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HIGH TIBIAL OSTEOTOMY FOR RHEUMATOID ARTHRITIS OF THE KNEE

A One to Six Year Follow-Up Study

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Although high tibial osteotomy for osteoarthrosis of the knee joint is well recognized, its place in the management of rheumatoid arthritis of the knee is much less well established. Thirty-six rheumatoid knees were reviewed 1 to 6 years following tibial osteotomy. The results were 42 per cent good, 19 per cent satisfactory and 39 per cent poor. No patient remained free of pain for more than 3 years, and recurrence of pain was not always associated with recurrence of deformity. Varus knees did considerably better than valgus knees despite some technical errors. Maintenance of a normal femoro-tibial angle range of 164° to 177° at follow-up was important but not as vital as in osteoarthrosis of the knee. The beneficial effect of tibial osteotomy in rheumatoid arthritis of the knee seldom lasted more than 3 years after which time an increasing number of bad results were seen. It was concluded that high tibial osteotomy was a satisfactory procedure for rheumatoid arthritis of the knee but its efficacy was not comparable to that seen in osteoarthrosis nor was its effect long-lasting.

Key words: rheumatoid arthritis; knee; tibial osteotomy

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High tibial osteotomy for osteoarthrosis of the knee is now a well recognized procedure (Wardle 1962, Coventry 1965, 1973, Bauer et al. 1969, Jackson et al. 1969, Jackson & Waugh 1974, Harding 1975). It is also known that good results can last up to 10 years (Seal & Chan 1975). The efficacy of tibial osteotomy in the management of rheumatoid arthritis of the knee, however, has not been well established. The purpose of this report is to assess the value of tibial osteotomy in rheumatoid arthritis of the knee and to evaluate the importance of maintaining the correction within Bauer's femoro-tibial angle range of 164°–177° (Bauer et al. 1969). The femoro-tibial angle is defined as the lateral angle formed between the axes of the femur and tibia in the longitudinal plane during weight-bearing.

PATIENTS AND METHODS

From June 1969 to August 1974, 35 patients underwent high tibial osteotomy for rheumatoid arthritis of the knee in Bath. Two patients had bilateral osteotomies of which one procedure fell outside the period of study. Thirty-six osteotomies are thus available for assessment. No patients were lost to follow-up and all were seen and examined by one of the authors (JPP). The indications for osteotomy were pain, deformity and instability. The length of follow-up is from 1 to 6 years with an average of 3 years.

Preoperative profile

There were 28 females and 7 males with an age span of 22 to 78 years; the average age being 61 years. Twenty-four patients were seropositive at the time of surgery and the same number of patients were on steroid medication. The duration of rheumatoid arthritis at operation was from 5 to 31 years. With the exception of five patients all had multiple joint involvement, often affecting the hips and feet. Preoperatively four patients used crutches and one was confined to a wheelchair. Thirteen patients had undergone surgery to the affected knee 6 months to 3 years prior to osteotomy. The surgical procedures included twelve synovectomies, three being associated with patellectomies and one Platt's femoral condylar replacement.

Operative details

There were 29 valgus knees and seven varus knees. The deformities as measured by Bauer's femoro-tibial angle on weight-bearing ranged from 145° to 193°. With one exception, closing wedge excision was the method used for correction of the deformity. Two osteotomies were carried out below the tibial tubercle since the deformities were considered too great for correction above the tubercle. Two patients had synovectomy at the time of osteotomy. Eleven patients had no internal fixation as the bone was considered too soft to hold staples. Immobilization in a plaster cast was maintained for a period of 6 to 8 weeks.

Immediate postoperative radiographs showed that all knees were corrected to a femoro-tibial angle range of 165° to 180°, thus being without exception within the femoro-tibial angle range for normal knees. At review the range had widened to 155° to 190°.

Complications

There was one case each of infection, osteotomy into the joint, fractured tibial plateau and foot drop. There were two cases of staples wrongly inserted into joints.

