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Previous synovectomy or epiphyseal stapling and the influence on knee replacement in juvenile chronic arthritis

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Abstract Seventy-seven anatomically graduated components (AGC) total knee arthroplasties (TKA) were performed on 52 patients with juvenile chronic arthritis. According to the nature of previous surgery on the knee, the patients were subdivided into three groups. The mean age at onset of disease in 23 patients with previous synovectomy of the knee was 11 (1.5–16) years, the mean age at the time of synovectomy was 20 (4–42) and the mean age when arthroplasty was performed was 31 (18–45) years. In nine patients with previous epiphyseal stapling, the mean age at disease onset was 4 (1.5–8) years, at stapling 8 (4–16) years, and at arthroplasty 23 (18–30) years. In patients with no previous surgery, the

mean age at disease onset in this group was 7 (1.5–16) years and the mean age at arthroplasty 34 (16–64) years. Patients with need for epiphyseal arrest had an early disease onset and knee replacement in early adulthood. The mean age at knee replacements was highest in the group with no prior surgery.

Résumé 77 arthroplasties totales du genou total (TKA) de type AGC ont été exécutées sur 52 malades avec arthrite chronique juvénile. D'après la nature de la chirurgie précédente sur le genou les malades ont été divisés en trois groupes. L'âge moyen du début de la maladie chez les 23 malades avec synovectomie était de 11 (1,5–16) années, l'âge moyen au temps de la synovectomie était de 20 (4–42) ans et l'âge moyen quand l'arthroplastie a été exécuté était de 31 (18–45) ans. Pour 9 malades avec agrafage épiphysaire, l'âge moyen au début de la maladie était de 4 (1,5–8) ans, avec 8 (4–16) ans à l'agrafage et 23 (18–30) à l'arthroplastie. Pour les malades sans chirurgie précédente, l'âge moyen au début de la maladie était de 7 (1,5–16) ans et l'âge moyen à l'arthroplastie de 34 (16–64) ans. Les malades ayant eu besoin d'un blocage épiphysaire avaient un début de la maladie précoce et un remplacement précoce du genou à l'âge adulte. L'âge moyen au remplacement du genou était plus élevé dans le groupe sans chirurgie précédente.

Study conducted at Rheumatism Foundation Hospital, Heinola, Finland.

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Introduction

In juvenile chronic arthritis (JCA), the joint most frequently affected is the knee [1, 9, 20]. About 60% of patients remit, and only 6–10% are severely disabled [8]. Chronic synovitis of the knee joint typically causes growth disturbances resulting in valgus deformity of the knee or in leg-length discrepancy [13, 21]. The outcome of synovectomy seems to be good with respect to pain relief, improvement of knee function, reduction of synovial swelling, and effusion [3, 6, 7, 10, 12, 16, 17, 18, 19, 23]. On the other hand, there is no evidence that synovectomy will retard cartilage damage or bony de-

struction [12, 17, 18]. Antirheumatic drugs have radically improved during the last few years. Intra-articular glucocorticoid injections have gained acceptance as a routine procedure in treating inflamed joints. The patients in the present study are of the age group that has not been treated as actively as the patients today.

The purpose of the present study was to investigate the impact and temporal connection of the previous knee synovectomy or stapling of knee epiphyses on the timing of TKA in patients with JCA.

Materials and methods

During the years 1985–1995, 77 knee replacements were performed on 52 patients (45 women) fulfilling the criteria of JCA [5] at the Rheumatism Foundation Hospital, Heinola, Finland. Rheumatoid factor was positive in 15/52 patients. In all patients, AGC (anatomically graduated components) prosthesis was used. Standard or small components were implanted into 72 knees, and custom-made implants were used in five knees. Knee replacements were performed using nonconstrained components with careful soft-tissue balancing and filling prevailing bone defects with cancellous bone from resections (either blocks or morselized bone). Cementless fixation technique was favored [15].

The knees were divided into three subgroups: knees with previous synovectomy (PS), knees with previous epiphyseal stapling (ES) and knees without synovectomy or stapling procedure (NS). Demographic data of patients is shown in Table 1.

During the years 1967–1991, 37 knee synovectomies (30 knees) were performed on 23 of these 52 patients. All procedures were performed surgically using classical method and anteromedial approach. The mean age of the patients in this subgroup was 11 (1.5–16) years at the onset of disease and 20 (4–42) years at the time of synovectomy.

From 1965–1982, 13 temporary epiphyseal staplings of the knee due to valgus deformity (12 knees) or leg-length discrepancy (one knee) was performed on nine patients. The mean age of patients was 4 (1.5–8) years at the onset of disease and 8 (4–16) years at the time of epiphyseal stapling. The knees with valgus deformity were stapled medially (two vitallium staples) at the distal femoral epiphysis and additional temporary arrest of the medial proximal tibial epiphysis was used in difficult deformities or in cases with the risk of imminent epiphyseal closure. The knee with leg-length discrepancy was stapled at the distal femoral epiphysis both medially and laterally. Differences between the subgroups were tested using the analysis of variance (ANOVA).

