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THE EFFECT OF HIGH TIBIAL OSTEOTOMY ON PAIN IN OSTEOARTHRITIS OF THE KNEE JOINT

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Since MacMurray in 1935 described the subtrochanteric femoral osteotomy, this operation has gained wide acceptance as a valuable procedure in the treatment of osteoarthritis of the hip joint.

The first publication of favorable results after tibial osteotomy as treatment for osteoarthritis of the knee joint was published as late as 1961 by Jackson & Waugh. This first promising report has been confirmed later by several clinical studies (Wardle 1962, Gothefors & Hult 1964, Coventry 1965, Helal 1965, Wiley 1967, Ahlberg et al. 1968, Bauer et al. 1969, Devas 1969, Goerttler & Debrunner 1969, Gunn 1969, Jackson et al. 1969, Gagnaire et al. 1970, Harris & Kostuik 1970). Harris & Kostuik (1970) summarized the prevailing opinions of operative techniques in the literature and recommended as the operative method of choice a high tibial wedge osteotomy proximal to the tibial tubercle.

The results after tibial osteotomies have been reported to be particularly favorable in cases with preoperative varus or valgus deformity of the knee. The success of the osteotomy has been ascribed to the fact that the femoro-tibial axis was restored to the "normal angle of 2-17 degrees of valgus" (Bauer et al. 1969).

The results in the published series were not evaluated according to any standardized method. Furthermore, the effect of the operation on the different qualities of pain from an osteoarthritic knee joint—capsular, muscular and venous—as described by Helal (1965), does not seem to have received much attention.

The aim of the present investigation is to study the correlation—if any—between the different types of pain and the correction of the tibio-femoral angle obtained by osteotomy of the tibia.

For this purpose we have chosen to differentiate between two qualities of pain.

Pain at rest (described as venous pain by Helal) is the dull ache that occurs when sitting and lying, often disturbing sleep at night. The intensity of this type of pain is usually correlated to the activity the patient has undertaken during the day.

Pain in motion (described as capsular and muscular pain by Helal) is the type of discomfort that the patient experiences when moving the joint, walking, climbing stairs, etc.

MATERIAL AND METHODS

In the Department of Orthopaedic Surgery at the University Hospital in Umeå, Sweden, 45 tibial osteotomies were performed on 40 patients during the period 1959–1969. The diagnosis in all cases was osteoarthritis of the knee joint. Nine patients (10 joints) could not be examined—6 had died and 3 were not available for examination. The remaining material thus consisted of 35 operated knees in 31 patients—11 males and 20 females—between the ages of 47 and 75. The mean age at operation was 61.5 years.

Indications for operation are enumerated in Table 1. It can be mentioned that all patients had pain in motion. Seven knees had no pain at rest.

Table 1. Indication for tibial osteotomy.

Femoro-tibial angle	Pain at rest and pain in motion	Pain in motion only	Total
Varus	18	4	22
Valgus	5	4	9
Neither varus nor valgus	3	1	4
	26	9	35

Operative Technique

Twenty-four horizontal osteotomies with valgisation and 10 horizontal osteotomies with varisation were performed proximal to the tibial tubercle.

In 24 knees the angle correction was achieved by a minus-type osteotomy (i.e. removal of a bone wedge). In 10 cases it was performed by a plus-type osteotomy (i.e. insertion of a bone transplant). One valgisation osteotomy was made below the tibial tubercle.

Internal fixation with staples was used on 26 occasions and with an AO T-plate on 3 occasions. In 6 osteotomies no interval fixation was used. External fixation with plaster of Paris was used postoperatively in one case without and in 8

cases with internal fixation. The remaining 26 were treated without external fixation. Early mobilisation of the knee joint was started within the first week in 25 of these 26 cases.

The time from operation to full weight-bearing varied from 6 weeks to 6 months and was in the majority of cases (19 knees) 2-3 months. The one low osteotomy showed delayed union and was not allowed full weight-bearing until 12 months after the operation.

Complications

No complications with significance for the end-results occurred. No cases of thrombosis could be verified by clinical examination and no paralysis of the peroneal nerve occurred.

Follow-up Examination

Twenty-eight patients with 32 operated knees were examined by clinical examination 1.5 to 9.3 years (average observation time 5.4 years) after the operation. X-ray examination of the knees was made with the patient both in lying and in standing position with weight-bearing on both knees (Ahlbäck 1968). Three patients on whom arthrodesis meanwhile had been performed are included in the material but were not examined.