Method of assessment

At review standard radiographs of the knees were taken together with weight-bearing views. Bauer's femoro-tibial angle was measured. Rheumatoid activity was assessed both clinically and by estimation of the rheumatoid factor and sedimentation rate. Examination of the knee included measurement of range of movement, assessment of collateral stability and synovial activity. Analgesics intake was noted. In rheumatoid arthritis multiple joint involvement often makes specific assessment of individual joints difficult and at the same time probably not very meaningful. Pain relief, however, can be assessed. Thus Coventry (1973) in his evaluation of rheumatoid knees graded results according to pain relief only. We have graded our results as good, satisfactory and poor according to the following criteria:

Pain

Grade 1	No pain in knee
Grade 2	Occasional analgesics for knee pain
Grade 3	No change/worse

Mobility

Grade 1	Improved
Grade 2	No change
Grade 3	Decreased

Function

Grade 1	Considerable improvement
Grade 2	Improved
Grade 3	No change/worse

GOOD:	All grade 1, one grade 2; no grade 3
SATISFACTORY:	One grade 1, all grade 2; no more than one grade 3.
POOR:	No grade 1, two or more grade 3.

RESULTS

Of the 36 knees assessed 15 knees were classified as good (42 per cent), 7 as satisfactory (19 per cent) and 14 as poor (39 per cent).

Pain relief

At review eight patients did not complain of pain in their knees. It is important to note that none of these eight patients had had the osteotomy for more than 3 years. Nine patients stated that their knees were much less painful than before surgery and they only took occasional analgesics for knee pain. Four replied outright that surgery had been totally unsuccessful as regards pain relief. Another eight patients had already undergone further surgery to their knees with pain as the main reason for revision surgery.

The efficacy of tibial osteotomy for pain relief in rheumatoid knees is thus poor and

contrasts sharply with the results in osteoarthrosis. Our findings in this series are not specifically related to the general level of rheumatoid activity among patients since there was an equal distribution of patients with positive RA Latex and raised sedimentation rate at the time of surgery and at the time of review.

The most important finding as regards pain relief is that in no knee did pain relief last for more than 3 years. Indeed with passage of time increase in pain is more than likely.

Range of movement

Comparing the range of movement measured at follow-up with that recorded preoperatively, 24 knees (66 per cent) had an unchanged range of movement. Five knees had an increased range, the maximum being 50°; all five knees were graded good. Seven knees had a diminished range, the maximum being 70°. Of these five were graded poor and two satisfactory; one of the latter knees became ankylosed following surgery with concomitant decrease in pain.

Fifteen knees had a fixed flexion contracture at follow-up with a range of 5 to 30° (average 11°). There seems to be no definite correlation with results except when the deformity is severe. There was one case of recurvatum of 10° at review giving a poor result.

Functional assessment

In contrast to osteoarthrosis where functional improvement is excellent following high tibial osteotomy, only 10 out of 35 patients (36 knees) admitted to definite improvement following surgery. Patients' acceptance of a second and similar procedure is a good index of subjective assessment and in this series only two patients had subsequent osteotomy of the contralateral knee. In one series of osteoarthrosic knees (Seal & Chan 1975) 11 out of 47 patients had bilateral osteotomies. Another indication of relative lack of functional improvement is that four patients required crutches and three were confined to wheelchairs at review as opposed to four and one, respectively, before operation.

Femoro-tibial angle at follow-up

Immediate postoperative radiographs showed that all knees were corrected to a femoro-tibial angle range of 165°–180°; thus without exception within the femoro-tibial angle range for normal knees. At review the range had widened to 155°–190°.

The femoro-tibial angle at follow-up is shown in Figure 1; preoperatively varus knees being indicated by brackets.

Preoperatively valgus knees: There is a proportionately equal distribution among the good, satisfactory and poor groups of knees with a normal femoro-tibial angle at follow-up. This is in distinct contrast with osteoarthrosic knees where maintenance of a normal femoro-tibial angle is vitally important for a good result. In one series, all poor results fell outside the normal femoro-tibial angle range (Seal & Chan 1975).

