

Osteotomy of the Upper Portion of the Tibia for Degenerative Arthritis of the Knee

A PRELIMINARY REPORT

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Attempts to treat degenerative arthritis of the knee by surgical means have been limited. Patellectomy or patelloplasty may be done in the presence of symptomatic patellofemoral arthritis; and joint débridement, including removal of loose bodies, large osteophytes, and damaged menisci, is occasionally used. Arthrodesis and arthroplasty are seldom carried out.

Most patients with degenerative arthritis of the knee bear more of their weight on one tibial condyle than on the other. The male knee normally tends toward a varus position, the female toward a valgus position. As the articular cartilage degenerates over the tibial condyle that bears the most weight, the natural varus or valgus deviation increases and a vicious circle is set up in which increasing deformity creates increasing degenerative change. The uninvolved condyle and joint space usually appear normal. If weight-bearing and other stresses could be increased on this more normal area and decreased on the involved portion, it would seem that pain might be relieved and the useful life-span of the knee joint considerably prolonged.

In 1961, Jackson and Waugh described a ball-and-socket type of osteotomy of the tibia just below the tibial tubercle (and osteotomy of the fibula at its middle third) to correct the deformity created by osteo-arthritis. They reported on ten patients and stated that all had been relieved of their pain. In 1962, Wardle reported on tibial osteotomy for degenerative arthritis of the knee and stated that this type of operation had been done in Liverpool since the time of Sir Robert Jones. Wardle's osteotomy was transverse and about four inches distal to the tibial tubercle. The fibula was osteotomized at about the same level. Wardle stated that all but three of seventeen patients remained free of pain and had 90 degrees or more of flexion following osteotomy. MacIntosh used an endoprosthesis to replace and shim the more degenerated of the two tibial condyles, correcting the deformity in this way. In a preliminary report he stated that eight of thirteen patients achieved good results, two fair results, and three poor results.

Stimulated by the relief of hip pain observed after intertrochanteric osteotomy which altered weight-bearing surfaces and corrected deformity and further encouraged by the report of Gariépy's¹ lateral approach to the upper part of the tibia for the correction of flexion deformity in rheumatoid arthritis, I attempted to produce a somewhat different type of osteotomy proximal to the tibial tubercle. This modification is designed to fulfill six criteria. The osteotomy should (1) fully correct and, in fact, slightly reverse the varus or valgus deformity, (2) be near the site of the deformity, (3) involve bone that will heal rapidly—the bone should be primarily cancellous, (4) allow early motion of the knee and early bearing of weight, (5) provide convenience for exploration of the knee at the time of osteotomy, if such is indicated, and (6) present no undue technical difficulties or potential hazards. In

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addition to these advantages, an osteotomy proximal to the tibial tubercle allows the pulling force of the quadriceps mechanism to impact the site of the osteotomy.

Indications

If there are marked generalized degenerative changes with advanced patellofemoral arthritis and hypertrophic spurring, the indications become less clear. In a few such instances, joint débridement and patellectomy have been done as a first stage and an osteotomy as a second stage, or both osteotomy and débridement have been carried out in the same operative session. The indications, therefore, are not absolute, and more time must pass before it can be determined which patient is best suited for osteotomy. The ideal situation at the present time appears to be a patient with disabling pain and roentgenographic changes showing narrowing of the joint with resultant valgus or varus deformity but minimum degenerative change in other respects, such as loose bodies, excessive spurring, and patellofemoral arthritis. The patient should be muscular and sufficiently motivated to effect a good rehabilitation. Bilateral involvement is no contra-indication.

Operative Technique and Postoperative Program

The osteotomy is done through the upper part of the tibia in the general region of the previous epiphyseal line, just proximal to the tibial tubercle (Fig. 1-A). While my colleagues and I have made our osteotomy a horizontal one, some obliquity, as emphasized by Gariépy², may be desirable to prevent fracture of the proximal fragment through the region of the tibial spines. (Such fracture occurred on a few occasions but did not seemingly alter the result.)

