ELSEVIER MASSON

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

Orthopaedics
& Traumatology
Surgery & Research

ORIGINAL ARTICLE

Total knee arthroplasty in severe valgus deformity: Interest of combining a lateral approach with a tibial tubercle osteotomy

A.P. Apostolopoulos, D.D. Nikolopoulos*, I. Polyzois, A. Nakos, S. Liarokapis, G. Stefanakis, I.V. Michos

4th Department of Orthopaedic Surgery, Asclepeion Voulas General Hospital, V. Paulou 01 street, 16673 Athens, Greece

Summary

Introduction: Among the patients requiring total knee arthroplasty (TKA), approximately 10—15% presents with a valgus deformity (VD). Severely deformed valgus knees represent a surgical challenge. The purpose of this study is to evaluate the results of TKA in grade II and III valgus knee deformities (Ranawat classification), focusing on axis correction, by using a lateral parapatellar capsulotomy combined with tibial tubercle osteotomy.

Hypothesis: The lateral approach in combination with a tibial tuberosity osteotomy is highly beneficial in the treatment of severe valgus knees in patients undergoing primary TKA, for correction of anatomical axis.

Patients and methods: Between January 1995 and December 2001, 33 patients with severe VD, grade II and III, were treated with TKA by one surgeon. Twenty-six patients (19 male, seven female) with mean age of 72 years (57—79) were dealt with a resurfacing posterior stabilized design; whereas in seven cases, a constrained type implant was used. These seven patients were excluded from the study. Two more patients were lost for follow-up and were also excluded. The axis deviation of the remaining 24 patients ranged from 15 to 35 degrees, (average 23°). A lateral parapatellar arthrotomy, in combination with tibial tubercle osteotomy was used. Patients' clinical evaluation — using the International Knee Society (IKS) score — with simultaneous radiological assessment was performed yearly after the operation; and for a mean follow-up time of 11.5 years (8 to 15 years).

Results: The mean IKS score improved from 44 points (34 to 52) preoperatively, to 91 points (68 to 100) postoperatively, at the last follow-up. In terms of alignment parameter, only two knees had a residual valgus deviation greater than 7° (ideal range : 3—7°). One knee exhibited a 9° valgus, and another one 10°, according to anatomical axis measurments. In one case, there

* Corresponding author.
  E-mail address: drdnikol@hotmail.com (D.D. Nikolopoulos).

was a 5 mm proximal migration of the osteotomised tuberosity fragment, due to breakage of the screw. However, the final outcome was not affected. There were no cases of tibial tubercle's non-union; neither of delayed instability.

Conclusion: The lateral approach is a useful approach in the treatment of severe valgus knee deformity in patients undergoing primary TKA. Anatomical axis restoration is facilitated, as the contracted structures are easily accessed and, in severe cases, the patellar alignment may be achieved by displacing the osteotomised tubercle. However, careful fixation of the tuberosity is mandatory.

Level of evidence: Level IV, prospective study of case series.

Introduction

Ten to 15% of patients requiring total knee arthroplasty (TKA) present with a valgus deformity (VD). This type of deformity may be encountered in rheumatoid arthritis, osteoarthritis, post-traumatic arthritis, metabolic bone disease or an excessively overcorrected proximal tibial osteotomy [1,2].

Three grades of VD have been described by Ranawat et al. [3]. Grade I is characterized by a valgus deviation less than 10°, is correctable and the medial collateral ligament (MCL) is functional and intact. This type accounts for 80% of all valgus knees. In grade II (15% of valgus knees), the axis deviation ranges between 10° and 20°, and MCL is elongated, but functional. Finally, grade III is seen in the rest 5% of the valgus knees, and includes axis deviation more than 20° (Fig. 1). The medial stabilising elements are severely impaired and a constrained implant may be required [3].

The pathological changes of the anatomical units in the valgus knee are distinctive. The contracted structures are usually the iliotibial band, the lateral collateral ligament (LCL), the popliteus tendon, the posterolateral capsule. Rarely, the lateral head of the gastrocnemius and the long head of the biceps femoris are also affected. The stabil-

ising structures of the medial side are attenuated. Unlike the varus knee, most of the osseous defects detected on the valgus knee are met on the lateral femoral condyle, on its distal and posterior surface. The tibial plateau is usually less affected. Among the many factors that influence the long term success of a TKA, restoration and long-lasting maintenance of the limb's anatomical axis is one of the most crucial [4,5].