Results

In the NS subgroup, the mean duration of arthritis was 27 (10–56) years, and the mean age of patients at the time of TKA was 34 (16–64) years. In the PS subgroup, the values were 22 (10–37) years and 31 (18–45) years, and in the ES subgroup 20 (13–28) years and 23 (18–30) years, respectively. In four patients, both epiphyseal stapling and knee synovectomy were performed. Significant difference was found between the subgroups with respect to age at disease onset ($p<0.001$), age at the time of TKA ($p=0.006$), and disease duration ($p=0.032$).

The distribution of subgroups and the temporal connection between synovectomies, resynovectomies, and temporary epiphyseal arrest and TKA are presented in Fig. 1.

Fig. 1 Graphic presentation of age at disease onset and age at time of total knee arthroplasty (TKA) in patients with juvenile chronic arthritis (JCA) subdivided according to the nature of previous surgery on the knee. Patients with previous synovectomy as well as epiphyseal stapling are only included in the subgroup with previous epiphyseal stapling. The patient who had epiphyseal stapling due to leg-length discrepancy has been excluded. Patients with more than one synovectomy were excluded as well

Table 1 Demographic data of 52 patients with juvenile chronic arthritis (JCA) and subsequent total knee arthroplasty (TKA). CRP C-reactive protein

	No previous knee surgery	Previous synovectomy	Previous epiphyseal stapling	Both previous synovectomy and stapling ^a
Number of patients	24	23	9	4
Women/men	22/2	18/5	8/1	3/1
Number of knees	39	30	13	5
Mean age (years and range) at onset of JCA	6.7 (1.5–16)	11.3 (1.5–16)	3.5 (1.5–8)	3.9 (1.5–7)
Mean disease period (years and range) before TKA	27.0 (10–56)	21.7 (10–37)	19.8 (13–28)	16.8 (13–23)
Mean age (years and range) at the time of TKA	34 (16–64)	31 (18–45)	23 (18–30)	21 (18–26)
Mean preoperative CRP (mg/ml) and range at the time of TKA	29 (0–80)	32 (0–112)	36 (4–85)	36 (0–73)
Mean height (cm and range) of patients at the time of TKA	153 (130–167)	164 (150–174)	146 (130–169)	146 (136–161)
Mean weight (kg and range) of patients at the time of TKA	51 (28–72)	59 (47–78)	40 (32–72)	44 (34–56)

^a Patients and their data are also included in the groups “previous synovectomy” and “previous epiphyseal stapling”

Discussion

In this study, disease activity was high, resulting in arthritic joint destruction necessitating early joint replacement. Local growth disturbance primarily as valgus deformity of the knee reflects the severity of disease. The need for epiphyseal stapling of the knee in childhood was followed by a relatively early arthroplasty in adulthood. Stapling itself did not cause joint destruction but was a token of disease severity. In the NS group, the patients' age at the time of arthroplasty was higher than in other subgroups. Similarly, the patients' age in the PS subgroup was significantly higher than in the ES subgroup (Table 1).

Patients with severe JCA are frequently short, and their body weight is low. Our study indicated that short stature might correlate with disease severity and local growth disturbances and thus with the young age of patients at the time of arthroplasty (Table 1). The need for synovectomy has recently decreased because of an effective medical treatment of patients with JCA. If conservative treatment with intra-articular glucocorticoids and antirheumatic drugs fails after 3–6 months, there is an indication for surgical synovectomy [12]. In the current study, all synovectomies were performed with classical open technique. However, nowadays most synovectomies are performed arthroscopically, which is the case at our institution.

The condition of the knee joint before synovectomy is of utmost importance. The outcome of synovectomy depends on the preoperative stage of joint destruction. Early synovectomy is defined as a procedure performed in a joint with grade 0–2 involvement [14]; late synovectomy as a procedure performed in joints with involvement of grade of 3–5. Early synovectomy is reported to show significant pain relief and improvement of knee function, whereas late synovectomy is regarded as a palliative intervention postponing the need for joint replacement in 5–10 years [12].

Temporary epiphyseal arrest with staples was introduced in 1949 [4]. The first temporary arrest of epiphyseal growth at our institution was performed in 1956, and until the end of 1999, 119 patients had undergone the procedure [22]. Temporary epiphyseal stapling is a safe and effective method in managing knee valgus deformity in patients with JCA [2, 21].

Knee replacement in patients with JCA is often challenging, with many technical problems due to severe deformities, osteoporosis, and small bone size [11]. Patients are frequently in the younger group at the time of operation, and durability of the replacement is required for extended periods. In the present study, 77 knee replacements were performed in 52 patients with an overall survival rate of 99% and with the follow-up of 13 years, using revision surgery or death as an end point [15]. In this series, only one revision was performed due to loosening of both the tibial and femoral components in a patient with marked preoperative valgus deformity. No epiphyseal stapling was performed on this knee, and

retrospectively, the survival of TKA might have been enhanced by temporary epiphyseal arrest in childhood.

In patients with JCA and severe knee involvement, every effort should be made to postpone the necessity for joint replacement, including effective medical treatment, synovectomies, and temporary epiphyseal arrests with stapling. However, in the present study, the need for epiphyseal stapling due to valgus deformity in childhood was also associated with the need for an early arthroplasty in adulthood.

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