Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jcot

Case Report

Total knee replacement in triple deformity with posterior subluxation of the knee joint[☆]

Hitesh Lal MS Orthopaedics^{a,*}, V.K. Sabharwal DNB Orthopaedics^b,
Yashwant Tanwar MS^c

^a Assistant Professor, Department of Orthopaedics, PGIMER & Associated Dr. Ram Manohar Lohia Hospital, New Delhi 110001, India

^b CMO (SAG), Department of Orthopaedics, PGIMER & Associated Dr. Ram Manohar Lohia Hospital, New Delhi 110001, India

^c Senior Resident, Department of Orthopaedics, PGIMER & Associated Dr. Ram Manohar Lohia Hospital, New Delhi 110001, India

ARTICLE INFO

Article history:

Received 7 July 2014

Accepted 17 February 2015

Available online 18 March 2015

Keywords:

Triple deformity

Posterior dislocation knee

Total knee replacement

ABSTRACT

Dislocation or subluxation following total knee arthroplasty has been extensively reported, but vice versa that is total knee replacement for subluxed or dislocated knee has not been published. Triple deformity of knee that is flexion, external rotation, valgus at knee associated with posterior subluxation of tibia occurs in rheumatoid arthritis, advanced tubercular arthritis and neglected posttraumatic residual dislocated knee. A 50 year old female with seropositive rheumatoid arthritis had the above disabling deformity in left lower limb and varus with medial tibial thrust in the other. Bilateral total knee arthroplasty was planned. Conservative method of reduction of left knee posterior subluxation preoperatively by 90-90 skeletal traction failed; hence patient was subjected to a staged bilateral total knee replacement using an innovative technique. The most difficult and determining initial surgical step of knee replacement in such dislocated/subluxed knee is reduction of posterior subluxation and gaining flexion at knee, as only after gaining flexion and reducing dislocated tibia, will we be able to do knee arthroplasty in triple deformity of knee. These knees are grossly unstable as most of the capsule-ligamentous structures are attritioned/non-existent. So, a fine balance of bone cuts and soft-tissue release needs to be done in a sequential manner to fine tune valgus and posterior subluxation correction without jeopardising neurovascular structures. After 3 years of knee arthroplasty the patient has painless, stable knee with good range of motion and is able to do all her activities, of living in a hilly terrain.

Copyright © 2015, Delhi Orthopaedic Association. All rights reserved.

[☆] **Work done at:** Department Of Orthopaedics, Post Graduate Institute of Medical Education & Research and Associated, Dr. Ram Manohar Lohia Hospital, New Delhi, India.

* Corresponding author.

E-mail address: drhiteshlall@gmail.com (H. Lal).
<http://dx.doi.org/10.1016/j.jcot.2015.02.004>

0976-5662/Copyright © 2015, Delhi Orthopaedic Association. All rights reserved.

1. Introduction

While dealing with the challenge of performing a total knee arthroplasty in a patient with rheumatoid arthritis (RA) the surgeon faces several unique challenges. Besides comorbidities, they have osteopenia and present with wide range of bone and soft tissue deformities, impacting the initial success and long term durability of a total knee replacement. Yet early and long term results of total knee arthroplasty in patients with rheumatoid arthritis have proven to be excellent, and are comparable to in osteoarthritis.¹

The common knee deformity in rheumatoid arthritis is of valgus and flexion deformity. We describe a case of a 50 year female who presented with a classical triple deformity of knee (flexion, valgus, external rotation) with posterior subluxation of the tibia and the technical challenges and tricks to deal with the deformity while performing arthroplasty in such cases. This is also to the best of our knowledge after a thorough review of current literature concerning the topic, the first case report of its kind.

2. Case report

We present a case of 50 year old female from hilly terrain, diagnosed as rheumatoid arthritis on disease modifying anti-rheumatic drugs (DMARD) for the past 10 years with bilateral knee involvement. The patient was able to ambulate with a lot of pain & difficulty, but she could not squat. Besides this she had no other orthopaedic deformity and hand joints were mobile with no deformity.