The results of TKA in valgus knees with conventional medial parapatellar capsulotomy have been inferior to those of varus knees with significant deformity [6]. A number of authors have reported full restoration of the anatomical axis in 70—78% of valgus knees [6,7]. Incomplete axis restoration has been linked with impaired clinical outcome [6].

Conversely, authors using lateral parapatellar capsulotomy have reported better results in terms of anatomical axis correction and also in terms of clinical performance [8,9]. The rationale of using lateral parapatellar arthrotomy is the preservation of the extensor mechanism's blood supply. The latter may be seriously affected, if lateral release is added to the medial capsulotomy performed in the conventional approach [10]. Moreover, the contracted structures, which require release, are much easier approached laterally. Keblish published, in 1991, the results of TKA in valgus knees with lateral approach and presented the technique of tibial tubercle osteotomy [8]; whereas Whiteside, in 1993 [11], and Bulki et al. in 1999, showed their outcome in valgus deformed knees after lateral approach and tibial tubercle osteotomy [12]. A disadvantage of this approach is the osteotomy of the tibial tuberosity which is necessary for patellar eversion.

This prospective study reports the outcome of TKA in 24 knees with a fixed valgus type II—III deformity by using a midline skin incision with lateral parapatellar capsulotomy, combined with tibial tubercle osteotomy to facilitate medial reflection of the patella and discuss the technical details of the procedure. Due to the fact that there is paucity in the literature regarding this approach for primary TKA in valgus knees, we have the purpose to verify that the lateral approach in combination with a tibial tuberosity osteotomy is highly beneficial in the treatment of severe valgus knees in patients undergoing primary TKA, for correction of anatomical axis.

Patients and methods

We recruited 33 patients, between January 1995 to December 2001, with severe valgus fixed deformities, grade II and III (Ranawat classification) [3], who underwent total knee
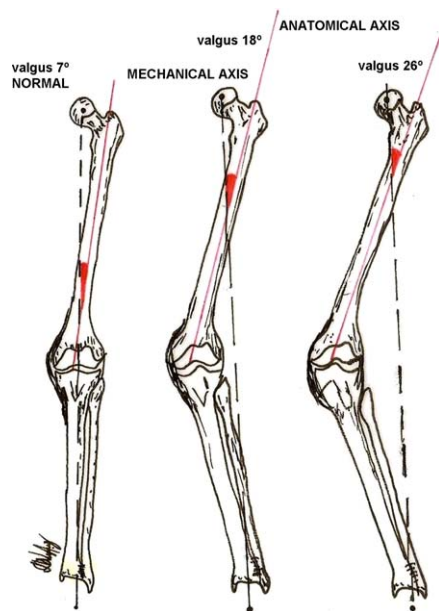
Figure 1   The mechanical and anatomical axis of the knee without deformity and with valgus deformity grade II and III.

Table 1 Patients' demographic characteristics.

Valgus knee grade II & III (n = 24)	
Age (year)	57—79 (av. 72)
Male: Female	18:7
Right: Left	14:10
15—25° valgus	16 (66.7%)
25—45° valgus	8 (33.3%)
Diagnosis	
Osteoarthritis	17 (70.84%)
Rheumatoid arthritis	9 (29.16%)
Type of prothesis	Resurfacing posterior stabilized
Follow-up (year)	8—15 (av. 11.5)

av.: average.

Table 2 Preoperative and postoperative results and complications in valgus knee grade II & III patients.

Valgus knee grade II & III (n = 24)	
Preoperative valgus deformity	15—35° (av. 23°)
Postoperative valgus deformity	(n = 22) 2—7° (av. 5.5°)
	(n = 1) 9°
	(n = 1) 10°
Late-onset instability	None
Preoperative ROM	85—105° (av. 96°)
Postoperative ROM	93—125° (av. 110°)
Preoperative fixed flexion deformity (n = 9)	5—22° (av. 11°)
Postoperative fixed flexion deformity > 5°	None
Postoperative extension lag	None
Preoperative IKSS	34—52 (av. 44)
Postoperative IKSS	68—100 (av. 91)
Tibial tubercle transfer	n = 2 (8.3%)
Complications	
Proximal migration of osteotomised tibial tubercle	n = 1 (4.16%)
Deep venous thrombosis	n = 1 (4.16%)
Superficial or deep infections	None
Hematomas, bruises, skin blisters	n = 7 (29.17%)
Skin necrosis	None
Peroneal nerve palsy	None
Patellar dislocation	None
tibial fracture	None

av.: average; IKSS: International Knee Society score; ROM: Range of Motion.

replacement. In seven patients with grade III deformity, it was necessary to proceed to extensive soft tissue release on the lateral side, resulting to unexpectable instability. We decided, at operation, to implant constrained — hinged implant for achieving satisfactory alignment. These cases were excluded from the study due to the fact that the deformity correction relies more on implant properties. The remaining 26 patients, 19 male and seven female, with a mean age of 72 years (range, 57 to 79 years), were dealt with resurfacing posterior stabilized prosthesis. Two types of prostheses were implanted. The implant used up to 2000 was the Foundation (Encore Medical, Texas, USA); and after 2000 the Vanguard (Biomet Inc., Warsaw, USA). Two patients died of causes unrelated to the procedure during the follow-up period and were excluded (Table 1).