Attempts were made for an objective grading of the functional state of the patients. We found, however, that thorough questioning of the patient regarding use of sticks, feeling of weakness and instability when walking and going up and down stairs, gave such inconstant answers that these factors could not be used in a satisfactory way in the evaluation of the results.

RESULTS

In three cases arthrodesis was performed 4, 10 and 42 months after the osteotomy respectively.

Results at Follow-up Examination (32 knees)

Patient assessment: Twenty-seven knees were considered by the patients as improved. In 3 knees the symptoms were the same as before the operation and in 2 knees they were worse. However, in 29 knees the patients considered the operation as a worthwhile procedure and would agree to the same type of surgery again if their preoperative symptoms should return.

Pain at rest: In 24 out of 27 knees where pain at rest was prominent before the osteotomy, this symptom had disappeared after the operation. No statistical* correlation could be found between good results

* χ^2 -analysis.

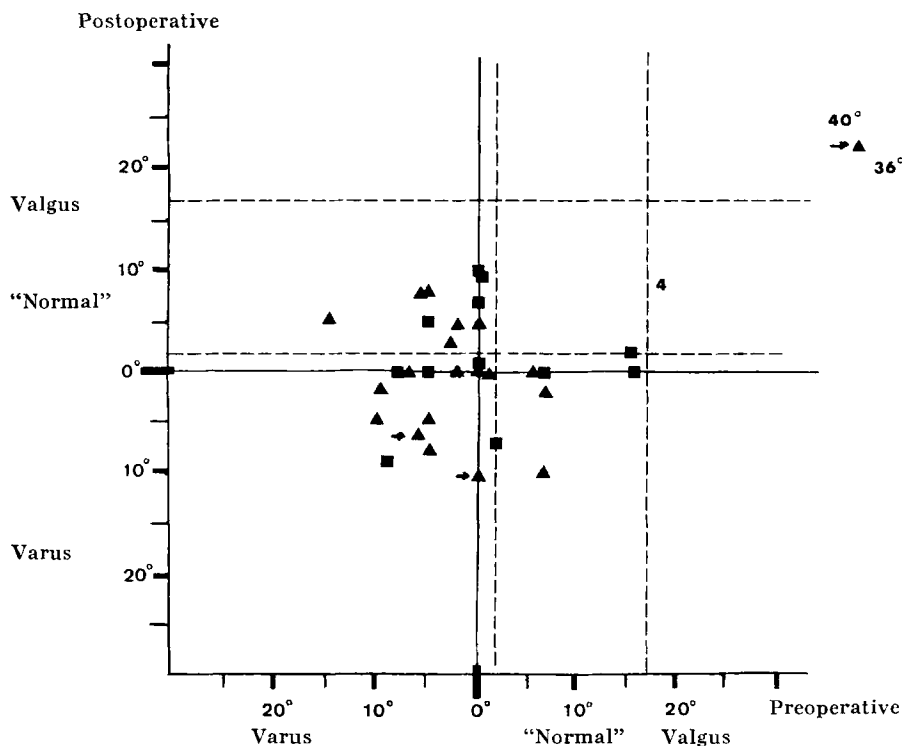


Figure 1. The correlation between occurrence or not of pain on motion and pain at rest and the post- and preoperative femoro-tibial angles is illustrated.

■ = knees with no pain on motion postoperatively.

▲ = knees with pain on motion postoperatively.

The three knees with pain at rest postoperatively are pointed out by the arrow (→).

and the "normal" roentgeneological valgus angle between femur and tibia (Figure 1).

Pain in motion: In 23 knees the pain in motion had decreased after the operation. In 12 this pain in motion had disappeared. Statistical analysis does not confirm any existing correlation between postoperative "normal" (2–17°) valgus angle and effect on pain in motion (Figure 1). However, in 10 of the 12 knees where pain in motion had disappeared after the osteotomy, the postoperative femoro-tibial angle was between 0–17 degrees of valgus.

In the 24 knees where pain at rest had disappeared, there was still pain in motion in 15 knees.

Walking capacity: The walking capacity in 26 patients with 30

operated knees remained unchanged or was increased after the operation. Only in 2 knees had the walking capacity decreased.

Occupation: Twenty-two patients with light work (mostly housewives) could undertake the same occupation after the osteotomy as before. Six patients with heavy occupations had to change to a lighter form of work.

