Osteotomy at the knee for advanced cases of Kashin-Beck disease

F. D. Liu¹, Z. L. Wang², M. Hinsenkamp³

¹ Orthopaedic and Traumatologic Hospital, Yaoxian County, Shaanxi Province, P.R. China

² Xian Medical University, Xian, P.R. China

³ Service d'Orthopédie Traumatologie, Hôpital Erasme, Université Libre de Bruxelles, Brussels, Belgium

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Summary. *The results of 247 osteotomies at the knee were analysed in 195 patients with Kashin-Beck disease. Since 1983, 37 varus and 210 valgus deformities have been operated on. Supracondylar osteotomy was carried out so that there is a cortical spike in the distal metaphysis which is impacted into the femoral condyle. A U-shaped tibial osteotomy is made 0.5 cm below the growth plate and around the insertion of the patellar ligament. The mechanical axis is corrected and stability obtained by impacting the fragments; internal fixation is not used. Correction of the initial angular deformities was achieved after the osteotomies, and function was improved.*

Résumé. *Les résultats de 247 ostéotomies du genou sont analysés sur 195 patients atteints de la maladie de Kashin-Beck. La technique d'ostéotomie utilisée se caractérise, au niveau de la métaphyse distale du fémur, par la réalisation d'une section supracondylienne présentant un ergot cortical et au niveau de la métaphyse proximale du tibia par une section respectant l'insertion du ligament rotulien en la contournant distalement. Vu l'absence de matériel de fixation interne ou externe, l'impaction des fragments permet de stabiliser efficacement la correction de l'axe mécanique. Depuis 1983, 37 genu vara et 210 genu valga ont été ostéotomisés. Les résultats présentent la distribution des déformations angulaires initiales et les corrections obtenues après ostéotomie.*

L'amélioration fonctionnelle confirme l'intérêt de cette technique en l'absence de matériel d'ostéosynthèse.

Introduction

Kashin-Beck disease (KBD) is an endemic osteoarticular disease involving both growth and articular cartilage. The clinical manifestations found in Central Tibet region have been described recently [3]. The present study analyses the results of the surgical treatment of advanced cases in the Yaoxian County of the Shaanxi Province in the Central part of the People's Republic of China. The population in Shaanxi Province is 34 000 000 and in Yaoxian County 288 000; the prevalence of KBD is 0.9% and 6.7% respectively, so there are 315 252 cases in Shaanxi Province. Consequently, we are able to present a large series of very advanced cases with severe joint deformities. In the past, these patients were treated by arthrodesis [2], or by wedge or curved osteotomies at Xian Medical University [1, 4]. Since 1983, one of us (LF) has developed a technique of osteotomy for dealing with the severe valgus and varus deformities of the knee in the advanced cases of KBD, according to the surgical facilities available.

This paper describes the operative technique and reports the results.

Patients and methods

Since 1983, 247 knee deformities were operated on in 195 patients with KBD. There were 121 men (62%) who had 159 knees treated and 74 women (38%) with 88 knees

Reprint requests to: F. D. Liu, Orthopaedic and Traumatologic Hospital, Yaoxian, Shaanxi 727100, P.R. China

Table 1. Distribution of patients by sex and unilateral or bilateral deformities

	No. of patients		
	Unilateral knee	Bilateral knee	Total
Men	83	38	121 (62%)
Women	60	14	74 (38%)
Total	143 (73%)	52 (27%)	195 (100%)

Fig. 1. Age of the patients at the onset of symptoms **Fig. 2.** Age at the time of osteotomy

(Table 1). The earliest manifestation of the deformity appeared between 3 and 17 years of age (Fig. 1). The osteotomies were carried out between 12 and 41 years of age (Fig. 2). Genu varum was present in 24 cases (12%), 9 men and 15 women, with a total of 37 deformities (Fig. 3). Genu valgum was

Fig. 3. Degree of deformity in 37 varus knees **Fig. 4.** Degree of deformity in 210 valgus knees

present in 172 cases (88%), 112 men and 60 women, giving 210 deformities (Fig. 4). One woman had a varus deformity on one side and valgus on the other. Dysplasia of the femoral condyles was present in 83 cases. An associated pelvic tilt and functional scoliosis was frequently present. Dislocation of the patella was found in 34 patients. Abnormal rotation of the foot was found in 68 patients and 16 had pes equinus. Most of the patients with genu varum show a flexum of the knee. One had an old dislocation of the knee.

Before operation, all patients had either reduced, or given up, their work. The less severe affected were able to manage light work, although in persistent pain.

Surgical technique

The patients were supine and spinal or epidural anaesthesia was used. A scissor osteotomy was carried out (0.5 cm above the growth plate if present) in the supracondylar region (Fig. 5a). The lateral $\frac{3}{4}$ to $\frac{4}{5}$ of the femur was divided transversely in valgus deformities, or the medial part in varus deformities. The division was completed by an oblique section up to the medial side of the internal condyle or the lateral side of the lateral condyle producing a spike. After completion of the osteotomy, the axial and rotational deformities were corrected by impacting the spike into the femoral condyle. The cortical edges may be nibbled away to achieve the necessary impaction and correction (Fig. 5a).