The preoperative diagnosis was osteoarthritis in seventeen patients and rheumatoid arthritis in nine. The goals of surgery were to eliminate pain, correct the deformity, increase the range of motion, and improve function. In all cases, it was performed a lateral parapatellar arthrotomy, in combination with tibial tubercle osteotomy. Due to the severe VD, we decided to perform this surgical approach for the following reasons:

- the lateral release, most usually necessary in valgus knees, is part of the approach. In the alternative case of medial arthrotomy, the vascular supply of the extensor mechanism is seriously impaired;
- the lateral approach facilitates the release of the lateral contracted elements, offering better surgical view;
- it is possible (if required), to medialise the tubercle, improving this way the patellar tracking.

Preoperatively, every patient was evaluated for weight-bearing alignment, flexion contracture and ligamentous instability. Clinical examination played a major role in determining whether the deformity was fixed, correctable or unstable. This was further accompanied by preoperative radiological assessment, including standing anteroposterior, lateral, and sunrise views of the affected knee as well as measurement of the limb axis deviation with long film standing views or CT-scan with anterior orientation of the patella. It has been shown that rotation up to 20° has little effect on the measurement of the femorotibial axis deviation [13]. Postoperative radiological evaluation included weight-bearing anteroposterior, lateral and sunrise views of the operated knee in accordance with anatomical axis deviation measurement. In our 24 patients' series, the VD according to the anatomical axis preoperatively ranged from 15 to 35° (average 23°). Sixteen knees had deformities of 15—25° and eight had deformities 25—35°. The maximum flexion preoperatively ranged from 85 to 105° (average, 96°); whereas fixed flexion deformity was present in nine knees, ranging from 5 to 22° (average 11°) (Fig. 1, Table 2).

Patients were all assessed further preoperatively and postoperatively with the International Knee Society score (IKS) [14]. This scale comprises 50 points for pain, 25 for movement and 25 for stability. In case of malalignment, extension lag or fixed flexion, certain points are deduced. Clinical and functional scores of ≥ 85 points were categorized as excellent; 70 to 84 points, as good; 60 to 69 points, as fair; and < 60 points, as poor. Radiological assessment was also performed yearly after the operation. Besides, at the time of the latest follow-up, the tibial and femoral components were evaluated radiographically with use of the Knee Society roentgenographic evaluation system [15]. In addition

Figure 2 Lateral side tibial tuberosity osteotomy.

Figure 3 Lateral radiographic view in primary valgus knee TKA, with tibial tubercle osteotomy. Oblique direction of the wire loops for resistance to upwards pulling forces and step at the upper part of osteotomy, preventing the proximal migration.

to component positioning, each radiograph was assessed for the presence of osteolysis, which was defined as an expanding area of focal radiolucency measuring ≥ 1 cm in diameter. Any component with a circumferential radiolucency at the bone-cement or component-cement interface was considered to be loose [16].

Surgical technique

A midline skin incision was used, followed by a lateral parapatellar capsulotomy. The iliotibial band was elevated from Gerdy's tubercle. In order to medially displace the patella, the tibial tuberosity was osteotomised from the lateral side, leaving intact the soft tissues attachments medially (Fig. 2). The osteotomy length measured approximately 5—6 cm. Proximal — at the upper part of patellar tendon insertion— the transverse part of osteotomy which was nearly horizontal measuring 1.5 cm, prevented proximal migration (Fig. 3). Medial soft tissues were left intact. The tubercle was hinged medially with the patella, offering wide exposure of the joint surfaces.

The tibial surface resection was done with the use of intramedullary instrumentation, directing the level of the cut surface at 90° to the tibial longitudinal axis. The distal femoral cut was performed in 3° valgus in relation to femoral anatomical axis, trying to compensate for the pre-existing severe valgus. This opposes to the typical 5 to 7° of valgus used for a varus knee; in the purpose of protecting against undercorrection of the underlying deformity. Care was taken not to over-resect the lateral femoral condyle which was already absorbed, for avoiding marked elevation of the joint level. A posterior stabilizing implant was always used. A posterior stabilizing implant was always used, as we had to resect the PCL in our effort to correct the severe VD.