Exposure of the medial tibial condyle for varus osteotomy to correct genu valgum presents no problem. Lateral exposure to perform valgus osteotomy for genu varum is done according to Gariépy's^{1,2} description. The knee should always be flexed to at least 45 degrees to allow the popliteal and peroneal structures to be relaxed and to fall back. Either a transverse or a longitudinal incision is made over the fibular head and lateral knee-joint line. The upper portion of the fibula is exposed by subperiosteal dissection and removal of the fibular collateral ligament and biceps femoris tendon with the other soft tissues; this allows these structures to retract posteriorly. The peroneal nerve may be isolated and retracted, but this need not be done once experience with the technique has been gained. Enough of the fibula should be removed (the amount ranges from the entire fibular head to the proximal tip) to expose the lateral aspect of the tibia. The proximal end of the tibia is exposed subperiosteally both anteriorly and posteriorly to at least the mid-line. A Kirschner guide wire may be inserted, and roentgenograms may be made to determine the location and depth of the proposed osteotomy. A lateral wedge is removed with an osteotome; the posterior structures of the knee should be protected during the process. Although the osteotomy is carried to the opposite cortex, it should not be carried completely through it. After the wedge is removed, valgus force is exerted and the medial cortex breaks in a greenstick manner, and the osteotomized edges come together. Rotation is completely controlled if the opposite cortex is treated in this manner. The cortical edges can be held securely with one or two staples (Fig. 1-B). The anterior tibial artery is distal to the fibular head; the popliteal vessels are posterior and are protected by a retractor.

If more anterior than medial or lateral wedging is needed, as in a flexion contracture, an anterior incision can be used to effect the osteotomy. In this case, the patellar tendon is retracted both medially and laterally for exposure of the anterior aspect of the tibia proximal to the tibial tubercle.

The knee joint may be exposed through the osteotomy incision or a separate



FIG. 1-A

FIG. 1-B

Fig. 1-A: Anteroposterior roentgenogram of the knee of a man, sixty-seven years old. The site of osteotomy is generally marked on the roentgenogram before the osteotomy is begun.
 Fig. 1-B: Anteroposterior roentgenogram made six weeks after valgus osteotomy.



FIG. 2-A

FIG. 2-B

Fig. 2-A: Bilateral degenerative arthritis in a man, sixty years old, before osteotomy.
 Fig. 2-B: After bilateral osteotomy. Note medial parapatellar scar of wound used to explore the right knee at the time of osteotomy. The patient was relieved of his pain and could walk two or three miles at a time. The result was classified *satisfactory*.

TABLE I
UPPER TIBIAL OSTEOTOMY FOR DEGENERATIVE ARTHRITIS
(September 1960 to September 1964)

	Knees	Patients
Total		22
Male		17
Female		5
Age (years)	35-72	
Knees involved	30	
Right	16	
Left	14	
Osteotomy		
Valgus (varus deformity)	24	
Varus (valgus deformity)	6	
Results		
Satisfactory	18	12
Unsatisfactory	4	3
Unknown (patient died of unrelated cause)	1	1
Less than one year follow-up	7	6

incision may be employed at the time of the osteotomy. After the osteotomy has been completed, the common insertion of the biceps femoris tendon and the fibular collateral ligament is sutured either to the remaining portion of the fibular head or anteriorly to the iliotibial band near its insertion, and the wound is sutured. The limb is placed in a large compressive bulky dressing of the Robert Jones type, with a posterior plaster slab. This seems to be important in order to prevent pressure on the vessels or nerves that might result from a cast. The day after surgery, the patient is allowed out of bed, on crutches with the foot touching. Some weight-bearing is

