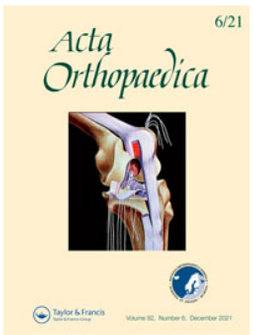

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Stability and motion after traumatic dislocation of the knee

In a series of 10 patients with traumatic dislocation of the knee joint, closed reduction could be accomplished in nine. Conservative treatment was employed in four and operative repair of the ligaments and capsule in six patients.

In two of three patients with complicating artery injury, vascular repair was successful. Above-knee amputation was performed in one patient because of delay in the diagnosis of vascular injury and in another patient because of arteriosclerotic gangrene. At follow-up examination, on average 6 years after the accident, the stability and motion of the knee were evaluated as good in five patients (three operated), fair in two (one operated) and as poor in one operated patient. The conclusions are that good knee function can thus be achieved with both conservative and operative treatment, and that limb salvage depends on prompt diagnosis and treatment of vascular complications.

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Traumatic dislocation of the knee joint is a rare injury (Hoover 1961, Kennedy 1963, Quinlan & Sharrard 1958), and most series are small. Because of the extensive soft tissue damage, and the neurological and especially the high incidence of vascular complications, the injury is a threat to the limb. In patients with vascular complications, amputation has been a frequent outcome with an incidence as high as 90 per cent (Eger et al. 1970), but in the last decade more papers have shown promising results with successful arterial repair in 85–90 per cent of the cases (Green & Allen 1977, Savage 1980). Opinions differ about whether conservative treatment is sufficient, or whether operative repair is necessary to achieve a stable knee. (Jones et al. 1979, Meyers et al. 1975, Shields et al. 1969, Taylor et al. 1972, Trickey 1976, Wright 1980).

The aims of this paper are to emphasize the severe consequences of dislocation of the knee joint, to stress the importance of diagnosis and treatment, especially of vascular complications, and to evaluate the long-term results concerning stability and motion.

Patients and methods

This paper is based on 10 patients with traumatic dislocation of the knee joint, treated in the 10-year period 1971–1981 in the departments of orthopaedic surgery, Odense University Hospital. There were two females and eight males with an average age of 32 (range 16–67) years. The right knee was involved in three and the left knee in seven patients. Eight patients were injured in traffic accidents (moped rider against automobile four, motorcycle single accident two, cyclist against automobile two). One patient injured his knee on a trampoline and one patient received his injury in a fall from one level to another.

The clinical diagnosis was confirmed by radiographs. There were five anterior dislocations (two with a medial component), two lateral, two postero-lateral and one rotational dislocation. In two patients the dislocation was open, and in both the treatment was operative.

Orthopaedic lesions

Closed reduction was successfully performed in nine patients. In one patient with a postero-lateral dislocation, closed reduction could not be accomplished because of interposition of the medial collateral liga-

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ment and the postero-medial capsule, as disclosed at subsequent operation. All reductions were completed within 4 h from the injury, six within 2 h. Assessment of the ligamentous damage was performed by manual stress-testing after reduction. In three patients the knee was evaluated as stable, and no operation was carried out. One of these patients, who at the time of the accident was receiving a disability pension because of arterial claudication, sustained a lateral dislocation. Associated fractures in the tibial condyles and the lateral femoral condyle healed uneventfully after conservative treatment. Within 3 months arteriosclerotic gangrene supervened, and 4 months after the injury an above-knee amputation was performed. In another patient, repair of the ligaments was not performed because of concomitant vascular injury, but during the arterial repair a tear of both cruciate ligaments and both collateral ligaments was noted. These four patients are described below as the "non-operated" group.

In six patients the knee was assessed as unstable, resulting in operative repair of torn ligaments and capsule. Four patients were operated immediately after closed reduction, two patients after 1 week. All these patients had tears of both cruciate ligaments. Both collateral ligaments were torn in two patients, the medial collateral ligament in two patients and the lateral collateral ligament in two patients. Both menisci were torn in two patients, the medial meniscus in one patient and the lateral meniscus in one patient. One patient showed a total tear of the patellar ligament.