On examination the right knee had a varus deformity of 10° with medial tibial thrust on weight bearing (Fig. 1A, B). The left knee was subluxed posteriorly with a flexion deformity of 5°, further flexion being possible to 45° and a valgus deformity of 15° with a functional knee society score of 10 (Fig. 1C–G). The overlying skin was normal with no signs of infection and no distal neurovascular deficit. She was not on steroids and was seropositive. Her complete blood count was normal, haemoglobin was 10 g%, Erythrocyte Sedimentation Rate was 40 mm/1st hour. Liver Function tests were normal, kidney function tests were deranged, she had polyuria, blood urea was 80 mg% and Serum creatinine 2.0 mg/dl.

3. Initial treatment

A staged approach to bilateral knee arthroplasty was planned, first stage being application of skeletal 90-90 traction on left lower limb for correcting the triple deformity of the left knee (Flexion, valgus and posterior subluxation) followed by a bilateral Total knee replacement (TKR) at a later stage in a sequential manner. However the 90-90 traction given for 4 weeks failed to correct/or even budge the deformity. So, the

treatment plan was revised, staged arthroplasties first on the right side which was easier followed 2 weeks later by that of triple deformed left knee. The right knee underwent a routine posterior cruciate ligament (PCL) substituting arthroplasty and its technique is not being described further (Fig. 1H); but the highlight being arthroplasty technique for triple deformed subluxed left knee is described below.

3.1. Surgical technique

Under combined spinal-epidural anaesthesia, with patient in supine position, a standard medial para-patellar approach was used to expose the knee. The tibia was externally rotated and soft tissues were sub periosteally erased from posteromedial aspect of tibia by a curved periosteal elevator. Retropatellar fat pad was excised and piecrusting of iliotibial band (ITB) was done. Thereafter both the menisci and the attritional anterior cruciate ligament were excised, but the knee with a preoperative flexion range of 5–45° could be only flexed to 50°, and posterior tibial subluxation was not completely reducible. So a tibial cut of 2 mm depth, measured from more affected antero-lateral tibial plateau was taken which increased the range of motion of knee further to 80°. This failed to reduce posterior tibial subluxation. Hence, thereafter soft tissue (ST) release were re-done as knee could be flexed to a greater extent, first from posteromedial corner of tibia with a curved periosteal elevator; secondly pie-crusting of iliotibial band was done from inside out to correct valgus and posterior subluxation of knee. But it also failed to reduce posterior knee subluxation. Releasing other tight offending soft tissues that is lateral hamstring would have made the knee unstable, and posterior capsule could not be released without hyperflexing the knee. So, there were now two options, either recut the tibia or cut the femur to reduce tibia and flex the knee to do TKR. It was observed that tibial cut brought the cut surface very close to patellar tendon insertion on tibial tuberosity; and further cutting of tibia would jeopardize the patellar tendon integrity. So after flexing the knee to 80° a free 2 mm cut of posterior femoral condyles was done by measured resection technique. The tibia could now be reduced. As knee could be flexed fully now, Whiteside line and transepicondylar axis were marked on distal femur, and intramedullary distal femoral cutting zig was inserted into the femur just anterior to posterior cruciate ligament insertion on femur but just medial to intersection of Whiteside line and transepicondylar axis. After cutting the distal femur, extension gap was checked for passage of minimum 10 mm spacer, limb alignment, stability and rectangular shape. The valgus angle for distal femoral cutting zig was set to 3°. Doing of a total knee arthroplasty on right knee gave us an idea of the size of femur. To ensure correct external rotation of the distal femoral 5 in 1 zig, as posterior condylar referencing was dubious in this case; all the landmarks like transepicondylar axis, perpendicular to