Movement: Four knees had a movement (measured from 0 degrees) of less than 90 degrees of flexion. In three of these knees the range of flexion was 100 degrees or more before the operation. Six patients showed an extension lack of more than five degrees.

Lateral instability: Three knees had moderate lateral instability. One knee showed a marked lateral instability—45 degrees varus deformity in standing—and this patient complained of considerable pain at rest and in motion. It can here be mentioned that marked lateral instability was also present after the osteotomy in the cases where arthrodesis was performed later.

Roentgenological: As seen in Table 2, radiological signs were in most of the knees unchanged. Only in two knees were all signs worse.

Table 2. Radiological changes.

	Better	Unchanged	Worse
Joint space	3	17	12
Cysts		19	13
Sclerosis	3	21	8

Observation time: The material was divided into two groups—one with an observation time of 1.5 to 5 years containing 15 knees, and the other with an observation time of 5 years or more containing 17 knees. No deterioration with increasing observation time could be found.

DISCUSSION

The results of the present investigation suggest that more complete information can be gained for the interpretation of the results of osteotomies as treatment for osteoarthritis of the knee joint if a distinction is made between pain at rest and pain in motion.

The results expressed in terms of the patients' total assessment showed improvement in 27 knees in spite of persisting pain during

motion in 17 of these cases. This indicates that pain at rest is the most disturbing symptom for the patient. If pain at rest is relieved, the patient finds a definite general improvement in spite of possible persisting pain in motion. The explanation given by the patients is that pain in motion can be controlled by walking more slowly and carefully. If such activities do not lead to aching pain at rest in the evening and at night, the patient is able to maintain or even increase his activities.

The discrepancy between the effect of the osteotomy on the two types of pain might indicate different pathomechanisms for pain at rest and pain in motion.

It has been demonstrated by intraosseous phlebography that the drainage from the bone adjacent to an osteoarthritic joint is impaired (Phillips 1966). Arnoldi et al. (1972) found that there is a positive correlation between pain at rest and intraosseous stasis and hypertension adjacent to the joint. This hypertension is reduced by an osteotomy concomitant with postoperative freedom from pain at rest (Arnoldi et al. 1971).

Our results provide evidence that regardless of the postoperative femoro-tibial valgus or varus angle, a positive effect on the pain at rest was found in the vast majority of the cases. This supports the view of Arnoldi et al. (1971) that the effect of the osteotomy on pain at rest is not due to mechanical factors.

The pain in motion, on the other hand, is probably due to abnormal mechanical stresses on the ligamentous structures (Helal 1965). Bauer et al. (1969) found that the best results in terms of the patient's own total assessment were obtained when the femoro-tibial angle after the osteotomy was within the "normal" range of slight valgus (2–17°). The statistical analysis of our results could not confirm this opinion. On the other hand, all except two of the patients with no pain in motion after the operation had a postoperative valgus angle between 0–17 degrees.

Marked instability must be considered as a contraindication to osteotomy as a treatment for osteoarthritis of the knee joint. The four failures in this series all had very pronounced lateral instability before operation. In three of these knees an arthrodesis had been performed and an arthrodesis is planned for the fourth.

From the roentgenological evaluation of the results, we, like other authors (Coventry 1965, Goerttler & Debrunner 1969, Gunn 1969, Jackson et al. 1969) could not observe any general trend of changes in the severity of the osteoarthritic process before and after osteotomy.

This might suggest that the osteotomy probably has no effect on the osteoarthritis itself, but is rather a treatment directed against its symptoms.

S U M M A R Y

The results of 35 high-tibial osteotomies performed as treatment for osteoarthritis of the knee joint in 31 patients are presented. Marked postoperative instability was present in 4 cases, in all of which the results were classified as failures. In 3 of these cases arthrodesis has later been performed. Of the remaining 31 osteotomies, 27 showed significant improvement of the symptoms from the joint. The mean observation time after operation was 5 years (1.9–9.3 years).

The two types of pain occurring in an osteoarthritic joint, namely pain at rest and pain in motion, are discussed. The results showed that the osteotomy had a very good and almost constant effect upon pain at rest regardless of postoperative varus or valgus angle.

The effect on pain in motion, on the other hand, is less predictable, but a positive effect seems to depend on a normal postoperative valgus position in the knee.

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