

## THERAPY

## The arthroscopic debridement in the management of osteoarthritis of the knee joint by high tibial osteotomy

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### Abstract

**The aim of the study:** The authors evaluated the benefits of the arthroscopic debridement performed in the same session with the high tibial osteotomy in the management of the knee joint of osteoarthritis connected with varus or valgus deformity.

**Material and methods:** Arthroscopy was indicated in 52 patients from 96 patients with high tibial osteotomy in the years 1996–2001.

**Results:** Significant intraarticular disorders were found in all 52 patients. 34 patients were fully satisfied, 10 were partially satisfied and 8 were not satisfied with the outcome. Twenty from 22 patients with meniscal tears had a marked improvement. 4 patients with loose bodies and 5 patients with chondral flaps causing blockages had no further blockages or irritation of the knee. The arthroscopic findings of chondral lesions were in 10 cases from 13 more significant than it was expected from weightbearing X-ray films.

**Conclusion:** The arthroscopy performed before high tibial osteotomy in the same session helped to detect a significant intraarticular disorder and the arthroscopic debridement improved the end results after high tibial osteotomy. (Ref. 16.)

**Key words:** arthroscopy, osteoarthritis, knee joint, tibial osteotomy.

The high tibial osteotomy is a common procedure in the management of early stages of osteoarthritis of the knee joint with unilateral involvement. We indicate this procedure in symptomatic stage I, stage II and in some cases of stage III of Kellgren–Lawrence classification. The high tibial osteotomy reduces the pain, preserves a good joint function and prevents rapid progression of the osteoarthritis of the knee joint. There are many factors worsening the end results. These are undercorrection of the axis deviation, osteoarthritis of Kellgren–Lawrence stage IV, the age over 60 years, body weight over 20 % of body mass index and lesion of the meniscus or other intraarticular disorder. In order to improve our results we introduced an arthroscopy before the high tibial osteotomy in the same session. The aim of the study was to assess the incidence of significant intraarticular findings in patients with osteoarthritis of the knee joint indicated for the high tibial osteotomy.

### Material and methods

92 high tibial osteotomies in 92 patients were performed at the Ist Orthopaedic Department, St. Anna's Hospital, Masa-

rykiensis University, Brno, Czech Republic in the years 1996–2001. The method of Coventry (3), a closed wedge osteotomy of the proximal tibia and a wedge osteotomy in the head of the fibula was used. The indication for the procedure was unilateral osteoarthritis of the knee joint, Kellgren–Lawrence stage I–III. The preoperative symptoms were in all patients an increasing blunt pain during walking and standing, varus or valgus axis deviation, crepitations in the knee, feeling of stiffness in the knee and synovitis or effusions after overloading. Arthroscopy was indicated in 52 patients with a history of blockage, giving away phenomenon, sharp pain during walking, severe crepitation, positive maneuvers for meniscal tear and with a history of trauma. In 11 patients a diagnostic arthroscopy for the evaluation of the lateral compartment of the knee joint in varus gonarthrosis was

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indicated. Arthroscopy was performed in the same session before the high tibial osteotomy. There were 31 males and 21 females in the mean age 47.5 years (27–61). There were 47 valgus and 5 varus closed wedged osteotomies. One or two Blount staples to stabilise the fragments and a plaster immobilisation from the groin to the tip of the toes for four weeks were used. Thereafter a physiotherapy was started. Full weight bearing after 10 to 12 weeks after the procedure was allowed. Low molecular weight heparin for thrombosis prevention was used. All patients were examined in the year 2003. The mean follow-up was 3.1 years.

### Arthroscopic findings

In the group of 52 patients following arthroscopic findings were detected: tear of the medial meniscus (12), tear of lateral meniscus (10), degenerative lesion of the menisci (11), large chondral defects in the weightbearing area (8), loose bodies (4), partially detached cartilage flapping in the knee joint and causing blockages (5), severe chondromalacia of the patella (9). There were a softening, oedema, abrasions and small fragmentations of the cartilage of the femoral or tibial condyles of stage I and II according to Outerbridge classification detected in all 52 patients. These findings belong to degenerative chondropathy as an anatomic basis of osteoarthritis.