Fig. 1 – (A) Anteroposterior view of right knee with mild varus and medial tibial deficiency; and **(B)**: Anteroposterior view of left knee with valgus. **(C)**: Lateral view of right knee. **(D)**: Lateral view of left knee shows posterior subluxation of tibia. **(E & F)**: clinical photograph showing posterior sag of tibia and **(G)**: clinical photo shows valgus at knee. **(H)**: Postoperative anteroposterior and lateral view of right knee. **(I)**: Postoperative anteroposterior and lateral view of Left knee with posterior tibial subluxation completely reduced.

whiteside line and keeping the 5 in 1 zig parallel to tibial cut were taken into account. Having done anterior, posterior condylar and chamfer cut, notch cut for posterior cruciating substituting knee replacement was done. Flexion deformity was corrected by posterior capsular release; the release of posterolateral capsule from the distal femur aided in further valgus correction. Checking of extension and flexion gap revealed it to be trapezoid being tight on lateral side. The valgus correction was further fine-tuned by subperiosteal release of lateral collateral ligament (LCL) from femoral origin. This balanced the flexion and extension gap. The bony defects on posterolateral femoral condyle disappeared as the posterior condylar cut passed through its base; and defect on the tibial side was drilled and augmented by cement and screw technique. Hereafter the tibia was drilled and broached for a suitable sized tibial tray. Trialling was done, knee was stable in flexion and extension and patellar tracking was satisfactory by the “no-thumb test”. After irrigating the knee the osseous surfaces were dried and the final implants were cemented into place. Patella was not replaced but deinnervated by cautery (Fig. 1I). Post-operative period was uneventful; range of motion exercises were

started on following day and patient allowed to bear full weight. At 3 years of follow-up patient is pain free, has knee range of motion from 0 to 100° with no extensor lag, stable knee, valgus of 5° with no subluxation of tibia and flexion deformity at knee (Fig. 2). Patient had a Knee Society Score of 85 and functional score of 95. At 3 years of followup in radiographs the tibiofemoral angle were in neutral on right side and left side had 5° valgus (Fig. 3A) with no posterior subluxation in extension (Fig. 3B) or flexion of knee (Fig. 3C).

4. Discussion

There are quite a few debatable issues pertaining to knee arthroplasty in cases of rheumatoid arthritis; starting right from the approach to be used in such patients (whether medial or lateral), the methods to deal with the complex challenging deformity (which and how the lateral structures to be released, and in precisely what sequence),^{2,3} the implant type to be used (constrained Vs. non-constrained/PCL retaining Vs. PCL substitution), the pre-operative and post-operative drug regimens to be followed and the post-op

Fig. 2 – (A) 3 years postoperative anteroposterior X-ray of both knee showing good axial alignment. **(B):** 3 years postoperative lateral X-ray of both knee showing good axial alignment with no posterior subluxation of tibia. **(C):** 3 years postoperative lateral X-ray of both knee in flexion showing no posterior subluxation of tibia. **(D & E)** showing anteroposterior and lateral X-ray of both knees 3 years postoperatively and **(F)** shows clinical photo front view of both knees with good axial alignment. **(G):** clinical photograph at 3 years showing joint line of both knees from front, side (also shows no posterior subluxation and reduced triple deformity).

rehab protocol to be followed in such cases. Fascia lata and the ilio-tibial band are the main deforming forces in the flexion and valgus deformity; and the ITB with hamstring contracture contributes to the posterior subluxation of the tibia. This along-with erosion of the posterior aspect of the femoral condyles, and quadriceps weakness leads to a peculiar drum stick appearance of the limb. The contracted ITB may be released by transverse section above the joint line⁴ or by sub-periosteal elevation from the Gerdy's tubercle, or modulated, by section of the Kaplan fibres by Z or VY plasty and "pie crusting".⁵ However isolated fascia lata release proves sufficient only in small deviations. Other methods to deal with the deformity are tibial tubercle osteotomy, lengthening of vastuslateralis tendon, release of the posterolateral capsule, sub-periosteal release of the femoral attachment of the lateral collateral ligament and dissection of the popliteal muscle, release of the lateral head of the gastrocnemius muscle.⁶