At this stage, due to the fact that the extension and flexion gaps were not satisfactorily balanced, subperiosteal elevation of the popliteus and LCL from the epicondyle was

stagely performed in all cases. Four (25%) of the 16 knees with 15—25° deformity and five (62.5%) of the eight knees with 25—35° VD had also posterolateral capsule release.

At closure, in 22 knees (91.7%) the tuberosity was fixed to the tibia to its original position. In two cases only (8.3%) tibial tubercle was transferred, as the patella tended to track laterally and to dislocate. In all cases, the fixation was done with three wire loops inserted in the tibia prior to the application of the prosthesis. Oblique direction of the wire loops offers better resistance to proximal directed force on it. In two cases, the tubercle was fixed with two cortical screws 4.5 mm.

Postoperatively the usual regime was followed. The patients were instructed to use walking aids for at least six weeks, or until there was evidence of radiological union of the osteotomised tuberosity.

Results

Complications

In one case, a 5 mm proximal migration of the osteotomised fragment occurred. This had been stabilised with screws only, without the use of wire loops. However, this did not affect the final outcome, despite breakage of one screw (Fig. 4). No clinical or radiological patellar instability was seen.

One deep venous thrombosis was detected, which was successfully treated without any deleterious effects to the final outcome. There were no superficial or deep infections. However, hematomas, bruises and skin blisters were seen in seven of our patients, treated conservatively. We did not have any skin necrosis, neither any peroneal nerve palsy or patellar dislocation. No

Figure 4 Fixation with screws only: Six weeks postoperative, slight proximal migration of tubercle, with one broken screw.

Figure 5 Severe valgus deformity (A). Full correction after the operation (B).

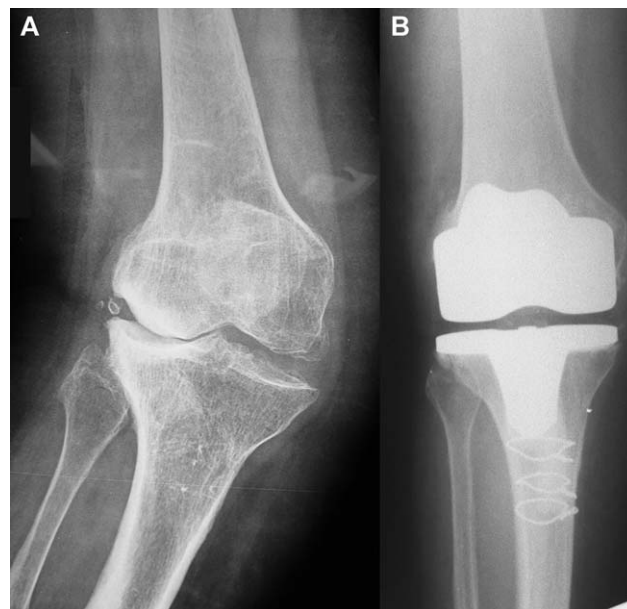revision surgeries have been required until the last follow-up.

Clinical results

The 24 patients were followed for a time ranged from 8 to 15 years (average, 11.5 years). The preoperative IKS score ranged from 34 to 52 points (average 44), and 68 to 100 points (average 91) at last follow-up (ANOVA, $p < 0.05$). Pain (VAS) was significantly improved in 87.5% after the first semester. Preoperatively, the maximum flexion ranged from 85 to 105° (average, 96°); whereas the postoperative range of movement was 93 to 125° (average 110°). Fixed flexion deformity was present in nine knees, ranging from 5 to 22° (average 11°) before operation. Not any of the patients presented flexion contracture more than 5° postoperatively. There were no cases of extension lag. Analysing the results in the mediolateral stability parameter, 15 knees scored the highest rate (15 points), five knees scored 10 points and four received five points. There was no malalignment. Furthermore, there were no cases of residual or late-onset instability, at the last follow-up time (Table 2).

Radiological results

All tibial tubercle osteotomies united completely in three to four months postoperatively. No postoperative tibial fracture was observed.

In the alignment parameter, the valgus knee deformity preoperatively ranged from 15 to 35° (average 23°). The postoperative angle between mechanical and anatomical axis ranged from 2 to 7° (average, 5.5°) in 22 knees. (ideal range 3—7°). Only two knees had a valgus deviation greater than 7°. One knee declined valgus 9°, and another one 10°, according to the anatomical axis; scoring minus six and nine points respectively, according to IKS score.