Examples of arthroscopic findings:

- Male, 46 y, O.A. grade II, chondral lesion of the medial femoral condyle grade II and a radial tear of medial meniscus.
- Male, 51 y, O.A. grade III, chondral lesion of the medial femoral condyle grade IV, chondral lesion of medial tibial condyle grade III and a degenerative lesion of the medial meniscus.
- Male, 52 y, O.A. grade III, chondral lesion in the weightbearing area of medial femoral condyle 2x2 cm grade IV. and degenerative lesion of the medial meniscus.
- Female, 46 y, O.A. grade III, chondral lesion of medial femoral condyle grade III, chondral lesion of medial tibial condyle grade IV and a degenerative lesion of the medial meniscus. The arthroscopic findings were more significant than X-ray findings in the weightbearing position.
- Female, 44 y, O.A. grade II, chondral lesion of medial femoral condyle grade IV and chondral lesion of medial tibial condyle grade III. The arthroscopic findings were more significant than the narrowing of the joint space on X-ray in the weightbearing position.
- Male, 33 y, loose body causing blockages of the knee joint.
- Male, 41 y, pieces of a torn cartilage flapping in the joint and causing blockages.
- Male, 44 y, neglected old rupture of the lateral meniscus.

### Arthroscopic surgery

Following procedures were performed: excision of the meniscal tear or the affected area of the degenerative lesion of the meniscus, removal of loose bodies, removal of flapping parts of the cartilage and torn parts of cruciate ligaments, shaving of chondral lesions, excision of a symptomatic synovial plica, release of

lateral capsule to relieve a pressure of the patella on the femoral groove in chondromalacia.

### Results

All 52 tibial osteotomies united within 12 weeks after surgery. According to the patient's assessment 34 patients were fully satisfied, 10 patients were partially satisfied and 8 were not satisfied with the outcome of the procedure. Twenty patients with meniscal tears and 4 patients with loose bodies claimed to have no further blockage of the knee joint. They had a marked improvement. They had a marked reduction of the pain and no further irritation of the knee. They used no analgetics, they had a good range of movement and they could walk for longer distances without any support. Eight from 11 patients with degenerative meniscal lesions suffered less irritation of the knee joint with no further effusions. They felt some crepitations during weightbearing. Three from 8 patients with large chondral defects had a partial improvement and 5 were not satisfied. Five from 8 patients with severe chondromalacia of the patella claimed to have less pain in femoropatellar joint with a partial improvement and three did not improve. All 8 not satisfied patients had osteoarthritis grade III of Kellgren–Lawrence classification before the surgery.

The operative time was about 15 minutes longer and did not have any adverse effect on the postoperative recovery. There were no major complications perioperatively or in the postoperative time. Two cases of superficial phlebitis of the operated leg without any further consequences were observed.

A significant intraarticular disorder requiring an arthroscopic procedure in all 52 patients with osteoarthritis of the knee joint connected with varus or valgus deformity was detected. The arthroscopic findings of chondral lesions were in 10 cases from 13 more significant than it was expected from weightbearing X-ray films. Radiological examination from weightbearing X-ray films did not reveal deep defects of the cartilage in weightbearing areas of femoral or tibial condyles detected during arthroscopy.

### Discussion

Coventry (4) stated correct indications for high tibial osteotomy: osteoarthritis localised mostly in one compartment of the knee joint with corresponding varus or valgus deformity, a good range of movement (at least 0–90° of flexion), a good condition of muscles, a good cooperation of the patients and to correct the obesity before the procedure. Most authors agree that the causes of bad results are undercorrection of the axis deviation, age over 60 years, osteoarthritis of the knee stage IV, severe instability, valgus deformity over 12°, necrosis of tibial condyle, intraarticular intraoperative fracture, body weight over 20 % of body mass index and a significant intraarticular disorder.