Preoperatively varus knees: There were only seven varus knees in this series but it is of interest to note that firstly, a disproportionate

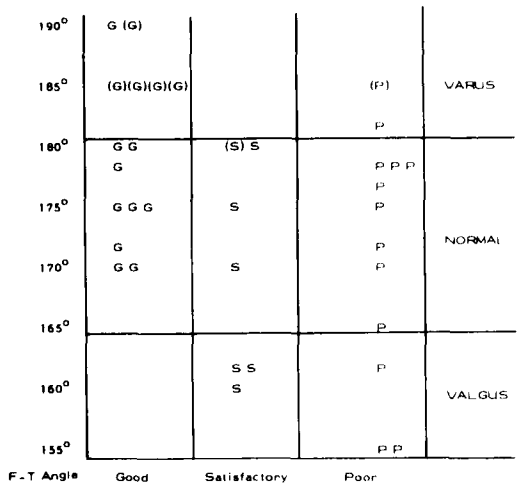

Figure 1. Femoro-tibial angle at follow-up.
(G) (S) (P) = Knees in varus preoperatively
G S P = Knees in valgus preoperatively

number belonged to the good group (five out of seven) and secondly, despite undercorrection the results remained good (Figure 2). The numbers are too small for definite statement but the results suggest that varus knees do better than valgus knees. This finding applies even to knees with severe articular damage at the time of operation (Figure 2). The same observation has also been made in osteoarthrosic knees (Harding 1975).

Poor results

Fourteen knees were assessed as poor at review (39 per cent). Of these eight had undergone further surgery at 1 to 6 years following tibial osteotomy. The reasons for revision surgery were recurrence of pain in all patients, deformity in four and instability in one patient.

Some failures were technical in nature. There was one case each of the osteotomy being carried into the joint, a staple protruding into the joint and over-correction. Five knees were under-corrected even though the immediate postoperative radiographs showed correction to be within Bauer's femoro-tibial angle. This was due to the fact that collateral laxity was not recognized at operation resulting in apparent rather than real correction of the deformity (Figure 3). Previous surgery to the knee prejudices the results; seven out of thirteen of these knees were graded poor at review (55 per cent). The reason for this is not clear since analysis of clinical details and radiographs showed that this group did not contain an undue number of radiologically severely affected knees which might have accounted for the high percentage of failure.

Three knees showed radiologically mild rheumatoid arthritis at the time of surgery but subsequently deteriorated rapidly with an