In addition, no radiolucencies were noted adjacent to any of the 24 femoral or tibial components at the time of the latest follow-up. No tibial or femoral component was associated with osteolysis or had radiographic evidence of loosening (Fig. 5A and B).

Discussion

A primary TKA for a knee with a severe VD represents a surgical challenge, due to the performance and longevity of the TKA is strongly related to limb axis alignment [4,5]. Many different surgical techniques have been described for correcting these severe deformed knees, with both bone and soft-tissue abnormalities [16]. However, results are generally inferior and the complication rates are generally higher when correcting such a deformity compared with its varus counterpart [6,7]. In the latter, by using a standard approach with medial parapatellar capsulotomy, mechanical axis restoration is achieved in no more than 80% of the cases [6,7]. It has also been reported that severe varus deformities have superior clinical outcome compared to severe valgus deformities. This has been attributed to an incomplete mechanical axis correction often observed in severe valgus deformed knees [6].

In severe deformities, release of lateral patellar retinaculum is necessary in most cases in order to prevent patellar instability. Lateral release in combination with medial capsulotomy, results in significant impairment of the extensor mechanism blood supply [10]. If the knee joint is approached via a lateral parapatellar arthrotomy, release of the lateral retinaculum is integrated in the approach. A lateral capsulotomy offers excellent exposure of the contracted lateral structures, thus facilitating their adjustment. Keblish recommended the lateral approach as the ''approach of choice'' for fixed VD in TKA. The advantages of this approach in comparison with the medial are that firstly the

lateral release is direct and is performed as part of the procedure, without affecting patella's medial blood supply [17,18]; and secondly the medial displacement of the quadriceps—patellar tendon mechanism internally rotates the tibia, which brings the pathologic posterolateral corner forward into the operating field, facilitating the release of contracted elements. Lastly, the patellofemoral tracking and alignment stability are optimized, and if needed the tubercle can be transferred medially, eliminating the postoperative hazard for patellar maltracking [8].

In certain situations, such as in severe deformed valgus or varus knees or in cases of TKA after a previous tibial osteotomy, where preoperative flexion is restricted and patella's eversion may be compromised by scar tissue, the patellar ligament may be particularly prone to spontaneous avulsion by forceful intraoperative retraction (especially if patella cannot be everted with the knee flexed at 90°). Therefore, in these cases, during surgery, additional surgical techniques are needed to give adequate exposure and protect the knee extensor mechanism. These surgical procedures are performed either proximally (V-Y quadricepsplasty or ''quadriceps snip'') [19,20], or distally to the patella [12,21—24]. Tibial tubercle osteotomy — as first described by Dolin in 1983 [21] and made popular by Whiteside and Ohl [22] — has been valuated as a highly beneficial and safe procedure in achieving gentle medial eversion of the patella. In addition, an osteotomy of the tibial tubercle prevents internal rotation of the tibia during patellar eversion, which may simplify proper positioning of the tibial component in severe valgus knees [24—26].

We believe that when a tibial tubercle osteotomy is added to the lateral approach in primary TKA in severe deformed valgus knees, then the surgeon has another means for patella safe everting; obtaining an adequate medial plateau exposure; controlling patellar tracking and tension; as also for optimizing extensor mechanism balance in the sagittal plane. In our series no patellar instability was seen, as we had the chance to easily release the soft tissues and also to transfer the tuberosity medially in two cases, succeeding the optimal quadriceps—patella tendon balance. Alike, Burki et al. [12] presenting the results in a series of 51 cases of primary TKA with a combination of lateral approach and tibial tubercle osteotomy, observed good results in 88%. Among the published studies, the majority refers to series of revisional TKA [27,28]. Recently, Piedade et al. [24] reported a continuous series of 1474 consecutive primary TKAs, where 8.5% underwent tibial tubercle osteotomy to improve exposure; and only 48% were performed in valgus knees.

One of the advantages of the tibial tubercle osteotomy — as already referred — is that in closure allows transfer of the patellar tendon insertion medially, which is required in order to improve the extensor mechanism alignment. Whiteside performed tibial tubercle transfer at the time of surgery in 15.8% of knees with preoperative deformity greater than 25°, so as to ensure stable patellar tracking [11,22]. More specifically, at closure, Whiteside firstly assessed the angle between the quadriceps tendon and the patellar tendon; and if it was greater than 20° and secondly, the patella tended to track laterally and to dislocate, then the tibial tubercle was transferred. Whiteside elevated the tibial tubercle from the anterior tibial crest and transferred it medially 1.5—2 cm. The medial periosteal attachments to the tibial

tubercle were left attached to the bone fragment and were elevated from the medial tibial flare [11,22]. In our series, tibial tubercle transfer were performed only in two cases (8.3%).