The study shows that significant meniscal tears and chondral lesions are often present in the osteoarthritic knee joint. Fifty two from 92 patients with osteoarthritis of the knee joint had a

significant intrarticular disorder with marked clinical symptoms. Our study proves that the arthroscopic debridement with the high tibial osteotomy is justified in these cases. Twenty from 22 patients with meniscal tears, 8 from 11 patients with a degenerative meniscal lesions and 3 from 8 patients with large chondral defects had a substantial improvement after the arthroscopic debridement and the high tibial osteotomy. Four patients with a loose body and 5 patients with partially detached chondral flaps had no further blockages after the arthroscopic debridement and the high tibial osteotomy. We admit that we could achieve some improvements even with the high tibial osteotomy alone without the arthroscopy.

The review of the literature shows that meniscal tears are often connected with osteoarthritis of the knee. Bhattacharyya et al (1) investigated the relationship between meniscal tears and osteoarthritis with magnetic resonance imaging. They performed magnetic resonance imaging in 154 patients with clinical symptoms of osteoarthritis of the knee and in a group of forty nine age matched asymptomatic controls. 91 patients with symptomatic osteoarthritis were scored according to WOMAC score. The average age of them was 67 years. Meniscal tears were more common in patients with symptomatic osteoarthritis in 91 % and in asymptomatic patients in 76 %. A higher Kellgren–Lawrence grade was in correlation with a higher frequency of meniscal tears in a group with symptomatic osteoarthritis. The authors stated that meniscal tears are associated with osteoarthritis of the knee. They suggest that osteoarthritic knees with meniscal tears are not more painful than those without a tear and the meniscal tears do not affect functional status. Their data do not support the routine use of magnetic resonance imaging for the evaluation of meniscal tears in patients with osteoarthritis of the knee. According to their opinion magnetic resonance can not differentiate between stable and unstable meniscal tear. It contributes little to the decision-making process regarding the treatment of the patients with symptomatic osteoarthritic knee. Magnetic resonance imaging may be useful in identifying osteonecrosis of the knee, osteochondral defects, loose bodies, ligamentous injuries and tumors. We use magnetic resonance imaging in some cases to precise the intraarticular pathology of the knee joint. In that way we can precisely indicate or avoid an arthroscopy before high tibial osteotomy.

Dervin, Stiell, Rody and Grabowski (6) used an arthroscopic debridement for the treatment of symptomatic osteoarthritis of the knee in a group of 126 patients after failure of medical management. Sixty seven of them were females. The mean age of the patients was  $61.7 \pm 8.6$  years. The medial compartment was more frequently and severely involved, with 57 % showing grade III or IV according to the system of Dougados. Seventy nine patients (63 %) had an unstable meniscal tear. The authors performed resection of loose chondral flaps and unstable meniscal tears and synovectomy. Fifty six patients (44 %) had a clinically important reduction in pain as determined with the WOMAC pain scale two years after arthroscopic debridement. The review of the literature suggested that arthroscopic debridement consisting of resection of chondral flaps and unstable meniscal tears

can offer a substantial therapeutical advantage compared with simple lavage, whereas abrasion arthroplasty does not yield predictable improvement. They summarize that their prospectively evaluated quality-of-life benefit from arthroscopic debridement of the osteoarthritic knee is less than that reported in previous retrospective surveys. Only three variables were significantly associated with improvement: the medial joint line tenderness, a positive Steinmann test and the presence of an unstable meniscal tear at arthroscopy.

