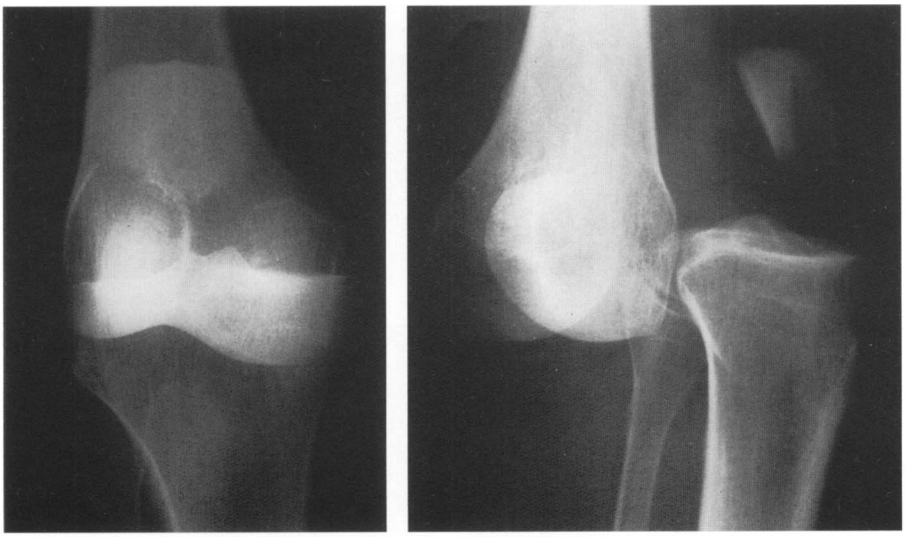


Figure 2. Postero-medial dislocation of the knee with peroneal nerve injury which recovered at 7 months after neurolysis performed after 4 months.

ligamentous instability, pain, joint effusion and atrophy. Radiography included lateral, intercondylar and standing posteroanterior views. Arthritic changes were assessed from the presence of osteophytes, subchondral sclerosis and joint space narrowing. Function was graded as excellent, good, fair and poor (Meyers et al. 1971, 1975). A rating of excellent implied that the patient was able to return to work without instability, pain or disability and nearly normal range of motion. A rating of good was given to a patient with mild instability and limitation of motion. A rating of fair was given for major instability or disability. Patients with poor rating were disabled and unable to return to work because of instability or pain; the latter had greater varus deformity compared to the unaffected side and more severe arthrotic changes in all the compartments of the joint. Patients experienced pain only with strenuous activity, had a substanial loss of extension and flexion, and a decrease of muscle power.

Results

The patient with the ruptured popliteal artery and tibial and peroneal nerves, developed necrosis of the forefoot and later fibrosis of the anterior and the peroneal muscular compartments. He underwent midtarsal amputation and plantar arthrodesis with late reconstruction of the PCL and ACL with patellar tendon and iliotibial band grafts, respectively. The patient returned to routine activities with very good knee function, wearing a custom made foot orthosis. The loss of the forefoot and of the function of the ankle made Meyers classification not applicable.

The patient with the peroneal nerve injury underwent nerve conduction studies 3 months after the dislocation which revealed no signs of spontaneous recovery. The peroneal nerve was explored and found intact, but constricted from fibrosis. Microsurgical neurolysis was performed, and 4 months later complete recovery was observed with a 5° loss of ankle dorsiflexion (Figure 2).

1 patient underwent a total knee arthroplasty of the constraint type 10 years after the dislocation. 2 knees were rated poor according to the evaluation scale suggested by Mayers (Table 1).

Of the remaining 11 patients who received operative treatment, 3 were excellent including the young patient with the open dislocation. Their ages at injury were 15, 17 and 18 years, with follow-up at 53, 36 and 58 months, respectively. 2 knees were rated good, both in active men. Radiography showed mild arthrosis. The patients had 110° range of motion and mild thigh muscle atrophy. 2 patients were rated fair mainly due to severe limitation of motion, not exceeding 95° of flexion and 5° loss of extension. Poor results were found in 3 patients. 1 developed reflex sympathetic dystrophy and 2 patients had severe limitation of motion and instability.

Discussion

Because of the high incidence of neurovascular injuries complicating dislocation of the knee, the leg must

Table 1. Observations in 16 patients with dislocation of the knee

Case	Age	Trauma [a]	Months from injury	Popliteal art. rupt.[b]	Nerve damage	Status at admission	Management	Outcome
1	70	MVA	146	+	peroneal rupture	reduced	conservative	dead
2	54	fall	140	–	–	dislocated	conservative	TKR 10 yrs later
3	81	MVA	59	–	–	dislocated	conservative	–
4	18	crush	58	–	–	reduced	surgical	excellent
5	65	fall	50	–	–	dislocated	surgical	poor
6	72	crush	52	–	–	dislocated	conservative	poor
7	17	MVA	36	–	–	open dislocated	surgical	excellent
8	19	MVA	33	–	–	dislocated		good
9	15	MVA	53	–	nerve apraxia	dislocated		excellent
10	16	crush	44	+	peron. + tib. rupt.	dislocated		good
11	38	fall	39	–	–	dislocated		good
12	27	MVA	32	–	–	dislocated		fair
13	63	MVA	29	–	–	reduced		poor
14	54	MVA	26	–	–	dislocated		poor (pellegrini)
15	58	MVA	22	–	–	open reduced	conservative	poor
16	37	MVA	21	–	–	reduced		fair

[a] MVA motor vehicle accident; [b] Artery rupture

be evaluated for pulses and nerve function before and after reduction. Palpable pulses near the ankle does not prove absence of vascular damage. The survival of the limb is related to the duration of ischemia. An amputation rate of 0.1 has been reported in cases with vascular repair occurring in less than 6 hours, but exceeds 0.8 when revascularization was delayed for more than 8 hours. Of the 2 cases with concurrent vascular and nerve damage, 1 was fatal and the other was limb-threatening, leading to partial amputation. In contrast, isolated nerve injuries were recoverable.

Review of the literature reveals that both operative and nonoperative treatment can give acceptable results. We choose surgical treatment for almost all individuals younger than 40 years. Nonoperative treatment was selected for only 4 elderly patients. Adolescents and young adults demand a stable knee joint that could not be guaranteed with nonoperative treatment. Surgery is required to appreciate the extent of the capsulo-ligamentous injury and for ligament repair or reconstruction. The results were satisfactory only in the very young patients. More mature adults did not have comparable results. The establishment of mild arthrotic changes, even in the cases with excellent knee function appears to be related not only to some residual instability after ligamentous reconstruction, but also to the amount of energy dissipated on to the cartilage at the time of the injury.

In conclusion, our experience with a relatively small number of knee dislocations, demonstrated that delayed primary operative repair of the capsulo-ligamentous structures gave excellent results, in the short-term, only in the adolescents without initial vascular damage. The rupture of both the artery and the peroneal nerve in the same leg was associated with either fatality or to partial limb loss. Both operative or conservative management of patients over 50 years, gave the least satisfactory results.

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