In five patients all injured ligaments and the capsule were sutured. For unknown reasons, in one patient with a tear of all four ligaments, repair of only the lateral collateral ligament was performed. In two patients both menisci were removed and in another two a meniscal lesion was sutured. These patients are described below as the "operated" group.

After closed reduction or operation, immobilisation for an average of 40 (range 3–56) days was obtained by a plaster cylinder in nine patients and by external fixation in one patient. Associated lesions were encountered in five patients, including fractures in the injured knee in three (Table 1). All fractures were treated conservatively.

Table 1. Associated lesions in five patients with traumatic dislocation of the knee

Lesion	No. of patients
Tibial condyle fracture	3
Femoral condyle fracture	1
Fractures outside knee region	4
Cerebral trauma	3
Avulsion of brachial plexus	1

Neurological lesions

Before reduction, four patients, three with an anterior and one with a rotational dislocation, showed signs of damage to the peroneal nerve, but in three patients the peroneal palsy vanished totally following reduction.

In the fourth patient a transplantation from the sural nerve was performed 2½ months later. Another patient, with a postero-lateral dislocation, who initially did not show any signs of peroneal palsy 2 days later gradually developed total peroneal paralysis. Operative repair was not attempted.

Vascular lesions

Prior to reduction, four patients had no pedal pulses, but one patient regained normal pulses following closed reduction. Popliteal artery injury occurred in three patients, two with an antero-medial and one patient with a rotational dislocation. These patients were all referred from other hospitals because of the arterial complication. In two of these patients arterial repair was successfully performed 6 and 12 h after the accident. The third patient, a 16-year-old boy, underwent acute operative repair of torn ligaments and capsule including meniscectomy. However, a popliteal artery injury was missed. Two attempts at arterial repair during the following week failed, necessitating above-knee amputation.

Results

Above-knee amputation was necessary in two patients because of vascular injury and arteriosclerotic gangrene, respectively. Prosthetic fitting was accomplished in both patients. The remaining eight patients were all seen by one of us, on average 72 (range 14–118) months after the accident, and questioning, physical examination including manual stress-testing, and radiography were performed.

Non-operated group

Periodic pain when the knee was strained was experienced by one patient. No patient showed any instability of the knee compared with the non-injured knee. All patients showed 90 degrees of flexion or more, but the mean lack of flexion compared with the other knee was 33 degrees. One patient had a 10 degrees lack of

extension; she limped and used a cane. Radiological arthrosis, as defined by Ahlbäck in 1968, was seen in two patients. In one patient a few millimetres of subluxation was seen.

Operated group

Strain-associated pain was experienced by two patients. In three patients no instability was detected compared with the other knee. One patient had a valgus instability of 10 degrees, a varus instability of 15 degrees and a posterior drawer sign of 1 cm. Another patient had a varus instability of 10 degrees and an anterior drawer sign of 1 cm, but none of these patients complained of giving way. All patients showed 100 degrees of flexion or more, and the mean lack of flexion was 16 degrees compared with the other knee. One patient had a 5 degrees lack of extension. Radiographic gonarthrosis was seen in one patient (Figure 1) 14 months past injury. Capsular and ligamentous calcifications were seen in three patients and a few millimetres of subluxation in one patient. Details of the eight patients seen at follow-up are outlined in Table 2.