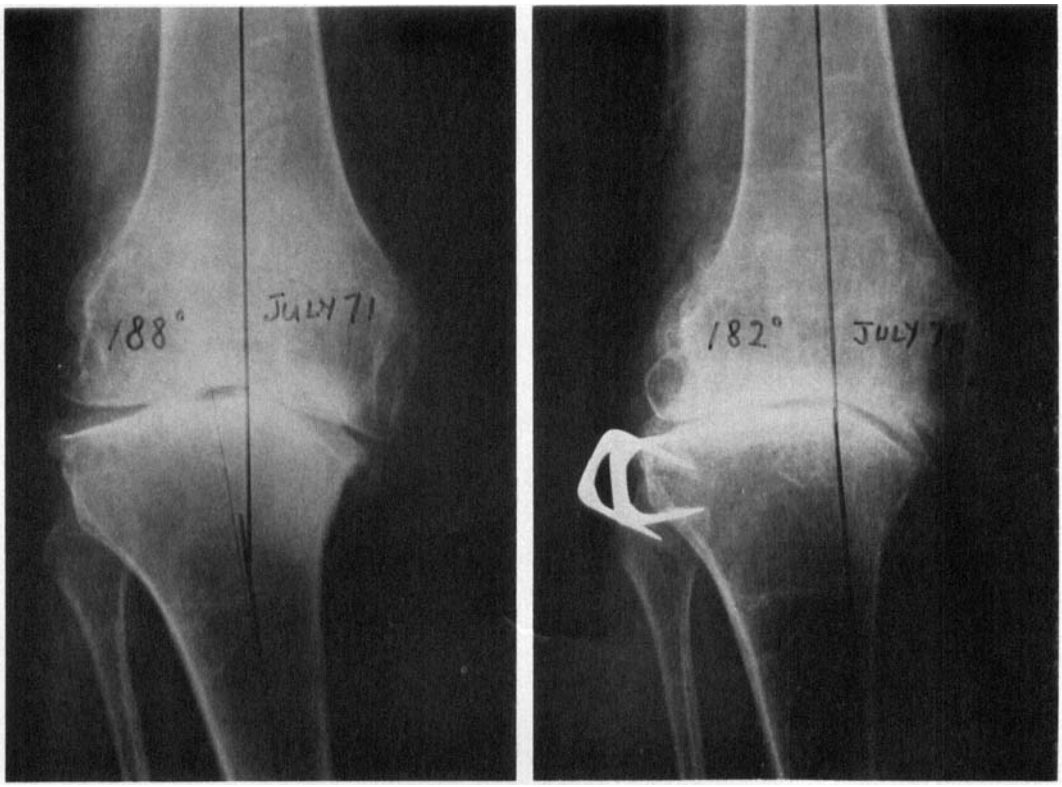

Figure 2. Varus knee. Preoperative femoro-tibial angle 188°, July 1971. Follow-up angle 182°, July 1975. Note under-correction. Result good.

eventual poor result. The knees however remained well corrected at the time of review.

Up to 3 years postoperation there is a bias towards a good result, after which time a progressive worsening of results is seen usually associated with recurrence of pain and less frequently with recurrence of deformity (Table 1).

Good results

Fifteen knees were graded as good (42 per cent). Five of these were preoperatively varus knees and measurement of femoro-tibial angle at review showed that they were still in varus. Of the ten preoperatively valgus knees graded as good at review, one had been over corrected and the rest had been maintained within a normal femoro-tibial angle range. Three knees in the good group were clinically and radiologically severely affected at the time of operation but subsequently did well. There is no obvious explanation for this except that the knees were either well corrected and the correction was subsequently maintained, or that the knees were in varus at time of surgery. Sloping joint line was not significant provided the femoro-tibial angle was within normal limits.

DISCUSSION

Corrective high tibial osteotomy has now gained an important place in the management of osteoarthrosis of the knee and good results in 70 per cent or more can be expected and maintained for many years after surgery (Coventry 1973, Seal & Chan 1975). There is also general agreement on the importance of correction of the deformity to a range within Bauer's femoro-tibial angle (Bauer et al. 1969,

