

ARTHROSCOPY OF THE KNEE

An Analysis of 588 Consecutive Knee Arthroscopies

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In a consecutive study of 588 knee arthroscopies, the accuracy of the clinical and arthroscopical diagnosis is evaluated by means of the diagnostic specificity and sensitivity. The investigation includes a number of orthopaedic knee disorders, and it is shown that arthroscopy gives a substantial increase in the diagnostic accuracy. Follow-up examination of the non operated patients showed that surgery was avoided in 19 per cent of the patients, in whom surgery was indicated by clinical diagnosis.

It is concluded that arthroscopy is a safe and valuable procedure in the diagnosis of knee disorders, and the best method to avoid unnecessary surgery.

Key words: arthroscopy; diagnostic accuracy; knee disorders

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In the last 10 years a great number of papers have evidenced the value of arthroscopy in the diagnosis of internal disorders of the knee joint, acute as well as non-acute (Jackson & Abe 1972, O'Connors 1974, Gillquist et al. 1977).

Most papers concentrate on patients in whom arthroscopy is followed by surgery, and only a few (Carruthers & Kennedy 1980, Dandy & Jackson 1975, DeHaven & Collins 1975, Jackson & Abe 1972, McGinty & Freedman 1976) investigate the fate of patients who did not need surgery as judged by arthroscopy.

The purpose of this paper is to evaluate the accuracy of the arthroscopic and clinical diagnosis in various knee disorders, expressed by the specificity and the sensitivity, and to review those patients where the findings at the initial arthroscopy did not indicate surgical treatment.

PATIENTS AND METHODS

From 1 December 1976 to 31 August 1979, 588 consecutive knee arthroscopies were performed at the De-

partment of Orthopaedic Surgery O, Odense University Hospital. The study was designed as a prospective study. All patients were examined by a specialist in orthopaedic surgery, with consecutive registration of symptoms, clinical findings and radiography, resulting in a *clinical diagnosis*. At arthroscopy the structures of the knee joint were systematically examined and registered, resulting in an *arthroscopic diagnosis*. In 428 patients (73 per cent) arthroscopy was immediately followed by an arthrotomy, while surgery was not indicated in 160 patients (27 per cent) at the time of arthroscopy. In the 428 patients immediately operated upon, the pathological findings at operation were registered, and all data were then computerized.

In the non operated group, clinical follow-up examination was possible in 148 patients (92.5 per cent). One patient had his final clinical examination 1 month after the arthroscopy because he had no complaints, and the clinical examination was normal. The other patients had their final examination 3–37 months (mean = 13 months) after the arthroscopy. A second arthroscopy was performed in 23 patients, within the follow-up period, all confirming the primary arthroscopic diagnosis. In all operated patients the operative diagnosis is used as diagnostic reference, and the diagnosis at the follow-up examination is used in the non operated patients. The results are evaluated by their *diagnostic specificity* (predictive value of positive test) and *diag-*

Table 1. Arthroscopic approaches to the knee joint

Approach	No. of arthroscopies (<i>n</i> = 588)
Inferior antero-lateral	469
Inferior antero-medial	29
Combined approaches	90

nostic sensitivity (predictive value of negative test), which is the most relevant way to evaluate a diagnostic test (Vecchio 1966, McNeil et al. 1975, Wulf 1971 and 1976). All values are given with 95 per cent confidence limits (Documenta Geigy 1968).

The arthroscopy was performed as described by Jackson & Abe (1972). All examinations were done with the same Dyonics Needlescope, 2.2 mm, straight view, 55° field, by six surgeons, and with a bloodless field and the patient under general anaesthesia. Table 1 shows the arthroscopic approaches used. The inferior antero-lateral approach was routinely used but was supplemented by other approaches when this was indicated.

There were 176 women aged 13–68 years (mean 29 years) and 412 men aged 13–66 years (mean 33 years) in the material.

RESULTS

There were no complications that could be attributed to the instrumentation; in particular, no infections occurred. The arthroscope never broke down.