At follow-up, one patient still had a total peroneal palsy with dropfoot and sensory disturbances. The other patient, who had previously had a nerve transplantation, experienced only minor inconvenience and played handball without problems. Both patients with vascular repair showed normal pedal pulses, and ischaemic muscle fibrosis was not seen in any patient. According to Taylor et al. (1972), results can be evaluated as good (a stable, painless knee with 90 degrees of flexion or more), fair (slight instability on straining, no pain, range of flexion 60 to 90 degrees) and poor (the remainder). In this series a good re-

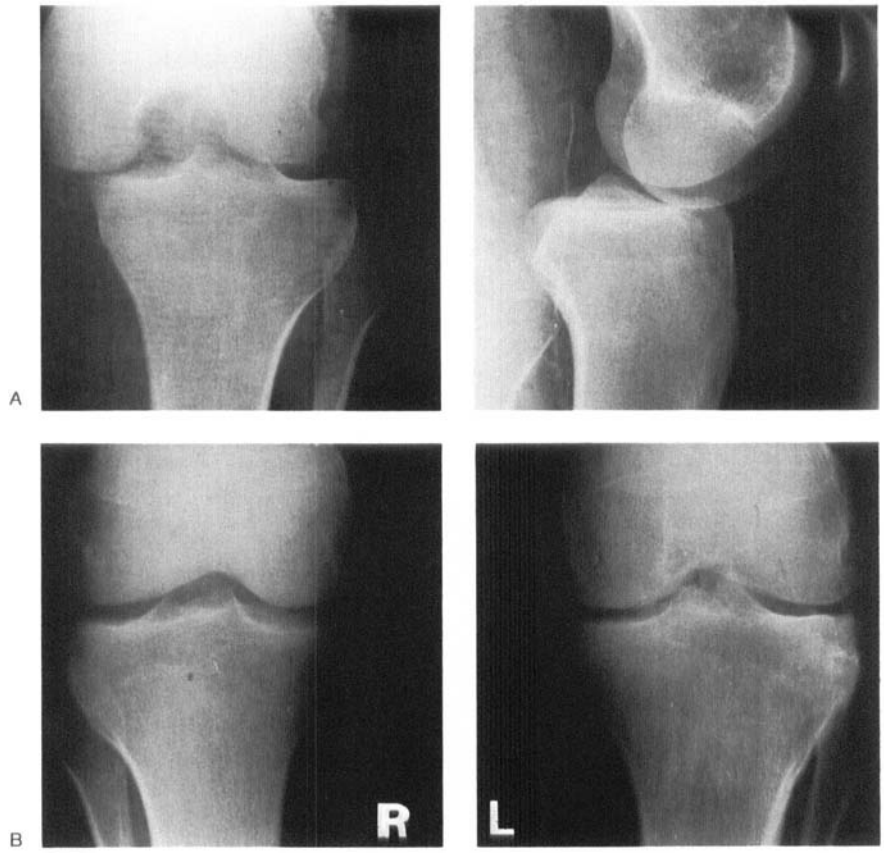

Figure 1. A) Unstable postero-lateral dislocation of the left knee after primary closed reduction, before operation.
B) A–P radiogram of both knees (standing) at follow-up 14 months later. Narrowing of the joint space in the injured knee.

Table 2. Ligamentous injury and -repair correlated to knee instability and knee movement at follow-up examination in eight patients

Pat. No	Sex	Age *yrs*	Type of dis-location	Ligaments injured ACL	PCL	MCL	LCL	MM	LM	Liga-ments repaired	Years fol-lowed	Pain	Instability	Knee move-ment
1	M	18	Antero medial	+	+	+	+			LCL	8	+	10° varus Anterior 1 cm	0–120°
2	M	18	Postero lateral	+	+	+	+	+	+	All liga-ments. Menisci removed	1	(+)	10° valgus 15° varus Posterior 1 cm	5–100°
3	M	19	Anterior	+	+		+			All	8		No	0–150°
4	M	16	Postero lateral	+	+	+		+		All	4		No	0–140°
5	M	19	Anterior	+	+		+		+	All	1		No	0–135°
6	F	19	Antero medial	+	+	+	+			0	8		No	0– 90°
7	M	67	Lateral							0	10	+	No	0–120°
8	F	67	Anterior							0	8		No	10–130°

ACL = Anterior cruciate ligament; MCL = Medial collateral ligament; MM = Medial meniscus; PCL = Posterior cruciate ligament; LCL = Lateral collateral ligament; LM = Lateral meniscus.

sult was obtained in five patients (three operated), a fair result in two (one operated) and a poor result in one operated patient.