The correct alignment after the procedure is in varus gonarthrosis  $8-14^\circ$  valgus, in valgus gonarthrosis  $3-5^\circ$  valgus. Rudan (14) has stated that  $1^\circ$  of the removed wedge means  $1.2^\circ$  of the correction of the alignment. He recommends an optimal femoro-tibial alignment  $6-14^\circ$  valgus in varus gonarthrosis. In Coventry's method, 1 mm of the base of the removed wedge from lateral part of the proximal tibia means  $1^\circ$  of the correction. Rudan notices that this is applicable only for the width of the tibia of 57 mm. Terauchi et al (16) recommend in the varus knee with a substantial varus inclination in the distal femur an overcorrection of  $14-16^\circ$ , with  $16^\circ$  as a limit of the appropriate overcorrection.

The favourable results after high tibial osteotomy deteriorate during the time. Coventry (5) achieved 90, 65 and 61 % of good results after 5, 10 and 15 years respectively. He advises  $5-8^\circ$  of valgus alignment  $+5^\circ$  of overcorrection in varus gonarthrosis. The prerequisite for good results was in varus gonarthrosis at least  $8^\circ$  of valgus alignment and body weight under 1.32 multiple of the ideal body weight. If the correction of the alignment in varus gonarthrosis was under  $8^\circ$  valgus and body weight was over 1.32 multiple of the ideal body weight good results were in 38 and 19 % after 5 and 10 years after the procedure respectively. He advises a slight overcorrection in the case of overweight.

Naudie, Bourne and Rorabeck (12) published their results in 85 patients with 106 high tibial osteotomies after 10 to 22 years. They have achieved good results in 73, 51, 39 and 30 % after 5, 10, 15 and 20 years respectively. In patients with good conditions, that is the age under 50 years, range of motion  $0-120^\circ$  of flexion, a perfect surgical technique, body mass index under  $25 \text{ kg/m}^2$  and correction of varus deformity to  $8-12^\circ$  valgus, they achieved good results in 95, 80 and 60 % after 5, 10 and 15 years after the surgery respectively. Negative factors for good long term results are the age over 50 years, lateral tibial thrust, undercorrection of varus deformity, body mass index over  $25 \text{ kg/m}^2$  and limited flexion less than  $0-120^\circ$ . The prerequisite for a good long term result is a proper selection of the patients and a perfect operative technique.

Korovessis et al (11) evaluated 63 patients after valgus high tibial osteotomy in varus gonarthrosis 12 years after surgery. All the patients were employed in agriculture with heavy labour. They used an AO plate for rigid internal fixation. The maintenance of  $6-10^\circ$  valgus anatomic alignment is a prerequisite for good long term results. He achieved in 91, 73 and 57 % good results after 5, 10 and 12 years, respectively.

Billings, Scott, Camargo and Hofmann (2) used a calibrated guiding block for the osteotomy and a rigid fixation with L buttres

plate for closed wedge valgus osteotomy in 64 patients. The mean preoperative femorotibial alignment was  $-1.4^{\circ} \pm 3.3^{\circ}$  and at the latest follow-up  $9.2^{\circ} \pm 3.7^{\circ}$ . There was a loss of correction  $1.7^{\circ} \pm 3.7^{\circ}$ . They emphasized that for good long term result the femorotibial alignment should be in valgus osteotomy at least  $8-10^{\circ}$  valgus. In 64 patients with valgus osteotomy 85, 53, 38 % of very good and good results after 5, 10, 15 years were achieved, respectively. Most of their patients had  $5-13^{\circ}$  valgus femorotibial alignment at the latest follow-up.

We (13) have evaluated 130 patients after closed wedged high tibial Coventry osteotomy performed in the years 1975–1990. The mean follow-up was 8 years (5–15) and the mean age of the patients at the time of the surgery was 53 years (20–70). There were 45 good, 35 satisfactory and 50 bad results. The survivorship curve was 86, 61 and 39 % after 5, 10 and 15 years after the surgery, respectively. The cause of bad results were an under-correction of the axis deviation, the age over 65 years, osteoarthritis stage IV, a severe instability, a valgus deformity over  $12^{\circ}$ , a necrosis of tibial condyle and an intraarticular intraoperative fracture. The correct alignment after the procedure was in varus gonarthrosis  $8-14^{\circ}$  valgus and in valgus gonarthrosis  $3-5^{\circ}$  valgus. There was a mean loss of correction of  $2-4^{\circ}$  in valgus osteotomy.

