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Arthroscopy in acute knee injuries

The diagnostic value of arthroscopy was evaluated in 148 patients with acute hemarthrosis and/or instability of the knee. The treatment planned after clinical examination was compared with the treatment given after arthroscopy. Seventy-nine per cent of the patients had ligamentous injuries; 59 per cent of tears were combined with other injuries, and 71 per cent were complete ruptures. Stability testing under anesthesia was most inaccurate for the anterior cruciate ligament, with 13 per cent false positive and 30 per cent false negative results. The planned treatment was altered as a consequence of arthroscopy in 31 per cent of cases. Without arthroscopy, the preoperative diagnoses would have been seriously wrong in 15 per cent of the patients. Twenty per cent of total anterior cruciate ligament ruptures would have been overlooked.

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Distortion of the knee joint is a dynamic process in which the kinetic energy is absorbed by various articular structures. Ligaments and capsular structures are stretched and torn, and injuries to cartilages and menisci may occur. Exact diagnosis of the injuries is essential for optimal treatment. Several authors have recommended arthroscopy as a diagnostic aid in knee injury (Noyes et al. 1980, Gaudernak 1982, Lysholm et al. 1981). We have evaluated the increase in diagnostic and therapeutic accuracy achieved by using arthroscopy as an adjunct to clinical examination of acutely injured knees.

Patients and methods

Since 1981, patients referred with acute knee injuries with hemarthrosis and/or instability without fractures have undergone a standardized examination with stability testing, with and without anastesia, and arthroscopy.

The stability tests consisted of valgus and varus stress tests on the extended and semiflexed knee, anterior and posterior drawer test in 90° of flexion, the Lachmann test and the Hughston pivot-shift test. Standard grading was used for instability findings (American Medical Association 1966).

Arthroscopy was performed with the Stortz 5 mm arthroscope by the transligamentous or anteromedial approach; both 30° and 70° optics were used. The structures were probed with a hook, and thorough flushing was carried out when hemarthrosis was present.

Over a period of 32 months, 148 patients who underwent all the examinations were included; results of 72 from the first half of the period were reported earlier (Simonsen et al. 1984). The mean age of the patients was 27 (11–71) years. There were 111 men and 37 women. One hundred and two patients were operated on under the same anesthesia.

The operative and arthroscopic diagnoses were used to evaluate the accuracy of clinical examination and stability testing under anesthesia, as given by the predictive values of positive or negative tests.

To evaluate the therapeutic gain from using arthroscopy, the treatment planned after examination under anesthesia was compared with the treatment given after arthroscopy. Our indications for operation after examination under anesthesia were isolated Grade III and Combined Grade II injuries. The indication for operation as judged by arthroscopy was a total ligament rupture. Isolated meniscal injuries were resected transarthroscopically. Overlooking such an injury before arthroscopy was not considered an error in this study. Rupture of the medial patellar retinaculum and dislocation of the patella were treated operatively.

Isolated Grade II injuries and partial ligament ruptures, as diagnosed by examination under anesthesia and by arthroscopy, respectively, were treated conservatively: injuries to the collateral ligaments by plaster cast for 6 weeks, and injuries to the cru-

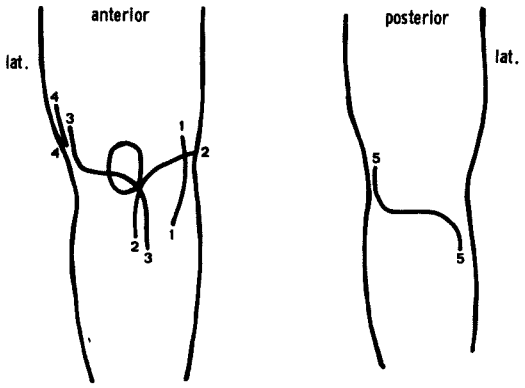


Figure 1. Incisions for the treatment of ligament ruptures in the knee joint. 1: isolated MCL ruptures, 2: isolated ACL ruptures and MCL ruptures combined with cruciate ligament ruptures, 3: ACL ruptures combined with LCL ruptures, 4: auxiliary incision in ACL ruptures, 5: PCL ruptures. Abbreviations as in Table 1.

ciate ligaments by non-weight-bearing on elbow crutches and muscle training.

