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FINDINGS AT ARTHROSCOPY AND ARTHROGRAPHY IN KNEE INJURIES

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The diagnostic accuracy of arthroscopy and arthrography was investigated. A total of 135 patients were examined by the two methods. All were operated on and 90 of them were analyzed in detail, the X-ray examinations being done at this hospital. In 82 patients arthroscopy gave correct information. In eight (9 per cent) the diagnosis was incorrect, in most cases a rupture of the posterior horn of the medial meniscus being overlooked. Arthrography gave accurate preoperative information in 52 patients, but in 38 (42 per cent) the diagnosis was inaccurate. This difference in correlation with the operation findings between arthroscopy and arthrography was highly significant ($P < 0.001$), and it is concluded that endoscopy gives more complete and more useful preoperative information than arthrography.

Arthrography, however, remains a valuable diagnostic tool, as arthroscopy cannot be performed in every patient with knee symptoms.

Key words: arthroscopy; arthrography; radiography; evaluation study; knee joint

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The diagnosis of knee joint injury has always been a problem. The list of methods available, including clinical examination, arthrography and arthrotomy, has recently been supplemented by arthroscopy. Special methods for testing instability of the knee joint have also been described (Kennedy & Fowler 1971, Sylvin 1975), but have not gained general acceptance. We have been using arthroscopy for diagnostic purposes in patients with knee injuries since 1971. In a limited preliminary study arthroscopy seemed to be superior to arthrography in the diagnosis of injuries (Alm et al. 1974). The present study was undertaken to compare the diagnostic findings at arthrography and arthroscopy.

PATIENTS

Between 1973 and 1976, 135 patients operated on for knee injuries were investigated preoperatively by both arthroscopy and arthrography.

Twenty women and 115 men (mean age 40 years, range 16–55) were included in the study. Forty-five of the roentgen examinations were performed elsewhere using various techniques, and these patients are not described in detail. Thus 90 patients were examined by arthrography and operated on in this department.

Arthrography

A modified technique (Levén 1974) based on Lindblom's (1948) method was used, supplemented by fluoroscopy. The knee joint was immobilized with a constant static load applied by means of slings placed round the leg and attached

to the edge of the table. Dodging was also employed (Levén 1974). The examinations were performed by several different radiologists.

Arthroscopy

Our technique of arthroscopy is described elsewhere (Gillquist & Hagberg 1976). Briefly the 5 mm Storz arthroscope (Stille–Werner, Sweden) is introduced into the suprapatellar bursa through the patellar tendon. Sterile water is flushed through the joint by an infusion pump (Sarns Model 5500, Stille–Werner, Sweden) and allowed to escape through a special needle (arthroscopy cannula, Stille–Werner, Sweden) inserted into the suprapatellar bursa. Hooks (Gillquist & Hagberg 1976) are used to test the menisci and the cruciate ligaments. Four surgeons performed most of the arthroscopies, but about 10 per cent of the examinations were done by another five surgeons under training.

Operation

In all our patients the history and clinical findings indicated arthrotomy, and all were therefore operated on irrespective of the findings at arthrography or arthroscopy.

Comparison of the findings

The findings at arthroscopy and arthrography differed in many respects. The results of the two modes of investigation are compared with the operation findings. A diagnosis was considered accurate when all injuries found at operation had been reported by both arthroscopist and radiologist. However rupture of the medial collateral ligament was excluded in all combined injuries as this was difficult to diagnose by either method especially in old injuries.

Statistical methods

The usual statistical methods were used (Armitage 1974).

RESULTS

Table 1 shows the diagnoses in the entire series as well as in the 90 patients examined by arthrography and arthroscopy in this hospital. The diagnostic findings at arthroscopy and arthrography agreed with the operation findings in 45 cases (Figure 1). In seven knees arthroscopy failed whereas X-ray gave the correct diagnosis. Thus the roentgen

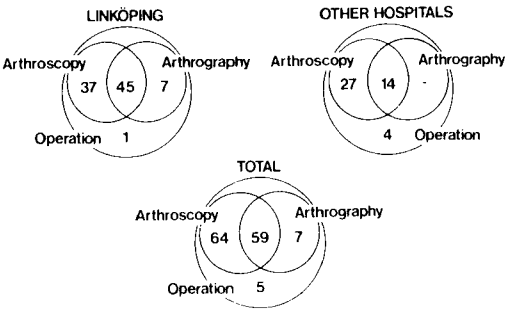

Figure 1. The correlation of findings at arthrography and arthroscopy with the findings at operation in the different groups. The number of correct diagnoses confirmed at operation with each method is indicated.

findings tallied with the operation findings in 52 out of the 90 knee joints operated on (58 per cent). Of the 38 patients in whom arthrography gave an inaccurate diagnosis arthroscopy succeeded in 37. In one patient both X-ray and endoscopy failed and operation was performed on clinical grounds. The arthroscopic findings tallied exactly with the findings at operation in 82 of the 90 patients (91 per cent).