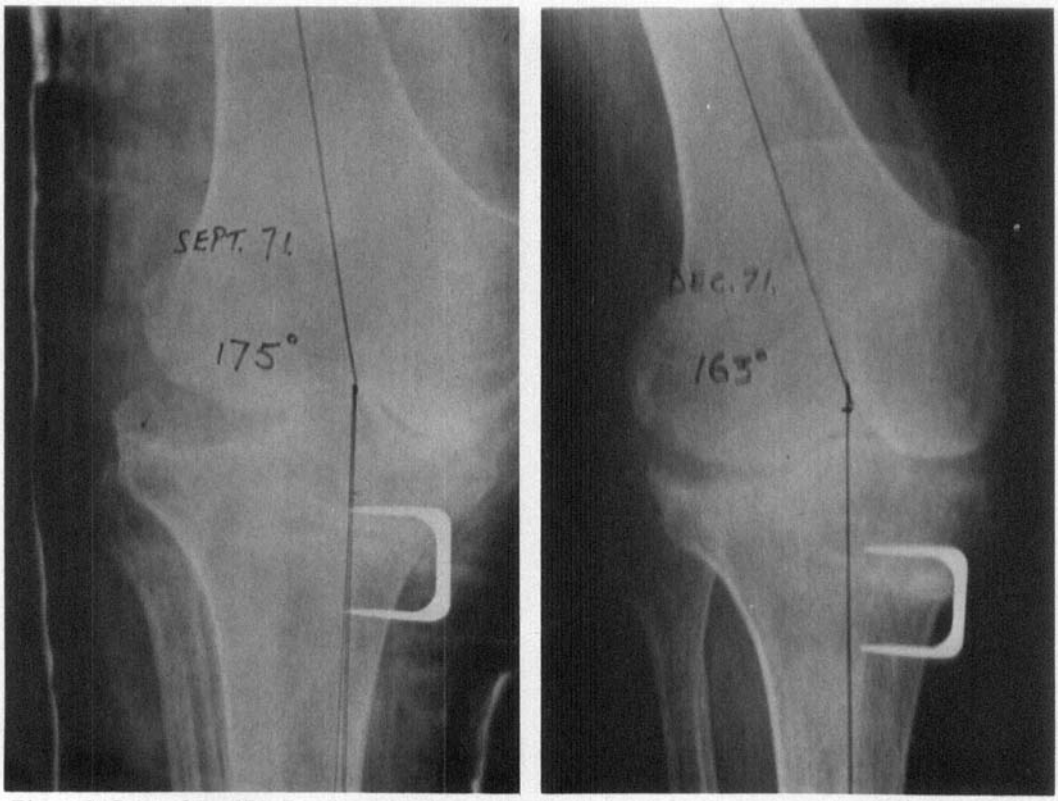

Figure 3. September 1971: Postoperative angle 175°. Note correction is apparent rather than real due to lateral collateral laxity. December 1971: Femoro-tibial angle out of plaster cast 163°. Result poor.

Harris & Kostuik 1970). Information on the value of tibial osteotomy for rheumatoid knees however is scarce. Of the 474 knees evaluated by Coventry (1973), Jackson & Waugh (1974) and Harding (1975), 37 were rheumatoid knees. This present study while small is therefore one of the largest series confined specifically to rheumatoid knees. It is clear from this study that the results of osteotomy in rheumatoid knees differ from those obtained in osteoarthrosic knees as follows:

1. Pain relief is of much shorter duration. There is no knee in this series with pain relief lasting more than 3 years. In osteoarthrosic knees, recurrence of pain is usually associated with recurrence of deformity and this is not necessarily so in rheumatoid knees.
2. Functional improvement is by no means as dramatic as that obtained in osteoarthritic knees; nor is the duration of improvement maintained for as long a period of time. This is true both subjectively and objectively. It is important to point out, however, that in rheumatoid arthritis any gain in function, albeit minor, is a real asset to an already crippled patient and any relief in pain, even of limited duration is advantageous in reducing disability.
3. Maintenance of the femoro-tibial angle, though important, is not as vitally significant as in osteoarthrosis of the knee. The reason for this is probably multifactorial since rheumatoid arthritis is a generalized disorder and there are more problems involved than simple mechanical correction of varus or valgus deformity. Varus knees treated by osteotomy require further analysis, since if our results are reproducible in a larger series then high tibial osteotomy for this deformity can lead to the same success rate as in osteoarthrosic knees.
4. It is vital to be meticulous with operative details. As bone in rheumatoid patients is usually osteoporotic, osteotomy is technically easy but may readily produce tibial plateau fracture or penetration of the joint. Furthermore, staple fixation can be difficult to achieve and may result in their insertion through the subchondral bone into the joint in error.
5. Steroid medication in this series had no significant effect on results at review. No problems were observed as regards wound healing, bone union and infection associated with steroid intake. There was one case of infection in 36 knees.
6. Mild and burnt out rheumatoid and varus knees appear to do best following high tibial osteotomy. Advanced disease should be avoided. A sloping joint-line is not a contra-indication, provided good alignment is obtained at operation. One should aim to over correct rather than under correct, as in osteoarthrosic knees. Due allowance for collateral instability is necessary and can only be checked and avoided by radiography at operation. A few knees moderately diseased at operation, subsequently deteriorated rapidly, both clinically and radiologically. At present no means of predicting these changes is known; a solution to this problem would greatly improve results.
7. The following categories tend to give poor results, viz., knees with severe fixed flexion deformity, with marked collateral instability, and those subjected to previous surgical procedures. Valgus knees tend to do less well than varus knees. Valgus, if under corrected, disposes to failure. Radiologically advanced rheumatoid joints will probably not respond.
8. Approximately 60 per cent good and satisfactory results were obtained in this

Table 1. Influence of time elapsed since operation on results

Length of time since operation	Good	Satisfactory	Poor
Up to 3 years	11	4	4
More than 3 years	4	3	10

series, with a follow-up of 1 to 6 years. However, as is shown in Table 1, the number of long-term good and satisfactory results beyond 3 years are considerably reduced. If the results of tibial osteotomy are to be compared with other procedures such as double osteotomy (Benjamin 1969) and total joint replacement, the follow-up period must be at least 3 years since prior assessment will give a disproportionate number of good results.

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