A COMPARISON BETWEEN ARTHROSCOPIC MENISCECTOMY AND MODIFIED OPEN MENISCECTOMY

A PROSPECTIVE RANDOMISED STUDY WITH EMPHASIS ON POSTOPERATIVE REHABILITATION

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Arthroscopy is now well established as a method of diagnosing meniscal lesions, and its advantages have been pointed out in several reports. Arthroscopic surgery, however, is difficult to master, so that for meniscectomy open methods remain commoner. By taking advantage of the new instruments and equipment developed for arthroscopic operations, a modified technique of open meniscectomy, designed to improve the postoperative course, has been developed. In a prospective randomised study, the results after this modified open meniscectomy were comparable with those obtained after arthroscopic operation and were significantly better than those after conventional meniscectomy. The best results of all, however, were those after partial arthroscopic meniscectomy.

Meniscal lesions are common and arthroscopy is a well-established method of diagnosing them (Gillquist and Hagberg 1976; Jackson and Dandy 1976; O'Connor 1977; Gillquist, Hagberg and Oretorp 1979; Johnson 1981). In recent years several reports have described the advantages of using arthroscopic techniques for dealing with meniscal tears (O'Connor 1977; Gillquist 1980; Johnson 1981; Lysholm and Gillquist 1981). Good results have been reported especially after partial meniscectomy for bucket-handle and flap tears (McGinty, Geuss and Marvin 1977; Dandy 1978; Oretorp and Gillquist 1979), but also after total arthroscopic meniscectomy (Gillquist, Hamberg and Lysholm 1982). The technique of arthroscopic meniscectomy is, however, difficult to master, and the necessary guidance and practice not easy to obtain. In many countries, therefore, open meniscectomy remains the commonest method.

By taking advantage of the new instruments and equipment designed for operating with the arthroscope, we have developed a modified technique for open meniscectomy, whether partial or total. Our objective was to improve the postoperative course and bring it to the same standard as after an arthroscopic operation. We now present a comparison of our results using this modified open technique with those of our standard

arthroscopic technique. Our study was prospective and randomised, with emphasis on postoperative rehabilitation.

MATERIAL AND METHODS

Patients with degenerative tears of the medial meniscus but with no history of previous injury or operation on the affected knee were selected. Before operation the patient was informed that the procedure was a minor one which could be done as an outpatient, that the torn meniscus would be removed after diagnostic arthroscopy, and that walking would be possible immediately after operation. Weight-bearing radiographs were taken of both knees before operation.

Diagnostic arthroscopy (Gillquist and Hagberg 1976; Gillquist *et al.* 1979) was performed once the clinical diagnosis of a degenerative meniscal tear had been made. When a horizontal cleavage or flap tear in the posterior horn of the medial meniscus had been confirmed, the patient was allocated by a table of random numbers to one of four different groups. There were 10 patients in each group and the methods of treatment were: (1) arthroscopic partial meniscectomy; (2) arthroscopic total meniscectomy; (3) open partial meniscectomy; or (4) open total meniscectomy. All meniscectomies were performed by one of three surgeons with long experience of arthroscopic and open operations.

The intention was to treat all patients as outpatients and for them all to have the same postoperative treatment. Rehabilitation was guided by a physiotherapist who also measured the muscle strength. Each patient was followed-up for at least eight weeks or until they returned to work and normal physical activity.

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Joint stability and degenerative changes in articular cartilage were recorded at the time of operation. Other factors including sex, age, occupation, duration of symptoms, operating time, time spent in hospital, postoperative attendances, sick leave, and time of restoration to physical fitness also were recorded.

Knee function. The Lysholm point-scoring scale adapted for meniscal lesions was used to evaluate knee function before operation and eight weeks after (Lysholm and Gillquist 1982). This system assesses eight criteria: limp (5 points), support (5), giving way (20), pain (25), catching (15), swelling (10), and the ability to climb stairs (10) and to squat (5). The maximum score was 95 points. Patients with scores above 90 points had no significant symptoms and the results were judged to be excellent. Patients with scores of 77 to 90 had mild symptoms on vigorous physical activity and were judged to be moderate. Below 77 points patients were considered to be fair or poor (Lysholm and Gillquist 1981).

Muscle strength. The strength of the thigh muscles was measured before operation and one, four and eight weeks after, using a Cybex II isokinetic dynamometer (Lumex, Bayshore, New York), at an angular velocity of 30° per second, and also isometrically at a knee angle of 60°. Muscle strength on the affected side was expressed as a percentage of that on the unaffected side.

Data analysis. The coefficient of variation for the score evaluation was $\pm 2.8\%$, and for the Cybex measurement $\pm 13\%$. Knee function scores were analysed by Student's *t* test for paired samples, and muscle torque values were treated by analysis of variance. Other data were treated by the Kolmogorov-Smirnoff test and the Mann-Whitney U test.