At the time of the accident two patients were receiving the old age pension and one patient was receiving disability pension because of arterial claudication (above-knee amputation 4 months after the injury) (Table 3). At follow-up examination, another patient was receiving disability pension (above-knee amputation and brachial plexus avulsion), one patient received disablement benefit, and five had resumed their customary work on average 5 months after the injury.

Discussion

Traumatic dislocation of the knee joint is a very rare injury (Meyers & Harvey 1971, Shields et al. 1969). Hoover (1961) found only 14 cases among more than 2 million new admissions at the Mayo Clinic from 1911 to 1961, and Quinlan & Sharrard (1958) found only six cases among 48 000 bone and joint injuries treated during a 10-year period. As in our series, most of the injuries were caused by traffic accidents (Jones et al. 1979, Kennedy 1963, Meyers & Harvey 1971, O'Donnell et al. 1977, Taylor et al. 1972).

Table 3. "Social status" of 10 patients after traumatic dislocation of the knee

	Before accident	At follow-up
Working	7	5
Disablement benefit		1
Disability pension	1	2
Old age pension	2	2

Rupture of all ligaments and capsular structures was experienced by only four patients in this series. Especially in anterior dislocations, the collateral ligaments are not necessarily ruptured (Kennedy 1963, Meyers et al. 1975, Taylor et al. 1972). Like Meyers et al. (1975), we also found rupture of both cruciate ligaments in nearly all cases. All authors agree upon operative treatment of irreducible dislocations and cases with vascular complications. In uncomplicated dislocations opinions differ about whether closed reduction, immobilisation and physiotherapy are sufficient (Reckling & Peltier 1969, Taylor et al. 1972, Trickey 1976), or whether operative treatment with suture of damaged ligaments and capsule is necessary to achieve a stable knee (Jones et al. 1979, Meyers et al. 1975, Shields et al. 1969, Wright 1980). In the rare postero-lateral dislocation, open reduction has been stated to be mandatory (Kennedy 1963, Quinlan & Shar-

rard 1958, Taylor et al. 1972). In one of our patients with this injury, closed reduction was easily performed, but the reduction could not be maintained because of pronounced instability. In our series, good results were obtained by conservative treatment in patients with a clinically stable knee after acute closed reduction and by operative repair in patients with an unstable knee. However, our series is too small to permit valid conclusions concerning treatment.

We have found no report discussing the occurrence of gonarthrosis after this injury, probably because the follow-up period is too short. In this series radiological gonarthrosis could certainly not be correlated to treatment or age. It is stated by Balkfors (1982) that in patients with knee ligament injuries late symptoms are independent of the nature of the treatment. Furthermore, gonarthrosis is found almost only in joints which have also been operated on with a meniscectomy (Balkfors 1982). Lesion of the popliteal artery complicating dislocation of the knee appears with varying frequency, ranging from five cases in 42 patients (Taylor et al. 1972) to nine cases in 14 patients (Hoover 1961). In our series the frequency is three in 10 patients. Arterial lesion is especially seen in anterior and posterior dislocations, where it appears with approximately the same incidence, 40 per cent (Green & Allen 1977, Savage 1980). In patients with knee dislocation the pedal pulses should be evaluated before and after acute reduction, and if the circulation is anything but normal, the popliteal artery should be explored immediately.

Dislocation of the knee is often followed by immense swelling of the leg, and four-compartment fasciotomy must be performed without hesitation in such cases (Ottolenghi 1982, Rich et al. 1976, Savage 1980). We did not perform fasciotomy in any case, and at follow-up examination no patient showed signs of secondary muscular fibrosis.

Conclusions

1. Traumatic dislocation of the knee is a severe and rare injury.
2. Conservative treatment of clinically stable knee joints after reduction appears to produce good long-term results.
3. Operative treatment is recommended in knees with pronounced instability.
4. There is a high incidence of popliteal artery injury and therefore careful monitoring of the peripheral circulation is imperative.
5. Vascular repair must be performed within 8 h of the accident.

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