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Repair of the anterior cruciate ligament

Augmentation versus conventional suture of fresh rupture

A prospective case control study was made by comparing the results of a modified combination parapatellar tendon transposition repair of a fresh anterior cruciate ligament rupture with those of the conventional Palmer technique. The mean follow-up time was 4 (3–7) years. A tendency to better stability was shown by an objective clinical device. Subjective results concerning stability sensations of the knee were also better than those obtained by the conventional method.

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Conventional repair of fresh anterior cruciate ligament (ACL) rupture is often unsatisfactory (Lysholm et al. 1982, Balkfors 1982, Clancy et al. 1982, Franke 1982, Odensten et al. 1984, Suomalainen et al. 1985), and later on additional procedures have often been necessary. In acute, fresh knee injuries we have repaired ACL tears by the Cambell's (1939) parapatellar transcondylar transposition technique modified with simultaneous local ligamentoraphy and transcondylar fixation between the ruptured parts of the ACL.

Patients operated on by this technique were compared with those operated on by the conventional technique (Palmer 1938) in a prospective case-control study.

Patients and methods

Thirty-two patients, 21 men and 11 women, aged 20–59 years, with total acute ACL tears were operated on by either the modified parapatellar tendon technique (Group P) or the conventional technique (Group C, Figure 1). Operations were performed 1–6 days after the accident, and the two groups were matched for occurrence of associated ligamentous and meniscus injuries, as well as for age (Table 1). Selection was not done on an alternate patient basis because it might have resulted in an uneven distribution of associated injuries between the groups. Patients with previous knee injuries – also in the other knee condylar fractures, eminential avulsion fractures, or tears of the ACL at the distal insertion with a bone fragment were excluded.

Operation technique

Parapatellar tendon transposition (Aho 1981) was performed as follows: a long 10-mm-wide tendon strip was dissected from the parapatellar reticulofascial and the patellar ligament tissue. Any fat tissue was removed. The strip was directed either over the proximal anterior edge of the tibia or through a low drill hole in the anterior part of the tibial condyle to the joint cavity. An 8–9-mm-wide tunnel was drilled through the lateral condyle of the femur to the middle insertion area of the ACL in the intercondylar fossa. The ruptured distal tibial part of the ACL usually available for additional repair was fixed with two transverse Mercilene® sutures. These were pulled through the lateral condyle to bring the distal part of ACL near its proximal part to facilitate and strengthen the local ligamentoraphy. The parapatellar tendon strip was pulled through the wide tunnel in the lateral condyle. The tightening of the constructed ligament was carried out in 5–10° knee flexion (Figure 1).

Postoperative immobilization with the knee in 15° flexion in a plaster cast was for 6 weeks in both groups. Physiotherapy was similar in both groups.

Thirteen patients from both groups could be followed. In both groups the mean follow-up time was 4 (2–7) years.

The *subjective results* were graded into good, fair, and poor. *Good results*: the patients had returned to work and physical activity of the pretraumatic levels including competitive sports, and they had no or only minor complaints. *Fair* results: patients had complaints, such as moderate stiffness, exertion- evoked pain, unable to participate in competitive sports. *Poor* results: disturbing instability of the knee, markedly limited capability of flexion, giving-way, pains, and limitation of normal physical activity.