Concerning the lateral release in severe valgus deformities, there is no consensus regarding the sequence in which the structures about the knee should be released [7—9,12,16,29—31]. Those structures most commonly addressed for release include the iliotibial band, LCL, popliteal tendon, posterolateral capsule, and the lateral head of the gastrocnemius muscle. Another method of progressively releasing the lateral side involves using multiple small incisions with a scalpel blade through the taut posterolateral capsule or iliotibial band with the knee in full extension (''pie crust'' technique) [32—34]. This technique may place the common peroneal nerve at risk [35]. If release of the lateral structures does not sufficiently stabilize flexion and extension gaps, then the medial side of the joint should be addressed [30,31]. Several techniques have been described for successfully and safely ''tightening'' the incompetent MCL by Krackow et al. [25] and Healy et al. [36].

Furthermore, on the subject of postoperative axis alignment, in our study, we achieved anatomical axis valgus deviation from the mechanical axis between 2 to 7° in 22 of 24 knees, (91%). There were also, no cases of late-onset instability, at the last follow-up time. In order to be succeeded the correct axis alignment, the distal femoral cut was adjusted at 3° valgus only, instead of five to seven degrees that is usually applied in varus knees, as a mean to protect against over-correction of the severe VD. The use of posterior stabilizing implant allows greater lateralization of the femoral and tibial components, which greatly improves patellar tracking and minimizes the need for lateral retinacular releases [3]. The PCL usually is not contracted in the valgus knee. However, when a large distal femoral resection from the medial femoral condyle is necessary to restore axial alignment, joint line elevation increases femoral rollback. In such knees, a PCL release or a PCL-substituting prosthesis should be selected [26,37]. Ranawat et al. believe firstly that the posterior stabilized design is inherently more stable than a cruciate-retaining design as a result of the post-cam mechanism and joint surface conformity; and secondly that the posterior stabilized design allows for greater lateralization of the femoral and tibial components, which greatly improves patellar tracking and minimizes the need for lateral retinacular releases [3].

Considering the tibial tubercle osteotomy fixation system and the plausible complications, several authors have emphasized that fixation with two or three screws or metallic wires is adequate to obtain bony consolidation provided the surgical technique is performed well [24,38,39]. All tuberosity osteotomies united successfully in our series. A delayed union occurred in one case, where screws instead of wire loops were used. In our opinion, the proximal step of the osteotomy is very important as it resists the traction forces of the patellar tendon. Besides, the oblique direction of the wires contributes to its stable fixation. As mentioned previously, our practice is to fix the osteotomised fragment with three wire loops. In two cases only, the osteotomy was fixed with two cortical 4.5 mm screws. In one of these two cases, the

tuberosity migrated one cm proximally, but united without complications.

In Burki's [12] and Piedade's studies [26] tuberosity migration had never occurred, despite the fact that nearly all osteotomies were fixed with screws only. The slightly larger length of their osteotomy, which was 7 cm long and 6—8 cm respectively, could be a contributing factor, but we think that the risks for other complications, such as tibia fracture, are more overriding this advantage. Hematoma formation has been the commonest complication in Burki's study [12]; whereas one case was complicated with anterior tibial compartment syndrome and had to be reoperated. Burki et al. concluded that when the tibial tubercle is osteotomised spaciously, the anterior tibial compartment would be traumatized. For this reason, it was recommended the anterior tibial fascia to be released with several longitudinal incisions [12]. The length of the osteotomised tubercle in their approach was 7 cm, while we tried to shorten it to 5 cm in our patients, in order to avoid tibial fractures. Piedade had two tibial tubercle osteotomy fractures and tibial plateau fissures in 8.7% [26]. Consequently, consideration needs to be given to the size of the bony fragment and the quality of the fixation with respect to achieving sound consolidation of the osteotomy. In our series, no serious complications from the osteotomy side were reported.