Giagounidis and Sell (9) evaluated 112 knees after high tibial osteotomy in 94 patients at the mean follow-up of 9 years. There were 71 varus and 23 valgus osteotomies. They achieved 73 % of very good and good results in varus gonarthrosis and in 65 % in valgus gonarthrosis. They consider meniscopatia, injury of the knee joint before the surgery and body mass index over 10 % of the ideal body weight as risk factors. The pain free interval in patients with body weight less than 10 % of the ideal body weight was 7.8 years and in patients more than 10 % of the ideal body weight only 5.0 years.

Sprengr, Jeff and Doerzbacher (15) evaluated 76 valgus – producing high tibial osteotomies in 66 patients in the years 1972–1990. The mean age of the patients was 69 years at the time of the surgery and the mean duration of follow-up was 10.8 years. They used a plate on the lateral side of the tibia and a figure of eight wire on medial side of the tibia. The survival after ten years was 90 % (95 % confidence interval), when the radiographic valgus angle at one year was between  $8^{\circ}$  and  $16^{\circ}$ , with arthroplasty as the end point. They recommend the procedure for people less than sixty years old.

Insall, Joseph and Msika (10) noticed that good results deteriorate during the time after the high tibial osteotomy. They achieved in 83 patients with 95 high tibial osteotomies at the mean follow-up of 8.9 years 97, 63 and 37 % of good results after 5, 10 and 15 years after the surgery, respectively. They recommend the high tibial osteotomy in young, active and heavy patients. They prefer a total knee arthroplasty in patients over sixty years of age.

Fuchs (8) evaluated 98 patients from 105 with unilateral osteoarthritis of the knee and without affection of the retropatellar joint and without significant ligamentous instability. The varus deviation was in all patients not more than  $10^{\circ}$ . The average fol-

low-up was 9.4 years. Seventy seven patients (78.6 %) were satisfied with the outcome of the high tibial osteotomy. Twenty three patients gave the judgment excellent, 31 good, 36 satisfactory and 8 were not satisfied. The age, the pain and the instability had no influence on this judgment. The author could not prove a significant correlation between the instability, the age and the pain. Thirteen cases (13.3 %) were absolutely pain-free, 67 cases (68.4 %) had a definite pain reduction. Thirteen revisions including 9 endoprosthesis implantations were performed at the end of the study. Fuchs recommends the high tibial osteotomy at the time of growing number of total knee replacements as a good solution in patients with unilateral arthrosis, with an axis deviation less than  $15^{\circ}$ , without retropatellar arthrosis and without involvement of contralateral compartment and ligamentous insufficiency, independent of the patient's age.

Precise preoperative planning and operative technique improves the end results. We do not have our own experience with 3D planning before high tibial osteotomy and with computer aided surgery. Ellis et al (5) stated that computer aided surgery brings a 50 % reduction of mistakes.

On the basis of our results we conclude that arthroscopy before high tibial osteotomy in the same session helped to detect significant intraarticular disorders which contribute to pathological symptoms of the osteoarthritic knee. The arthroscopic surgery helped to improve the end results after high tibial osteotomy. We emphasize that arthroscopy in connection with high tibial osteotomy is indicated in the following conditions: blockage, severe crepitation of the knee joint, positive maneuvers for the meniscal lesion, blocking loose body, significant chondral lesions examined on MRI and ultrasonography, symptomatic severe chondromalacia of the patella, injury of knee joint, another suspicious intraarticular disorders as symptomatic plica or torn anterior cruciate ligament, the need for assessment of the opposite compartment. This attitude helps to reduce the pain and other symptoms of an osteoarthritic knee. The patients with osteoarthritis of the knee grade I–III of Kellgren–Lawrence class are more precisely managed at our department with the help of this procedure.

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