Inaccurate diagnoses

Arthroscopy. The diagnosis was inaccurate in eight patients (9 per cent) (Figure 2). Six patients were examined during the first year of the study period, when the failure rate (6/26) was significantly higher than during the rest of the period (2/64) ($P < 0.01$).

The reason for failure was technical in two cases, when we used a 4 mm arthroscope (Storz). In five patients there was a linear rupture of the posterior horn of the medial meniscus. Two patients had a tear of the medial meniscus combined with rupture of the anterior cruciate ligament: in one case the arthroscopy demonstrated the ruptured ligament but not the meniscus tear, and in the other a second arthroscopy disclosed the injuries. In the eighth patient the diagnosis of ruptured medial meniscus was made by arthroscopy (X-ray normal) and at operation

Table 1. Diagnosis at operation and correct and incorrect findings at arthroscopy and arthrography in the different groups

Diagnosis at operation	Total no. of patients	90 patients X-rayed at Linköping				
		n	Arthroscopy		Arthrography	
			correct	incorrect	correct	incorrect
mm	45	37	31	6	25	12
ACL + lm	20	10	10	—	4	6
lm	19	14	14	—	9	5
ACL + mm	14	5	4	1	3	2
ACL	9	3	3	—	1	2
ACL + mm + lm	6	5	5	—	2	3
Chondromalacia of patella (+ lateral displacement)	5	4	3	1	2	2
mm + lm	3	3	3	—	3	—
Loose body	3	2	2	—	1	1
PCL	2	2	2	—	—	2
mcl	2	2	2	—	2	—
ACL + PCL + mm	1	—	—	—	—	—
PCL + mm	1	—	—	—	—	—
ACL + PCL + lm	1	—	—	—	—	—
Arthrosis	1	1	1	—	—	1
Osteochondritis dissecans	1	1	1	—	—	1
Fracture	1	—	—	—	—	—
Normal	1	1	1	—	—	1
	135	90	82	8	52	38

The symbols indicate injury to the following structures, ACL = anterior cruciate ligament, mcl = medial collateral ligament, mm = medial meniscus, lm = lateral meniscus, PCL = posterior cruciate ligament.

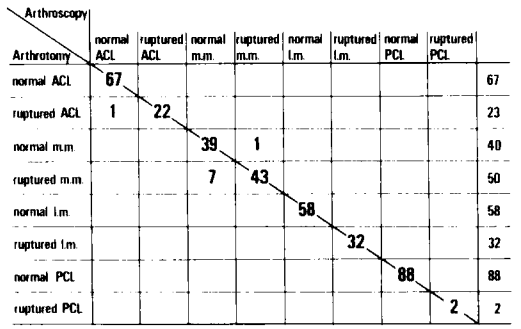

Figure 2. Arthroscopic diagnoses compared with operation findings in 90 patients. Note that one patient may have several diagnoses. False positive diagnoses are given to the right of the line and false negative to the left.

"Normal" meniscus includes also cases were one meniscus had been removed previously and where the operation findings tallied with the patient's history.

ACL = anterior cruciate ligament, PCL = posterior cruciate ligament, m.m. = medial meniscus, l.m. = lateral meniscus.

a suspected hypermobile meniscus was resected, but the symptoms persisted. After a second operation for recurrent dislocation of the patella with chondromalacia, the patient was fully restored.

Among the 135 patients operated on, a further four diagnoses were missed at arthroscopy; altogether 12 out of 135 (9 per cent) were thus incorrectly diagnosed (Figure 1). The reasons for failure were similar – one was technical and two patients showed rupture of the medial meniscus. Thus if the three technical failures are included eleven ruptured medial menisci were overlooked.