In rheumatoid disease there is soft tissue destruction resulting in joint instability. Even if the PCL is intact intra-operatively this may subsequently be eroded by inflammatory pannus postoperatively resulting in an unstable prosthetic joint. A few trials have demonstrated the increased rate of instability after PCL retaining implants.⁷ Others have shown that Cruciate-retaining implants can be successfully used in valgus knees and implant survival can be improved if at least one of the lateral-stabilising structures (LCL or popliteus) is preserved.⁸ Cemented implants are the preferred option.

Our case was unique as technique of total knee replacement for triple deformity with Posterior Subluxation of the knee joint has not been described. Triple deformity that is valgus, external rotation, flexion deformity of knee with posterior subluxation of tibia is usually seen in tuberculosis of knee and rheumatoid arthritis or in posttraumatic incompletely reduced old neglected dislocated knees. It is seen in advanced stage of tuberculosis arthritis and is a result of pull of hamstrings, iliotibial band and tight posterior capsule. The classical valgus and external rotation occurs because biceps femoris is the strongest hamstring. The bones over a long term of weight bearing deform as in a case of paralytic genu recurvatum; the upper end tibia gets eroded anteriorly selectively as due to posterior subluxation all weight bearing shifts to the anterior knee compartment. Hence uneroded posterior condyles of tibia appear pseudo-overgrown compared to anterior condyles, giving upper end tibia a "posterior spiky" appearance (Fig. 4b). This reverses the tibial slope and we suggest that tibial cut measurement be done from anterior part of plateaus.

The first step of TKR in such cases is to deliver the tibia forward from its subluxed position as then only the knee can be fully flexed which is so very essential for doing a knee arthroplasty. This was not possible in our case by the 90-90 skeletal traction applied preoperatively. In the intra-operative period also it was not possible even after posteromedial soft tissue release, pie-crusting of iliotibial band (which is the major reason for this posterior subluxation valgus and flexion deformity) and the tibial cut done 2 mm

Fig. 3 – (A) 3 years postoperative anteroposterior, (B) lateral X-ray of both knee in flexion, (C) showing no posterior subluxation of tibia.

Fig. 4 – (a) Preoperative X-ray of right knee shows normal tibial slope. (b) preoperative X-ray of left knee shows posterior tibial half has overgrown uninhibited as a peak compared to the anterior depressed area due to cyclical physiological loading by femoral condyle–“posterior spiky appearance”.

below the lateral tibial plateau. So, instead of releasing lateral hamstring, lateral collateral ligament and popliteus (it being a major stabilizing structure) a middle path/decision of taking a free cut of posterior condyle of femur was done. This step (free bone cut before soft tissue release of significant stabilizing structures) allowed Lateral collateral ligament to be released subperiosteally from femur conservatively thereafter, and spared popliteus preserving knee stability.

Having done a TKR on relatively less abnormal side first gave us the size of the distal femur. If that is not possible as in a unilateral case we recommend precise templating preoperatively by CT scan or templates available. The problem of getting the external rotation of femoral component right as the posterolateral femoral condyle is also eroded was accomplished by synergy of three surgical landmarks that is transepicondylar axis, perpendicular to Whiteside's line, parallel to the tibial cut. Having thus corrected the posterior subluxation fully; and flexion, valgus deformity partially by posteromedial soft-tissue release, IT Band pie crusting respectively; the valgus correction was further fine-tuned by posterolateral capsule and LCL subperiosteal release from femur.

We did not use a constrained or atleast a stemmed implant as the knee was very stable per-operatively and this is further supported by 3 year follow up of the patient. She is a patient who lives in hilly area does a lot of climbing up and down, her knee being stable at 3 years with good range of motion supports our decision of the implant used.