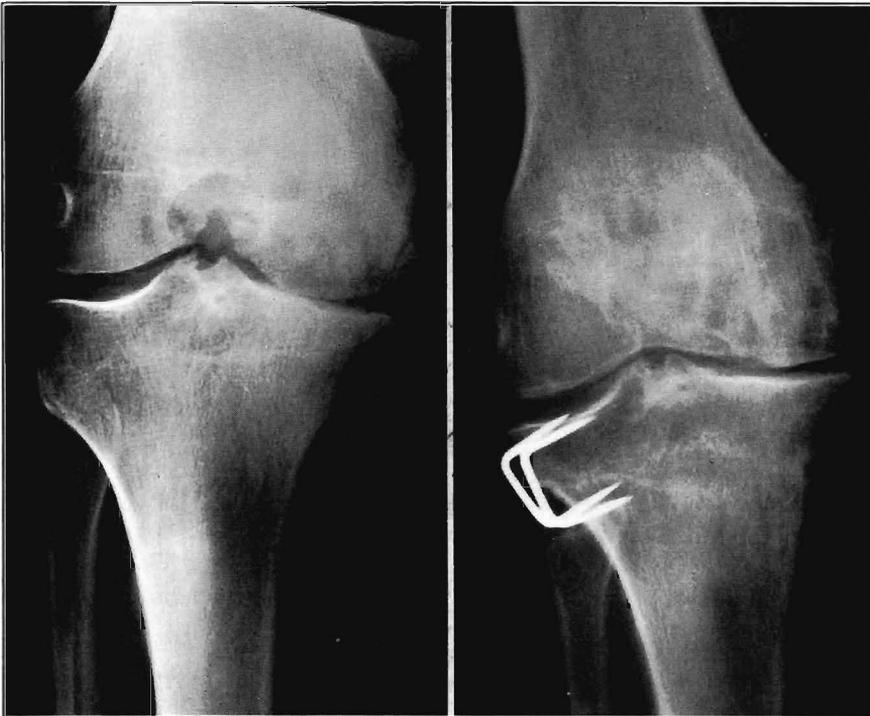


FIG. 3-A

FIG. 3-B

Figs. 3-A and 3-B: Old osteochondritis dissecans with degenerative arthritis.

Fig. 3-A: Before operation, the patient was unable to work because of pain.

Fig. 3-B: One year later. The patient had returned to work four months after operation and remained at full active farm labor without pain since that time. This patient was followed for four years.

beneficial because of its compressing effect at the site of the osteotomy. After the wound has healed, a cylinder cast is applied with the knee in zero degree of extension (straight). The cast is worn until there is early union at the osteotomy site, four to six weeks after operation. Exercises are then begun, with gradual return to full activity. The varus (or valgus) deformity should then have been corrected (Figs. 2-A and 2-B).

Results

Results were classified *satisfactory* or *unsatisfactory* after a minimum follow-up of one year. To the present time, all patients who had a satisfactory result at the end of one year continued to do well for as long as four years.

In a satisfactory result, most of the preoperative pain was relieved, at least 90 degrees of flexion and full active extension was possible, and the knee was stable and free of any catching or intermittent swelling (Figs. 3-A and 3-B and 4-A through 4-D). In an unsatisfactory result one or more of these criteria were not met.

Thirty knees of twenty-two patients with degenerative arthritis were operated on in a four-year period (Table I). There was a predominance of men and of valgus osteotomies for varus deformity. Eighteen knees of twelve patients had satisfactory results, and four knees of three patients had unsatisfactory results. One patient (one knee) died of unrelated cause before adequate follow-up could be made. Seven knees of six patients had been operated on too recently to be evaluated (less than one year).

Twenty-three knees of sixteen patients were operated on more than one year ago. All were evaluated except one knee of a patient who died of unrelated cause. The majority were examined at the clinic and roentgenograms were made. A few were questioned by letter and roentgenograms made in the patient's home community were sent to us for study.

Roentgenograms made postoperatively showed transference of weight-bearing to the opposite (uninvolved) tibial condyle, with usually a widening of joint space at the previously narrowed femoral-tibial junction.

Exact comparison of motion before and after osteotomy was not possible in all cases, but 90 degrees of motion was usually present before surgery and had to be obtained postoperatively for the procedure to be considered as satisfactory.

The unsatisfactory results could not be traced to any one factor and did not occur in any of the patients with the complications listed. One patient, a nurse, sixty-two years old, was obese and had long-standing, diffuse, degenerative arthritis of the knees, with resulting valgus deformity. Varus osteotomies straightened her knees; she obtained 90 degrees of flexion. But, at the time of writing, she continued to complain of pain and weakness in both knees and walked with a cane. She had not returned to her occupation despite attempts at muscle strengthening exercises, intra-articular steroid injections, and attempted weight reduction. Probably, her arthritis was too generalized throughout her knees, including the medial condylar surfaces, and her muscles were not capable of rehabilitation. A second patient was a farmer, thirty-six years old, with ancient osteochondritis dissecans. Exploration of his knee at the time of valgus osteotomy revealed a generalized degenerative change that was much greater medially than laterally. Correction of the deformity was obtained and full motion resulted, but he continued to complain of pain. Arthrodesis was done eventually. The cause for his unsatisfactory result is not clear. The third patient was a farmer, fifty-five years old, who had bilateral valgus osteotomies for degenerative arthritis of the knees. He achieved a satisfactory result in one knee. The other knee had instability on its medial side which existed prior to the osteotomy done laterally. At the time of follow-up, he was working regularly in a meat-packing



FIG. 4-A

FIG. 4-B

Figs. 4-A through 4-D: Degenerative arthritis of the right knee that caused pain and limping in a farmer, seventy-two years old.