Surgical technique. *Arthroscopic meniscectomy.* General or regional anaesthesia is used. A tourniquet is applied and inflated if necessary. A mechanical leg-holder is always used, and the operation is usually done with a television camera on the arthroscope. Partial or total arthroscopic meniscectomy is carried out immediately after diagnostic evaluation using the same arthroscope and the same positioning of the leg. Other instruments are introduced through portals medial or lateral to the arthroscope or into the posterior compartment. For partial meniscectomy a knife and basket forceps are used. The portion of meniscus left *in situ* is carefully probed to check for further tears and to evaluate the stability of the rim.

For arthroscopic total meniscectomy the one-piece technique described by Gillquist (1980) and Gillquist *et al.* (1982) is used. The meniscus is excised with the special knife using five portals and four to five incisions in the periphery of the meniscus. During excision of the anterior and middle portions of the meniscus the 30° telescope is used; for the posterior horn the 70° telescope is necessary. After extraction of the meniscus the small capsular rim is carefully checked with a probe for any remaining abnormal tissue, which is removed with basket forceps.

At the end of all arthroscopic meniscectomies the joint is cleared of debris by aspiration.

Open meniscectomy. Open meniscectomies, whether partial or total, are also performed immediately after diagnostic evaluation. The arthroscope is removed, the tourniquet inflated, and the surgeon changes his gown and gloves.

Open partial meniscectomy is performed through an anteromedial incision about 3 cm long. With the knee in 20° of flexion and under valgus stress applied with the mechanical leg-holder, it is easy to see right back to the posterior horn of the medial meniscus. Extra light can be brought into the posterior part of the joint by using the light cable for the arthroscope. Partial meniscectomy can be done with instruments designed for arthroscopic operations, such as basket forceps, a Stille knife and scissors.

Total meniscectomy also starts with an anteromedial incision (Smillie 1978). The antero-central part of the meniscus is mobilised using a Smillie's knife. The incision is made 2 to 3 mm from the meniscocapsular junction. The meniscus is mobilised to the posteromedial corner, and a posteromedial incision about 3 cm long is made (Smillie 1978). The mobilised part of the meniscus is pulled out through the second incision and held with forceps; the operation is completed by excising the posterior horn, again using a Smillie's knife.

Careful haemostasis is important in the open technique. The wound is closed in the conventional manner. The sutures can be replaced by surgical tape after one week.

RESULTS

Each of the four groups included one woman and nine men. The mean age was similar in all groups (Table I). In most patients (85%) the interval between onset of symptoms and operation was three months or more. At the time of meniscectomy moderate degenerative changes in the medial compartment were seen in 14 patients (35%) who were equally distributed between the different groups. Radiographs before operation showed slight joint-space narrowing on the medial side of the knee (Stage I according to Ahlbäck's classification, 1968) in only five patients (12.5%); in one of these no degenerative changes could be seen with the arthroscope.

All patients were treated as outpatients except for two; one of these two was admitted to hospital for one day for observation because of known heart disease, the other, a 37-year-old policeman treated by open total meniscectomy, was kept in for four days because of pain and swelling. (This policeman was off work for 22 weeks because of slow recovery of quadriceps strength and the active nature of his job.)

The operating time for arthroscopic partial meniscectomy was significantly shorter than for arthroscopic total meniscectomy ($P < 0.01$), for open total meniscectomy ($P < 0.01$), or for open partial meniscectomy

Table I. The four groups: age of patients, operating time (including 10 minutes for diagnostic arthroscopy), length of sick leave, and number of postoperative examinations

Type of meniscectomy	Mean age (years)	Mean operating time $\pm$ SD (minutes)	Mean sick leave (weeks)	Mean visits after operation
Arthroscopic partial	46.9 (34 to 60)	27.5 $\pm$ 14.0	1.5 (0 to 3)	1.6 (1 to 3)
Arthroscopic total	46.0 (36 to 55)	51.5 $\pm$ 16.0	3.4 (1 to 10)	2.1 (1 to 5)
Open partial	46.3 (34 to 56)	38.5 $\pm$ 4.7	2.6 (1 to 4)	2.3 (1 to 4)
Open total	52.2 (37 to 65)	43.0 $\pm$ 7.5	*3.4 (1 to 6)	3.1 (2 to 6)

* One patient who had 22 weeks' sick leave has been excluded

($P < 0.05$). The operating time was also significantly shorter for open partial meniscectomy than for arthroscopic total meniscectomy ($P < 0.05$), (Table I).