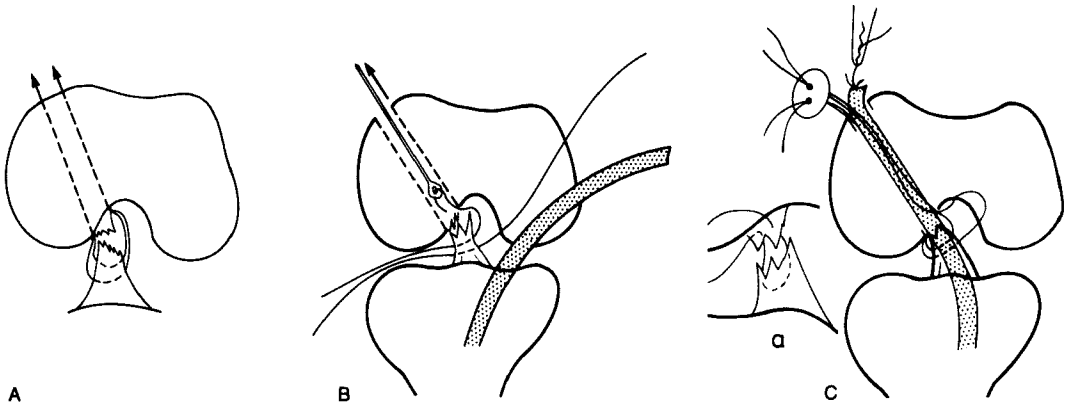

Figure 1. Repair of ACL tears.
A. Conventional repair technique (Palmer 1938) used in Group C.
B. The modified parapatellar technique used in Group P. The parapatellar tendon strip is dissected from the medial part of the patellar tendon. The threads through the tibial ruptured end of ACL available for reconstruction are pulled through the drill hole.
C. The dissected parapatellar strip is pulled through the drill hole and also local ligamentoraphy of ruptured ACL (a), if possible, is performed. Fixation of the strip can be done by a button or periosteal flap technique.

Table 1. Patients operated on with combined parapatellar transposition technique (Group P) and conventional surgical repair (Group C)

Group	N	Mean age	Medial collateral tears	Meniscus lesions	Patients at follow-up
P	16	33 (24–57)	13	3	13
C	16	35 (20–59)	14	2	13

Results

Flexion deficiency compared with the intact side was slightly greater in Group P than in Group C. No difference was observed in the circumference of the thigh musculature, and mediolateral instability of 5–10° (abduction-adduction stress) was found in 7 patients, but no intergroup difference was observed.

The mean value of the anterior drawer sign (ADS), measured with the knee in 90° flexion by a special device (Kujala et al. 1986), seemed smaller in Group P than in Group C, but the difference was not significant (Table 2). No completely failed reconstructions (ADS > 10 mm) were found in Group P, but Group C had three of them. The mean ADS value for the operated knee was greater than that of the intact knee by 0.7 mm in Group P and 2 mm in Group C; the difference between the groups was not significant. In 4 patients of Group P, the ADS value was lower than that of the intact knee.

The lateral pivot shift test was positive in 2 patients of Group C who also had a history of repeated giving-way symptoms. The lateral pivot shift test was negative in all patients of Group P.

In the patients with subjective good results,

Table 2. Anterior drawer sign measured in acutely operated ACL tears and in 33 healthy persons. Follow-up results

		Knees	Mean ± SD (mm)	Range (mm)	Difference between the operated and intact side (mm)
P	Operated on side	13	4.9±2.1	2–8.5	0.7
	Intact side	13	4.2±1.0	3–6	
C	Operated on side	13	6.5±3.0	2.5–13	2
	Intact side	13	4.5±1.8	2.5–9	
Healthy persons		66	3.4±1.2	2–7	

no difference was seen between the groups, and a difference between the groups was only found among poor results. The 2 poor patients in Group P had stable knees in the ADS test, with flexion deficiency (15–30°) being their main subjective complaint. In Group C, subjective sensations of instability were the main complaint in 5 patients.

Discussion

Optimal treatment in the acute phase of the ACL rupture has been increasingly discussed during recent years (e.g. Balkfors 1982, Warren 1983, Strand et al. 1984, Järvinen & Kannus 1985). However, not only timing of the operative intervention but also the reconstruction technique is important. The conventional technique does not seem to be sufficient for obtaining good stability, and additional procedures are sometimes used also in the primary repair (Solonen & Rokkanen 1967, Clancy et al. 1982, Renström et al. 1982).

Techniques involving the use of a tendon or a fascial graft to augment the suture in primary repair seem to have given satisfactory results, but a direct comparison has been difficult. Important factors affecting the results are the accompanying lesions and the age of the patients.

In most studies the results of ACL reconstruction have been scored by assessing manually the anterior drawer sign according to a four-category scoring system. Determination of this sign in experienced hands is a relatively good clinical method, but the need of a mechanical device for exact measurement is obvious (Markolf et al. 1978, Balkfors 1982). There are only scattered follow-up studies of surgically treated ACL tears in which the drawer sign has been compared with that of normal knees (Feagin & Blake 1983). In our study the drawer instability correlated with or slightly exceeded that reported in radiographic studies (Jacobsen 1981, Kennedy & Fowler 1971) and was below those measured with other nonradiologic devices (Balkfors 1982). In the study of Johnson et al. (1984), the anterior drawer instability of the reconstructed knee was on an average 2.2 mm greater than that of the intact knee. This is in keeping with our results in Group C, whereas this value in Group P was lower, although not significant, possibly due to the small number of patients.

Our parapatellar operation performed in the acute phase appeared superior to the conventional method in restoring the functional stability of the knee. Subjective evaluations supported this view.

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