Fig. 4-A: Anteroposterior roentgenogram made before operation shows narrowing of the medial part of the joint.

Fig. 4-B: Lateral roentgenogram made before operation.

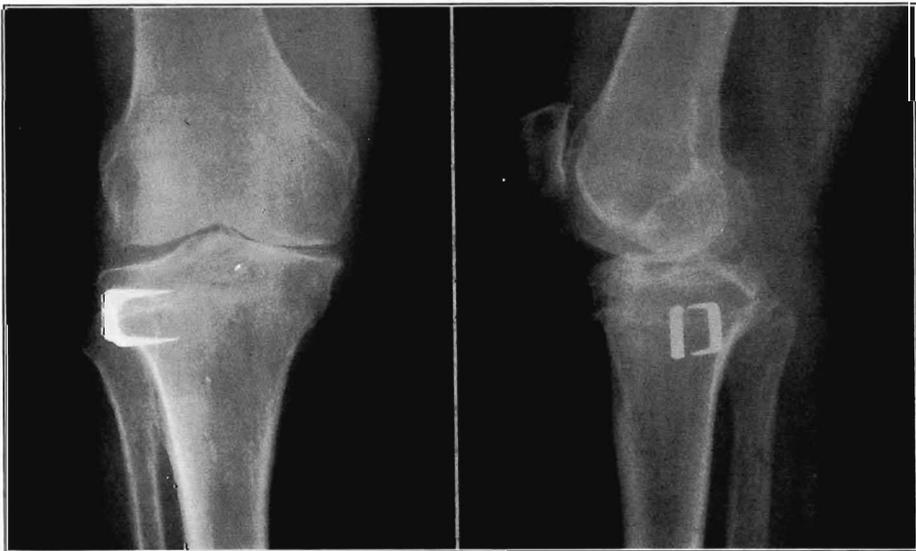


FIG. 4-C

FIG. 4-D

Fig. 4-C: Anteroposterior roentgenogram made five months after operation. The patient was fully active and his pain was relieved.

Fig. 4-D: Lateral roentgenogram made five months after operation.

plant on his feet all day. He had no discomfort if he wore a brace on this extremity. A medial collateral ligament tightening procedure is planned if his instability and pain continue.

Although this report deals chiefly with the problem of degenerative arthritis, osteotomy has been found useful in certain patients with rheumatoid arthritis. Six

knees of four patients with rheumatoid arthritis were operated on. These patients were carefully selected and included those with chronic and inactive stages of the disease. Two knees had synovectomies combined with osteotomy and, in two knees, the osteotomy to correct varus deformity was also fashioned to remove the wedge more anteriorly in order to correct flexion deformity. The results in all six knees were satisfactory two to five years after operation.

Complications

There were no vascular problems. Two wounds healed slowly because of soft-tissue infection. Staples (smooth, round, stainless-steel) loosened in two instances within a year after they were inserted. At the present time my colleagues and I use the rectangular bridged staple of Vitallium and have seen none of this type loosen. One patient who suffered a peroneal palsy has recovered motor function but not all of the sensory function. The palsy was caused by pressure from the cast and was not a result of the operation, since peroneal function was intact when the patient was returned to his room after operation.

The ligamentous structures at the site of the osteotomy tightened and became secure in all instances. One patient (the farmer, fifty-five years old, with an unsatisfactory result) continued to show some ligamentous relaxation on the medial (opposite) side two years postoperatively; the relaxation was present before surgery. There was no lack of complete active extension power in any of the patients (and no lag or difference between active and passive extension).

Summary and Conclusions

Thirty knees of twenty-two patients have been operated on in the past four years (1960–1964) to correct the varus or valgus deformity resulting from degenerative changes. Six knees in four other patients suffering from rheumatoid arthritis had similar procedures. An upper tibial wedge osteotomy was used in the general region of the closed epiphysis. The thrust of weight-bearing and other stresses was thus lessened on the degenerated tibial condyle and transferred to the more normal condyle. The results at from one to four years after operation have been encouraging. It is hoped that by this procedure the pain of degenerative arthritis of the knee can be relieved or reduced and the usefulness of the knee prolonged.

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