The incisions used in the operations are shown in Figure 1.

Results

One hundred and seventeen patients had a total of 160 ligamentous injuries, 94 of which were combined with other injuries (Table 1). Seventy-one per cent were complete ruptures. One patient had an isolated meniscal lesion, four patients had ruptures of the medial patellar retinaculum, and in 12 patients only minimal capsular tears were found. In 14 patients no injury could be demonstrated. In the 102 arthrotomized patients there was complete agreement between the arthroscopic and operative findings, except in four patients with rupture of the medial collateral ligament (MCL) without synovial rupture or subsynovial bleeding.

The diagnostic accuracy of clinical examination and of examination under anesthesia in demonstrating and ruling out an injury regardless of its grade is depicted in Tables 2 and 3 and Figure 2. The accuracy of the same examinations as regards their ability to demonstrate or exclude a total ligament rupture is shown in Figure 3.

In 53 patients the planned treatment was non-operative. In 26 of them the treatment was altered after arthroscopy (Table 4). Thirteen patients in whom mobilization had been planned were found at arthroscopy to have partial ligamentous injuries requiring closed treatment. In the other 13 cases, arthroscopy demonstrated injuries which, according to our policy, required operative treatment: three ruptures of the medial patellar retinaculum

Table 1. Fresh ligamentous and meniscal lesions in 117 patients with acute hemarthrosis or instability of the knee

Injured structure	Extent of injury		Combined lesion	Total
	Complete	Partial		
MCL	52	14	37	66
ACL	49	26	42	75
LCL	3	0	3	3
PCL	10	6	12	16
M			24	25

MCL: medial collateral ligament, ACL: anterior cruciate ligament, LCL: lateral collateral ligament, PCL: posterior cruciate ligament, M: meniscus.

Table 2. Calculation of the predictive values of the clinical examination in the diagnosis of anterior cruciate ligamentous injury

Clinical examination	Definitive diagnosis			Predictive values	
	No lesion	II	III	II+III	III
Positive, Grade II	12	9	13	$\frac{41}{59} = 0.69$	$\frac{17}{25} = 0.68$
Grade III	6	2	17		
Negative	55	15	19	$\frac{55}{89} = 0.62$	$\frac{91}{123} = 0.74$
Total	73	26	49		

Findings at the clinical examination are designated by standard grading (American Medical Associaion 1966). For the cruciate ligaments, Grade I (local tenderness, minimal swelling, no instability) cannot be used.

Table 3. Calculation of the predictive values of stability testing in anesthesia in the diagnosis of anterior cruciate ligamentous injury

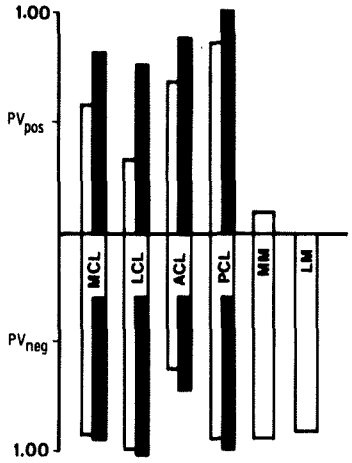
Stability testing in anesthesia	Definitive diagnosis			Predictive values	
	No lesion	II	III	II+III	III
Positive, Grade II	6	2	6	$\frac{47}{54} = 0.87$	$\frac{34}{40} = 0.85$
Grade III	1	5	34		
Negative	66	19	9	$\frac{66}{94} = 0.70$	$\frac{93}{108} = 0.86$
Total	73	26	49		

Findings at stability testing were designated by standard grading (American Medical Associaion 1966). In anesthesia, Grade I cannot be used.

and 10 total ruptures of the anterior cruciate ligament (ACL).

In 9 of 95 cases the planned operative treatment was changed to closed treatment or mobilization; in four of them the only injury was an old ACL rupture, and five had partial ligament ruptures.