The most commonly reported complications in patients with valgus deformities who undergo TKA are tibiofemoral instability (2 to 70%), recurrent VD (4 to 38%), postoperative motion deficits requiring manipulation (1 to 20%), wound problems (4 to 13%), patellar stress fracture or osteonecrosis (1 to 12%), patellar tracking problems (2 to 10%), and peroneal nerve palsy (1 to 4%) [30,35]. Elongation of the lateral side stretches the nerve and places it at risk for indirect injury, via traction or induced ischemia [35]. Other indirect mechanisms of injury may include compression or crushing from tight dressings [40]. None of our patients presented with a peroneal nerve palsy, despite the advanced stage of the deformity. Idusuyi and Morrey reported 32 postoperative peroneal nerve palsies in more than ten thousand consecutive TKAs. Of the 32 palsies, 10 knees had 12 degrees of preoperative valgus deformity or more [41]. It is generally recommended that patients have to be carefully evaluated for symptoms postoperatively. If peroneal nerve palsy type symptoms are elicited, the knee should be flexed to relax the tension that is effectively being placed on the nerve. There are no objective guidelines or data to support the efficacy of any immediate surgical intervention [30].

Conclusion

Severely valgus deformed knees represent a surgical challenge and the lateral approach is a useful tool for the surgeon. The mechanical axis restoration is facilitated, as the contracted structures are easily accessed. The patellar alignment in extreme cases may be achieved by displacing the osteotomised tubercle. The extensor mechanism blood supply is not seriously impaired, because the lateral retinacular release is a part of the procedure. Complications from the osteotomy can easily be avoided if care is taken at crucial stages of the procedure. Lastly, postoperative regime does not require major alterations as compared to the standard approach. Consequently, the lateral approach in combination with a tibial tuberosity osteotomy is highly beneficial in the treatment of severe valgus knees in patients undergoing primary TKA.

Conflict of interest

None

IRB approval: Institutional Review Board approval was given prior to the review process.

References

[1] Fiddian NJ, Blakeway C, Kumar A. Replacement arthroplasty of the valgus knee. A modified lateral capsular approach with repositioning of vastus lateralis J Bone Joint Surg Br 1998;80:859—61.

[2] Aglietti P, Baldini A, Buzzi R, Lup D, De Luca L. Comparison of mobile-bearing and fixed-bearing total knee arthroplasty: a prospective randomized study. Arthroplasty 2005;20:145—53.

[3] Ranawat AS, Ranawat CS, Elkus M, Rasquinha VJ, Rossi R, Babhulkar S. Total knee arthroplasty for severe valgus deformity. J Bone Joint Surg Am 2005;87:271—84.

[4] Ritter MA, Faris PM, Keating EM. Postoperative alignment of TKR: Its effect on survival. Clin Orthop 1994;299:153—6.

[5] Sharkey PF, Hozack WC, Rothman RH, Shastri S, Jacoby SM. Insall Award paper. Why are total knee arthroplasties failing today? Clin Orthop 2002;404:7—13.

[6] Karachalios Th, Sarangi PP, Newman JH. Severe varus and valgus deformities treated by total knee arthroplasty. J Bone Joint Surg 1994;76:938—42.

[7] Stern SH, Moeckel BH, Insall JN. Total knee arthroplasty in valgus knee. Clin Orthop 1991;273:5—8.

[8] Keblish AP. The lateral approach to the valgus knee. Surgical Technique and analysis of 53 cases with over two year follow-up evaluation. Clin Orthop 1991;271:52—62.

[9] Buechel FF. A sequential three step lateral release for correcting fixed valgus knee deformity during total knee arthroplasty. Clin Orthop 1990;260:170—5.

[10] Wetzner SM, Bezrch JS, Scott RD, Bierbaum BE, Newberg AH. Bone scanning in the assessment of patellar viability following knee replacement. Clin Orthop 1985;199:215—9.

[11] Whiteside LA. Correction of ligament and bone defects in total arthroplasty of the severely valgus knee. Clin Orthop 1993;(288):234-245.

[12] Burki H, Knoch M, Heiss C, Drobny T, Munzinger U. Lateral approach with osteotomy of the tibial tubercle in primary TKA. Clin Orthop 1999;362:156—61.

[13] Swanson KE, Stocks GW, Warren PD, Hazel MR, Janssen HF. Does axial limb rotation affect the alignment measured in deformed limbs? Clin Orthop 2000;371:246—52.

[14] Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the knee society clinical rating system. Clin Orthop 1989;248:13—4.

[15] Ewald FC. The Knee Society total knee arthroplasty roentgenographic evaluation and scoring system. Clin Orthop 1989;248:9—12.

[16] Elkus M, Ranawat CS, Rasquinha VJ, Babhulkar S, Rossi R, Ranawat AS. Total knee arthroplasty for severe valgus deformity: five to fourteen-year follow-up. J Bone Joint Surg Am 2004;86:2671—6.

[17] Kayler DE, Lyttle D. Surgical interruption of patellar blood supply by total knee arthroplasty. Clin Orthop 1989;229:221—7.