There have been numerous trials pertaining to the potential benefits and drawbacks of Disease modifying anti-

rheumatic drugs (DMARDs) in the peri-operative period. There are many trials that refute the peri-operative use of DMARDs because of increased risk of infection especially with anti-Tumour Necrosis Factor α agents.⁹ It is advised to follow a risk-benefit ratio approach to the peri-operative use of such agents, to prevent RA flare. Drugs are stopped 3–5x the drug's half-life preoperatively and only restarted when there is good wound healing and no signs infection. This favours preferential peri-operative use of DMARDs. Methotrexate (MTX) is considered the gold standard and can be safely continued in the peri-operative period.¹⁰ In elderly with co-morbidities and renal impairment, it may be prudent to withhold MTX a week prior as MTX is renally excreted (as done in our case) and reinstated as soon as the patient is stable postoperatively as was done in our case. For the remaining DMARDs in current use, the available data does not support any clear evidence-based recommendations. Deformity of the proximal tibia in RA negatively correlates with the radial Bone Mineral Density (BMD) and lumbar BMD arguing the pre and post-operative use of bisphosphonates.¹¹

5. Conclusions

This case report technique shows that, in cases with triple deformity of knee or posterior dislocation of tibia the key is pulling the tibia forward from its posteriorly dislocated position as than only knee can be flexed for TKR. It also highlights reversal of tibial slope and posterior spiky appearance of proximal tibia to be taken into account while doing TKR in such cases by our tissue-conserving technique:

Conflicts of interest

All authors have none to declare.

REFERENCES

1. Ito J, Koshino T, Okamoto R, Saito T. 15-year follow-up study of total knee arthroplasty in patients with rheumatoid arthritis. *J Arthroplasty*. 2003;18:984–992.
2. Kanamiya T, Whiteside LA, Nakamura T, Mihalko WM, Steiger J, Naito M. Ranawat award paper. Effect of selective lateral ligament release on stability in knee arthroplasty. *Clin Orthop Relat Res*. 2002;404:24–31.
3. Whiteside LA. Selective ligament release in total knee arthroplasty of the knee in valgus. *Clin Orthop Relat Res*. 1999;367:130–140.
4. Zenz P, Huber M, Obenaus CH, Schwagerl W. Lengthening of the iliotibial band by femoral detachment and multiple puncture. A cadaver study. *Arch Orthop Trauma Surg*. 2002;122:429–431.
5. Aglietti P, Lup D, Cuomo P, Baldini A, De Luca L. Total knee arthroplasty using a pie-crusting technique for valgus deformity. *Clin Orthop Relat Res*. 2007 Nov;464:73–77.
6. 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 Sep;87 Suppl 1(Pt 2):271–284.
7. Meding JB, Keating EM, Ritter MA, Faris PM, Berend ME. Long-term followup of posterior-cruciate-retaining TKR in patients with rheumatoid arthritis. *Clin Orthop Relat Res*. 2004;146:52.
8. Rajgopal Ashok, Dahiya Vivek, Vasdev Attique, Kochhar Hemanshu, Tyagi Vipin. Long-term results of total knee arthroplasty for valgus knees: soft-tissue release technique and implant selection. *J Orthop Surg*. 2011;19:60–63.
9. Bongartz T, Sutton AJ, Sweeting MJ, Buchan I, Matteson EL, Montori V. Anti-TNF antibody therapy in rheumatoid arthritis and the risk of serious infections and malignancies: systematic review and meta-analysis of rare harmful effects in randomized controlled trials. *JAMA*. 2006;295:2275–2285.
10. Grennan DM, Gray J, Loudon J, Fear S. Methotrexate and early postoperative complications in patients with rheumatoid arthritis undergoing elective orthopaedic surgery. *Ann Rheum Dis*. 2001;60:214–217.
11. Kikkawa T, Okano T, Hagino H, Otsuki R, Katagiri H, Teshima R. Knee deformity in rheumatoid arthritis is closely correlated with generalized osteoporosis. *Mod Rheumatol*. 2008;18:45–51.