Fig. 5. Diagrams showing the line of the osteotomy and impaction in (a) the femur and (b) the tibia

Fig. 6. Initial varus deformities; anatomical tibiofemoral angle before and after osteotomy on 37 joints

A U-shaped tibial osteotomy was carried out (0.5 cm below the growth plate if present) below the tibial tuberosity and the insertion of the patellar ligament (Fig. 5b), and then transversely below the medial and the lateral tibial plateaux as far as the posterior cortex. Axial and rotational correction was carried out and the tibial diaphysis impacted into the tibial plateau (Fig. 5b). A plaster cylinder was used to maintain correction. Isometric muscle contractions were begun 2 days after operation, and weightbearing after 4 to 6 weeks. The cast was removed 6 to 8 weeks after operation, and functional exercises begun.

Fig. 7. Initial varus deformities; anatomical tibiofemoral angle before and after osteotomy on 210 joints

Fig. 8. Radiographs of valgus deformity before and after osteotomy

Results

The correction of the mechanical axis is shown in Fig. 6 for varus and in Fig. 7 for valgus deformities. Figure 8 shows the radiographs of a valgus deformity before and after osteotomy. Twenty-eight patients recovered almost normal knee function and mobility. Restoration of function had a beneficial effect on neighbouring joints, and the spine and pelvis were improved. The height of 169 patients was increased from 1 to 5.6 cm (mean 2.8 cm for men and 6.5 cm for women). The patellar dislocations were reduced and foot deformities improved. During recovery, patients com-

Fig. 9. Handicap and limitation of activity before and after osteotomy in 24 patients with initial varus deformities

Fig. 10. Handicap and limitation of activity before and after osteotomy in 172 patients with initial valgus deformities

plained of pain in the hip and ankle, which disappeared after 3 to 6 months. After follow-up of from 1.5 to 12 years (mean: 6.2 years), functional handicap and limitation of working ability was improved (Figs. 9, 10).

The complications are shown in Tables 2 and 3. Infection was recorded in 6.4% of cases.

Case reports

Case 1

A man, 23 years of age, had KBD from the age of 3 years. He had severe bilateral valgus of his knees and an equinus deformity of his right foot. The distance between his ankles was 50 cm and the angulation between the axis of the femur and of the tibia was 53° on the right and 43° on the left. He could not walk without crutches and could not lead an independent life. After bilateral osteotomy, he was able to work as an agricultural labourer. Two years later, he entered a health school and now he is rural doctor (Fig. 11).

Case 2

A woman, 20 years of age, had bilateral varus knees and painful ankles. She was 110 cm tall. The gap between her knees was 24 cm. The varus angulation was 50° on the right

Fig. 11. Case 1. Photographs of a man, 25 years of age, before and after osteotomy

Fig. 12. Case 2. Photographs of a woman, 20 years of age, before and after osteotomy

and 40° on the left; there was also bilateral rotation of 40° on the right and 50° on the left. She could not lead an independent life. The mechanical axes were corrected after bilateral osteotomy. Insufficient correction of the left knee was due to a secondary displacement in the plaster cast. After consolidation, her height increased by 10 cm and the pain in knees and ankles resolved. She was able to take part in farming work (Fig. 12).

Case 3

A boy, 12 years of age, with a severe bilateral valgus deformity. He was unable to stand or walk without stabilising his knee with his hands. His standing height was 95 cm and he was

Table 2. Complications after osteotomy for varus deformities

Complications	Number of joints
Insufficient correction	9
Infection	5
Secondary displacement	1
Decrease in flexion/extension	1

Table 3. Complications after osteotomy for valgus deformities

Complications	Number of joints
Infection	7
Insufficient correction	3
Local paresthesia	1

not independent. After bilateral osteotomy, the axes of the lower limbs were corrected. His height increased by 46 cm. Following recovery he worked as a shepherd; he was able to walk in the mountains and take part in farming.

Discussion

Osteotomies to correct varus or valgus deformities of the knee were carried out under the tibial plateau or above the femoral condyles. In the present series, as a consequence of the severe metaphyseal deformity, the osteotomy was carried out on the side which was most deformed. Precise correction of the angulation in all planes is often difficult in severe deformities with a wedge osteotomy and the stable apposition of the cortices may not be possible without osteosynthesis. A cylindrical osteotomy corrects angulation in only one plane. The advantage of the present technique is that by increasing the cross-section any angulation can be corrected and impaction stabilises the alignment

without osteosynthesis. When the growth plate is fused, the diaphysis is impacted into the epiphysis, but not when growth has to be preserved. If the lateral ligaments are lax after correction, they are tightened by suture. An osteotomy of the fibula is carried out when the correction cannot be achieved or when the head of the fibula overrides the tibial epiphysis.

Our results show that knee deformities occur in 61.5% of KBD patients after trauma or with associated diseases. Preventing injuries or other diseases in KBD patients may prevent aggravation of their dysplasia. Correction of valgus deformities gives better long-term results than correction of varus.

The present method of osteotomy with impaction and without internal or external fixation is a valuable treatment for the severe knee deformities in these patients. Social handicap, working ability and the capacity for self support were significantly improved. The need for arthrodesis is reduced. The same technique can be extended to other dysplastic joints in KBD and to deformities from other causes.

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