[18] Ritter MA, Herbst SA, Keating EM, Faris PM, Meding JB. Patellofemoral complications following total knee arthroplasty. J Arthoplasty 1996;11:368—72.

[19] Coonse K, Adams JD. A new operative approach to the knee joint. Surg Gynecol Obstet 1943;77:344—7.

[20] Garvin KL, Scuderi G, Insall JN. Evolution of the quadriceps snip. Clin Orthop 1995;231:131—7.

[21] Dolin MG. Osteotomy of tibial tubercle in total knee replacement. A technical note. J Bone Joint Surg (Am) 1983;65:704—6.

[22] Whiteside LA, Ohl MD. Tibial tubercle osteotomy for exposure of the difficult total knee arthroplasty. Clin Orthop 1990;260:6—9.

[23] Wolff Am, Hungerford DS, Krackow KA, Jacobs MA. Osteotomy of the tibial tubercle during total knee replacement. J Bone Joint Surg (Am) 1989;71:848—52.

[24] Piedade SR, Pinaroli A, Servien E, Neyret P. Tibial tubercle osteotomy in primary total knee arthroplasty: a safe procedure or not? Knee 2008;15:439—46.

[25] Krackow KA, Jones MM, Teeny SM, Hungerford DS. Primary total knee arthroplasty on patients with fixed valgus deformity. Clin Orthop 1991;273:9—18.

[26] Engh GA. The difficult knee, severe varus and valgus. Clin Orthop 2003;416:58—63.

[27] Mendes MW, Caldwell P, Jiranek WA. The results of tibial tubercle osteotomy for revision total knee arthroplasty. J Arthroplasty 2004;19:167—74.

[28] van den Broek CM, van Hellemondt GG, Jacobs WC, Wymenga AB. Step-cut tibial tubercle osteotomy for access in revision total knee replacement. Knee 2006;13(6):430—4.

[29] Murray PB, Rand JA. Symptomatic valgus knee: the surgical options. J Am Acad Orthop Surg 1993;1:1—9.

[30] Favorito PJ, Mihalko WM, Krackow KA. Total knee arthroplasty in the valgus knee. J Am Acad Orthop Surg 2002;10:16—24.

[31] Williot A, Rosset P, Favard L, Brilhault J, Burdin P. Total knee arthroplasty in valgus knee. Orthop Trauma Surg Res 2010, [Epub ahead of print].

[32] Mihalko WM, Krackow KA. Anatomic and biomechanical aspects of pie crusting posterolateral structures for valgus deformity correction in TKA: a cadaveric study. J Arthroplasty 2000;15:347—53.

[33] Clarke HD, Fuchs R, Scuderi GR, Scott WN, Insall JN. Clinical results in valgus TKA, with the ''pie crust'' technique of lateral soft tissue releases. J Arthroplasty 2005;20:1010—4.

[34] Aglietti P, Lup D, Cuomo P, Baldini A, Lapo de L. Total Knee Arthroplasty using pie crusting technique for valgus deformity. Clin Orthop 2007;464:73—7.

[35] Clarke HD, Schwarz JB, Math KR, Scuderi GR. Anatomic risk of peroneal nerve injury with the ''pie crust'' technique for valgus release in TKA. J Arthroplasty 2004;19:40—4.

[36] Healy WL, Iorio R, Lemos DW. Medial reconstruction during total knee arthroplasty for severe valgus deformity. Clin Orthop 1998;356:161—9.

[37] Insall JN, Easley ME. Surgical techniques and instrumentation in total knee arthroplasty. In: Insall JN, Scott WN, editors. Surgery of the Knee. 3rd ed. New York NY: Churchill Livingstone; 2001. p. 1717—38.

[38] Davis K, Caldwell P, Wayne J, Jiranek WA. Mechanical comparison of fixation techniques for the tibial tubercle osteotomy. Clin Orthop 2000;380:241—9.

[39] Caldwell PE, Bohlen BA, Owen JR, Brown MH, Harris B, Wayne JS, et al. Dynamic confirmation of fixation techniques of the tibial tubercle osteotomy. Clin Orthop 2004;424:173—9.

[40] Rose HA, Hood RW, Otis JC, et al. Peroneal-nerve palsy following total knee arthroplasty: a review of The Hospital for Special Surgery experience. J Bone Joint Surg Am 1982;64:347.

[41] Idusuyi OB, Morrey BF. Peroneal nerve palsy after total knee arthroplasty. Assessment of predisposing and prognostic factors. J Bone Joint Surg Am 1996;78:177—84.