The different lesions are listed in Table 2 with the number of true and false diagnoses. The specificity and sensitivity are given in Table 3. There were 22 false negative arthroscopies (8 per cent) of all meniscal lesions (*n* = 271): six lesions were located in the anterior horn (three medial and three lateral), 12 lesions in the posterior horn (eight medial and four lateral), three lesions in the middle third of the lateral meniscus, and one bucket-handle lesion in the medial meniscus was overlooked. The arthroscopic view was reported as poor in 19 of these knees. Of the 37 false positive arthroscopies (13.5 per cent), 11 were misinterpretations of other conditions (synovitis, plica synovialis). In the other cases the surgeon could not with certainty exclude a meniscal lesion because of a poor view. In 11 patients a tear of the anterior cruciate ligament was not diagnosed

Table 2. Number of true and false diagnoses at arthroscopy and clinical examinations in 576 patients (12 patients not followed up)

Diagnosis	True positive (TP)	False positive (FP)	True negative (TN)	False negative (FN)
Lesion of medial meniscus (<i>n</i> = 201)				
Arthroscopy	189	27	348	12
Clinical examination	177	148	227	24
Lesion of lateral meniscus (<i>n</i> = 70)				
Arthroscopy	60	10	496	10
Clinical examination	48	57	449	22
Lesion of ant. cruciate lig. (<i>n</i> = 43)				
Arthroscopy	32	3	530	11
Clinical examination	17	15	518	26
Free bodies (<i>n</i> = 45)				
Arthroscopy	38	8	523	7
Clinical examination	23	26	505	22
Chondromalacia patellae (<i>n</i> = 272)				
Arthroscopy	266	9	295	6
Clinical examination	113	72	232	159
Chondromalacia femoris (<i>n</i> = 229)				
Arthroscopy	214	11	336	15
Clinical examination	24	16	331	205

$$\text{Specificity} = \frac{\text{TN}}{\text{TP} + \text{FP}}$$

$$\text{Sensitivity} = \frac{\text{TN}}{\text{TN} + \text{FN}}$$

Table 3. The specificity and sensitivity of the arthroscopic and clinical diagnosis in 576 patients

Diagnosis	n	Arthroscopy	Confidence limits	Clinical examination	Confidence limits
Lesion of the medial meniscus	201				
Diagnostic specificity		87.5%	82.4%–91.6%	54.5%	48.7%–60.0%
Diagnostic sensitivity		96.6%	93.9%–98.1%	90.4%	85.5%–93.3%
Lesion of the lateral meniscus	70				
Diagnostic specificity		85.7%	75.3%–92.9%	45.7%	36.1%–55.7%
Diagnostic sensitivity		98.0%	96.4%–99.1%	95.3%	92.6%–96.8%
Lesion of the ant. cruciate lig.	43				
Diagnostic specificity		91.4%	76.9%–98.2%	53.1%	34.7%–70.9%
Diagnostic sensitivity		97.9%	96.3%–98.9%	95.2%	92.8%–96.7%
Free bodies	45				
Diagnostic specificity		82.6%	68.6%–92.2%	46.9%	32.5%–61.7%
Diagnostic sensitivity		98.7%	97.6%–99.5%	95.8%	93.8%–97.4%
Chondromalacia of the patella	272				
Diagnostic specificity		96.7%	94.1%–98.5%	61.1%	53.6%–68.2%
Diagnostic sensitivity		98.0%	95.5%–98.9%	59.3%	54.9%–64.9%
Chondromalacia of the femoral condyle	229				
Diagnostic specificity		95.1%	91.2%–97.5%	60.0%	43.3%–75.1%
Diagnostic sensitivity		95.7%	92.9%–97.5%	61.7%	57.5%–66.0%

at arthroscopy, mainly because palpation with a probe was not done as a routine.

In seven patients free bodies were overlooked at arthroscopy, either because of insufficient technique or because of a poor view. The free bodies missed at arthroscopy were evenly distributed over the whole joint.

Nineteen patients (13 per cent) in the initially not operated group underwent subsequent surgical treatment, listed in Table 4. In 11 patients the diagnosis at the initial arthroscopy proved to be

incorrect. Two patients, after a period with no symptoms, had suffered a significant new injury to the knee, requiring meniscectomy, and they are not considered arthroscopic failures. The remaining six patients were correctly diagnosed at the primary arthroscopy, but required later surgery for their disease. Table 5 correlates the diagnosis at follow-up examination and initial arthroscopy. At follow-up examination 47 patients (32 per cent) had no symptoms, and 82 patients (55 per cent) showed mostly minor symptoms, which agreed well with the arthroscopic diagnosis.

Table 4. Surgical procedures in 19 patients, in whom initial arthroscopy did not indicate operation

Procedure	n
Meniscectomy	11 (9)
Resection of shelf	1 (1)
Removal of free body	1 (1)
Operation for chondromalacia	4
Bilateral synovectomy	1
Explorative arthrotomy	1

Numbers in brackets show the number of diagnoses missed at initial arthroscopy.