The planned incision was correct in 75 pa-



◀ Figure 2. Predictive value (PV) for clinical examination □ and for stability testing under anesthesia ■ of the individual structures to ascertain injury regardless of its grade. Abbreviations as in Table 1.

Figure 3. Predictive value (PV) for clinical examination □ and for stability testing under anesthesia ■ of the individual structures to ascertain whether total rupture is present. Abbreviations as in Table 1. ▶

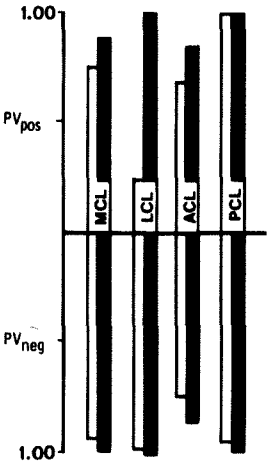


Table 4. Treatment planned prior to arthroscopy compared with the actual treatment in 148 patients with acute severe knee injury. For open treatment the planned and actual incisions are compaired. Cases in which the planned and actual treatment were identical are underlined

Treatment planned prior to arthroscopy	Actual treatment after arthroscopy						
	No treatment	Conservative treatment	Operative treatment				Capsulorrhapy
			Incision 1	Incision 2	Incision 3	Incision 5	
No treatment	19	13		7			1
Closed treatment		8		3			2
Open treatment: Incision 1		2	29	2			1
Incision 2	4	3	7	41			
Incision 3				1	3		
Incision 5						5	

For incisions, see Figure 1.

tients but would have been inexpedient in 11. In two patients with undetected ACL ruptures and in one with an undetected rupture of the medial patellar retinaculum, an exploration of the MCL only had been planned. These three injuries might have been overlooked at the planned operation. Seven patients with planned anteromedial incision had isolated MCL rupture, and one with planned incision 3 had an isolated ACL rupture. This would have resulted in inexpedient incisions, but the injuries would probably not have been overlooked.

Thus, in a total of 46 patient (31 per cent), the planned treatment was altered after arthroscopy. In 22 patients (15 per cent, 95% confidence limits 9–21 per cent), the preoperative diagnoses without arthroscopy were seriously wrong, as 10 of the total ACL ruptures (20 per cent, 95% confidence limits 10–34 per cent) and three ruptures of the medial patellar retinaculum had been overlooked, and nine patients would have been subjected to unnecessary arthrotomies.

Discussion

Clinical examination and even stability testing under anesthesia are inaccurate in acute knee injuries, especially as regards the ACL; only about 85 per cent of total ACL ruptures can be demonstrated (Noyes et al. 1980, Simonsen et al. 1984). As confirmed in our study, examination under anesthesia was correct only for the PCL. The inaccuracy of the examination of the ACL was especially remarkable, with 30 per cent false negative results.

In determining whether at total rupture was present or not, stability tests were more accurate; but still 11 per cent of the examinations under anesthesia were falsely positive for the MCL, and 15 per cent for the ACL, and there were 14 per cent falsely negative examinations of the ACL.

Our evaluations were based on the arthroscopic findings, which were checked by arthrotomy in 69 per cent of the cases. Arthroscopy, even in acute knee injury, provides an almost totally correct diagnosis (Gaudernak 1982). In our study, arthroscopic diagnostic uncertainty was only seen as regards those 6 per cent of MCL ruptures which neither penetrated the synovial membrane nor caused subsynovial bleeding. Thus, we may have overlooked a few MCL ruptures by both stability testing and arthroscopy among the 46 non-arthrotomized patients.

The importance of diagnostic errors made without arthroscopy obviously depends on the attitudes to therapy. Under a conservative policy, the extent of diagnostic errors is expressed by the predictive values of the stability tests *per se*. In our study some of the diagnostic errors were corrected peroperatively, but without arthroscopy 10–34 per cent of the total ACL ruptures would have been overlooked, and the preoperative diagnostic errors would have had serious consequences in 9–21 per cent of the patients, including patients in whom unnecessary arthrotomies would have been done.

In conclusion, we find arthroscopy important in severe knee injuries, irrespective of the attitude to therapy.

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