All patients were asked to return for postoperative examinations. Apart from significantly fewer attendances in the arthroscopic partial group compared with those in the open total group ($P < 0.05$), the groups did not differ significantly (Table I). Slight postoperative effusion occurred in all groups, but in the arthroscopic partial group only one patient needed aspiration. Five patients needed aspiration in the open partial group, three in the arthroscopic total group, and two in the open total meniscectomy group. No infection was observed.

In the open total meniscectomy group two of the patients had retired; the other groups consisted of equal numbers of patients with active and with sedentary occupations. Only patients treated by arthroscopic partial meniscectomy had significantly shorter periods of sick leave ($P < 0.05$) than the other groups (Table I). About five patients in each group took part in a physical fitness

programme. Patients treated by arthroscopic total meniscectomy resumed sport within six weeks; the corresponding time for all other groups was three to four weeks.

Knee function. Before operation the total mean score for all patients was 59.3 ± 13.3 points. Eight weeks after operation all groups had improved significantly to a mean score of 88.1 ± 8.1 points ($P < 0.01$). The end result was the same in all groups (Fig. 1).

Muscle strength. Quadriceps strength diminished significantly during the first week after operation; the decrease was similar for all groups ($P < 0.01$). After four weeks there was no significant difference from the pre-operative value (Fig. 2). Hamstring strength showed very little change, and had in general returned to normal four weeks after operation.

DISCUSSION

The results of our technique for open meniscectomy are significantly better than those previously reported in respect of the time spent in hospital, the length of sick leave, and the time taken to return to sport (Wynn-Parry,

Fig. 1

Knee function: mean score and standard deviation before and after meniscectomy in the different groups. AP, arthroscopic partial; AT, arthroscopic total; OP, open partial; and OT, open total.

Fig. 2

All groups: mean values of isokinetic and isometric strength in extensor muscles in the treated legs before operation and one, four and eight weeks after. The muscle strength is expressed as a percentage of that of the unaffected side. The arrow (†) indicates the time of operation; ● indicates the isokinetic strength at a velocity of 30° per second; and ■ the isometric strength.

Nichols and Lewis 1958; Saugmann-Jensen 1963; Nelson 1968; Smillie 1978; Bergström *et al.* 1984). This modified open technique gave results almost as good as those obtained with arthroscopic operation in this investigation and in an earlier study (Lysholm and Gillquist 1981; Hamberg and Gillquist 1984).

Degenerative tears of the medial meniscus constitute about 60 per cent of all meniscal lesions, which is why we selected them for the present study. Our results are thus applicable to the majority of patients with meniscal lesions.

A prerequisite for a good result is correct diagnosis. It is our opinion that operations on the menisci should be preceded by diagnostic arthroscopy in order to localise and classify the lesion. It is also important to detect any injury to ligaments or articular cartilage. Degenerative change in the cartilage is not a contra-indication to meniscectomy (Jackson and Rouse 1982); this is corroborated by our present finding that knee function in all groups improved significantly after operation.

It has recently been shown that the strength of the thigh muscles is impaired to a greater extent after open conventional meniscectomy than after closed meniscectomy (Hamberg *et al.* 1983), but in this present study no such difference emerged, probably because of the reduced operative trauma. Even though a tourniquet was used in all open operations and not in the arthroscopic operations, there was no difference in postoperative muscle torque; the same conclusion was reached in a randomised study in which the effect of a tourniquet on muscle torque was recorded after arthroscopic meniscectomy (Thorblad *et al.* 1983).

Although many surgeons advocate arthroscopic partial meniscectomy (Dandy 1978; Lysholm and Gillquist 1981; Gillquist *et al.* 1982; Jackson and Rouse 1982), the entire meniscus may occasionally have to be removed because no normal portion remains. Good results have been reported with arthroscopic total meniscectomy in such patients (Gillquist *et al.* 1982). However, the technique is extremely difficult to master, and this is one of the reasons that we developed an alternative. While surgeons are undergoing training in arthroscopic surgery there will remain a need for an alternative open operation with lower morbidity than the usual open technique. The operating time for an arthroscopic partial meniscectomy should normally be about 30 minutes in an uncomplicated case (Gillquist 1980); if, however, it exceeds one hour it is wise to change to an open procedure, otherwise the chances of complications are greatly increased (McGinty 1981).

If the technical resources for an arthroscopic operation are not available, diagnostic arthroscopy followed by partial or total open meniscectomy using our modified technique should lead to a good result in terms of rapid rehabilitation. Apart from the method of operation, all our patients received the same treatment. Some patients, treated previously by conventional meniscectomy to the other knee, insisted that our open technique was greatly superior, particularly because of the earlier return to work and normal activities. The arthroscopic partial meniscectomy group gave the best results, with a significantly shorter operating time, a shorter period of sick leave and a smoother postoperative course.

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