DISCUSSION

In agreement with other authors (Jackson & Abe 1972, Gillquist et al. 1977, Dick et al. 1978) we found no complications caused by the arthroscopic instrumentation. The diagnostic accuracy has not, to our knowledge, been previously evaluated by means of the diagnostic specificity and sensitivity, which is the clinically most relevant method to evaluate a diagnostic test (Vec-

Table 5. Correlation between arthroscopic and follow-up diagnosis in 160 patients in whom arthroscopy did not indicate surgery

Follow-up diagnosis	Arthroscopic diagnosis						Total
	Normal	Chondromalacia	Lesion of cruciate ligament	Synovitis	Distorsion	Lesion of lat. meniscus	
Normal	14	20	1	4	8	—	47
Chondromalacia	1	70	1	3	7	—	82
Lesion of cruciate ligament	—	—	4	—	—	—	4
Synovitis	—	—	—	1	—	—	1
Lesion of medial meniscus	—	4	1	—	1	—	6
Lesion of lateral meniscus	2	3	—	—	—	1	6
Synovial plica	—	1	—	—	—	—	1
Free body	—	1	—	—	—	—	1
No follow-up	3	8	—	—	1	—	12
	20	107	7	8	17	1	160

chio 1966, McNeil et al. 1975, Wulf 1971, 1976). Like other authors (Alm et al. 1975, DeHaven & Collins 1975, McGinty & Freedman 1976, Oretorp 1978) we have chosen the operative diagnosis as the reference. This was of course not possible in the non operated patients, and in these patients we have chosen the diagnosis at the clinical follow-up examination as reference. This means that the calculations are not optimal, but it seems to be the most reliable way to determine accuracy. Furthermore, the diagnosis at follow-up examination was in good agreement with the diagnosis at the initial arthroscopy, when correlated for the 11 diagnostic failures.

Our results tend to support most of the previously reported results (Jackson & Abe 1972, DeHaven & Collins 1975, McGinty & Freedman 1976, Gillquist et al. 1977, Ireland et al. 1980) that arthroscopy offers a substantial increase in the diagnostic accuracy of meniscal lesions and tears of the anterior cruciate ligament. In contrast, Gillies & Seligson (1977) found the arthroscopic accuracy in meniscal lesions as low as 68 per cent, whereas their clinical accuracy was 85 per cent.

We believe that the use of a probe, as a supplement to arthroscopy, undoubtedly would have increased our arthroscopic accuracy, especially in

tears of the anterior cruciate ligament and in lesions of the posterior horn of the menisci as these lesions can be difficult to expose arthroscopically (Gillies & Seligson 1979, Ireland et al. 1980).

It is, of course, important to detect lesions of the menisci, but it is also important to remember that a minor meniscal tear is not necessarily the cause of knee symptoms. Preserving the menisci is of major importance for the normal function of the knee joint (Goodfellow 1980, Noble & Erat 1980). Arthroscopy also offers a substantial increase in the diagnostic accuracy with chondromalacia, but we agree with Carruthers & Kennedy (1980) that the clinical assessment is more important than arthroscopy in determining the need for surgery in patello-femoral diseases. On the other hand, arthroscopy can be of great value in determining the type of operative procedure.

Johnson (1977) introduced the needlescope, recommending a multiple puncture technique. In a recently published paper Gillquist & Oretorp found that only by using the multiple puncture technique with the needlescope are the results equal to those using a big bore arthroscope with a single approach. This is not in agreement with our results of mainly using a single approach with the needlescope, as our 7 per cent rate of false nega-

tive arthroscopies corresponds well with the results of other authors using a big bore arthroscope (Jackson & Abe 1972, DeHaven & Collins 1975, McGinty & Freedman 1976, Carruthers & Kennedy 1980).

In our material at least 111 patients (19 per cent) avoided an unnecessary arthrotomy because of arthroscopy. As an arthrotomy is not a harmless procedure, it is important to avoid unnecessary surgery of the knee joint, which we believe is most safely done by employing arthroscopy.

CONCLUSIONS

1. Arthroscopy of the knee joint is a safe procedure.
2. As demonstrated by the specificity and the sensitivity, arthroscopy of the knee joint offers a substantial increase in the diagnostic accuracy.
3. Arthroscopy is the best method to avoid unnecessary surgery of the knee joint.

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