Arthrography. In 38 patients the X-ray diagnosis did not tally with the operation findings. The injuries most frequently missed were tears of the medial meniscus (15), of the lateral meniscus (11), and of the anterior

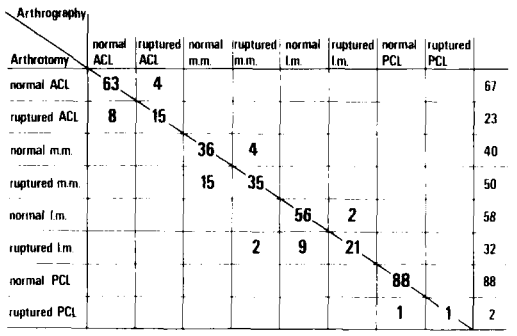

Figure 3. Arthrographic diagnoses compared with operation findings in 90 patients.
See also legend to Figure 2.

cruciate ligament (8) (Figure 3). In six patients arthrography showed a ruptured meniscus (4 medial, 2 lateral) but the lesions could not be found at operation. In two patients the wrong meniscus was thought to be torn, and four normal anterior cruciate ligaments were wrongly diagnosed as ruptured. It is, of course, unreasonable to expect to demonstrate loose bodies, chondromalacia of the patella, arthrosis deformans, and chondral fractures by arthrography (Table 1); these lesions are better diagnosed by arthroscopy.

The differences in correlation with the operation findings between arthroscopy (82/8) and arthrography (52/38) are highly significant ($P < 0.001$). Both with respect to the anterior cruciate ligament and the lateral meniscus the difference between the two methods was highly significant ($P < 0.001$), and with regard to the medial meniscus it was significant ($P < 0.02$).

Complications

No complications occurred in connection with arthroscopy or arthrography.

DISCUSSION

In this study arthroscopy gave more complete and more helpful operative information than arthrography. In about half of the patients arthrography gave satisfactory indications for treatment, whereas arthroscopy was successful in more than 90 per cent. In our hands, arthroscopy has been a simple and safe method with few misinterpretations.

Arthrotomy disclosed several lesions not found by arthrography. On the other hand, eight ruptures of the menisci demonstrated by arthrography were not found at arthrotomy. Few reports of a comparison of arthrography and arthroscopy have been published. In general the results of arthroscopy have been more accurate than the results of arthrography (Jackson & Abe 1972, De Haven & Collins 1975, Eikleaar 1975). Haage & Watanabe (1973) discussed the two methods and concluded that a negative X-ray calls for endoscopy and *vice-versa*, and that the two examinations complement each other.

As shown in this series a tear of the lateral meniscus may be difficult to recognize in arthrograms whereas arthroscopy gave the diagnosis in all instances. In contrast arthroscopic examination of the medial meniscus was sometimes difficult. If the medial ligament structures are intact and the joint space cannot be widened it is impossible to see the whole meniscus from the anterior approach using the 30° telescope. We have tried to eliminate this error by testing the meniscus by a hook (Gillquist & Hagberg 1976). Recently the technique for examining the posteromedial corner has been improved (Gillquist et al., to be published). Arthrography is said to be a reliable method in diagnosing ruptures of the medial meniscus, with an accuracy rate of more than 99 per cent (Nicholas et al. 1970, Butt & McIntyre 1969), yet no fewer than 15 out of 50 (30 per cent) of the X-ray examinations in our study failed to disclose the lesion, and in four cases an apparent rupture of the meniscus was not found at operation. In the light of our findings the results of Nicholas et al. (1970) and Butt & McIntyre (1969) are hard to explain. They used the double-contrast method while our arthrograms have been performed with mono-contrast, which may partly explain the differences. The proportion of false negative diagnoses in our

series suggests that arthroscopy should be done when arthrography is negative.

The cruciate ligaments are difficult to examine by arthrography especially in the acute stage. In the present study 35 per cent of ruptured anterior cruciate ligaments were not diagnosed, even though sagittal traction was applied (Liljedahl et al. 1966, Levén 1974). A further improvement in the roentgen diagnoses of ruptures of the anterior cruciate ligament has been proposed by Levén (1977a, b), the sagittal instability being measured on films exposed during sagittal traction. Even under direct observation, however, a tear may be masked by the synovia, but the lesion is easily demonstrated with a hook.

Arthroscopy has several advantages over arthrography. It is possible to inspect the lesions in conditions such as synovitis (Watanabe et al. 1969, O'Connor 1973), chondromalacia and osteoarthrosis (Jackson 1974, Gillquist & Hagberg 1976), and acute injury (Gillquist et al. 1977), and therapeutic procedures can be performed transcutaneously (Gillquist et al. 1976).

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