Issues That Complicate the Uncomplicated Total Knee Arthroplasty.

Agenda

Chair, Peter Myers
Speakers

- Wael Barsoum,
- Patrick Djian,
- Wilson Mello,
- Hirotsugu Muratsu ,
- Jan Victor,

Chairman's Introduction, Peter Myers		5 mins
1, Wael Barsoum	Fractures occurring during TKA.	7 mins
2, Patrick Djian	Ligament disruption during TKA.	7 mins
3, Wilson Mello	Complete avulsion of the patellar tendon during TKA.	7 mins
4, Hirotsugu Muratsu	Incorrect cuts compromising ligament balancing during TKA.	7 mins
5, Jan Victor	Vascular Injury during TKA.	7 mins.
Discussion and audience participation.		20 mins.

The speakers will discuss the issue and present relevant recent literature along with their own experience of the problem. A case scenario problem will then be discussed.

Fractures occurring during TKA.

Scenario: During a routine TKA, the femoral trial is tight and on removal a large portion of the postero-lateral femoral condyle comes away with the trial implant. Revision implants are not readily available.

Ligament disruption during TKA.

Scenario: During a routine TKA, you become aware that the medial collateral ligament has been badly damaged. It is not suitable for resuturing. This could also apply to the lateral side.

Complete avulsion of the patellar tendon during TKA.

Scenario: During a routine TKA, your assistant enthusiastically but too strongly retracts and completely avulses the patellar tendon from the tibial tuberosity.

Incorrect cuts compromising ligament balancing during TKA.

Scenario: You are called to a routine TKA, a junior surgeon has made the distal femoral cut using the wrong side cutting block. T do the correct cuts now would compromise balancing. You do not have revision equipment readily available. It can be provided in 1 – 2 hours.

Vascular Injury during TKA.

Scenario: During a routine TKA, you become aware that a sharp instrument has penetrated posteriorly. A vascular surgeon is 40 minutes away.

Handout - Wilson Mello

Issues That Complicate the Uncomplicated Total Knee Arthroplasty
Symposium: 10.00 – 11.00 on Sunday 15th May 2011 in Room 101

3. Complete avulsion of the patellar tendon during TKA

Avultion of the tibial tubercule is an intraoperative complication that should be avoided rahter than treated. The prevalence of a patelar tendon rupture was 18 of 8.288 total knee arthroplasty (0,22%) according to Rand.

Factors associated with patellar tendon rupture include a difficult exposure in a stiff knee, extensive release of the patellar tendon at the time of surgical exposure. With the patella dislocated laterally, considerable traction is exerted on insertion of the patellar ligament . Avultion of the tubercule during intraoperative maneuvers can happen easily, and if the periosteum tears across, an adequate reconstruction is very difficulty. So, prevention is an important issue in this matter.

The first important measure to prevent patellar tendon avultion is to recognize that "it can happen". If the knee is stiff or if it is difficult to dislocate the patela, start with gentle soft tissue release. Do not use force. External rotation of the tibia can help in geting the lateral dislocation of the patella. If with this manouver still being difficult, usa a Steimann pin into the tibial tuberule to hold the tendon in place. The pin must be smooth and not threaded to prevent damage to the tendon. The presence of a pin remember the surgeon and the assistant that the tendon is at risk.

If difficultty remains to expose the knee, a quadriceps snip can be used. Cutting the quadriceps tendon at a 45 degrees angle from its apex to the vastus lateralis to provide space for dislocation of the patella lateraly and distally. The other option is to do a tibial tubercule osteotomy.

Patellar tendon ruptures are difficult to treat. Direct suture or staple repair is often unsuccessful. Options for management of acute rupture include direct repair with augumentation with an autogenous semitendinosus tendon graft or a syntetic ligament if available. Options for a delayed reconstruction include Achilles tendon allograft , extensor mecanism allograft or an autogenous

gastrocnemius flap. The use of a syntetic ligament to augment the repair has been used but there is often an extention lag. Tha same can occur with the use of autogenous semitendinous and gracillis tendon. All described reconstruction methods will lead to an extention lag.

With this in mind, the best action to do is to prevent this catastrofic complication.

Things to remember:

1- gentle manipulation of the soft tissue
2- external rotation and flexion can help
3- pin the tendon if you suspect the avultion can happen
4- quadriceps snip is an option
5- tibial tubercule osteotomy is also an option
6- PREVENTION IS THE KEY FOR THIS COMPLICATION

References:

1- James A. Rand - Knee - AAOS Isntructional Course Lecture 2007 pp 39:48
2- Surgery of the Knee – Insall and Scott fourth Edition pp 1749
3- Knee Arthroplasty – Editor Paul A. Lotke 1995 pp 90
4- Modes of Failure and Preoperative Evaluation
   BY KHALED J. SALEH, MD, MSC, FRCSC CHARLES R. CLARK, MD, JAMES A. RAND, MD, AND GREGORY A. BROWN, MD - THE JOURNAL OF BONE & JOINT SURGERY · JBJS.ORG VOLUME 85-A · SUPPLEMENT 1 · 2003 pp – 21:25

ISAKOS 8th. Biennial ISAKOS Congress (May 15-19.2011) Symposia

Issues that complicate the uncomplicated total knee arthroplasty

Possible cause of incorrect femoral rotational osteotomy with gap technique in posterior stabilized total knee arthroplasty

(Influence of joint distraction force on soft tissue balance evaluation)

Hirotsugu Muratsu MD, Tomoyuki Matsumoto MD*, Seiji Kubo MD*,

Akihiro Maruo MD, Hidetoshi Miya MD, Ryosuke Kuroda MD*,

Masahiro Kurosaka MD*

Department of Orthopaedic Surgery, Nippon Steel Hirohata Hospital,

*: Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine,

Summary

In posterior-stabilized TKAs for varus type osteoarthritic knees using gap technique, unexpected medial or lateral instability with knee flexion has been occasionally observed as a result of incorrect femoral rotational osteotomy. To explore the mechanisms of this issue, the effect of joint distraction force on the intra-operative soft tissue balance evaluation was analyzed.

The joint distraction force during soft tissue balance evaluation has positive correlation to the varus imbalance. This means that rotational alignment of femoral osteotomy would be inconsistent and mismatched to the anatomical orientation depending on the joint distraction force resulting in the varus or valgus flexion instability after the surgery.

· Introduction ·

Appropriate component alignment and soft tissue balance are essential for the success of total knee arthroplasty (TKA). Although several methods including navigation system, development of surgical jig and 3D pre-operative planning have been reported as an effective method for the accurate component alignment in TKA, the soft tissue balance management during surgery is left much to the surgeon's feel and experience.

The modified gap technique has been advocated as an effective method to obtain proper soft tissue balance in TKA. On the other hand, unexpected post-operative flexion instability would be a possible risk with this technique as a result of incorrect femoral rotational alignment. Although both thickness and orientation of femoral bone resection rely on the intra-operative soft tissue balance evaluation, the biomechanical conditions during evaluation were not obscured.

We developed an offset type tensor system for TKA enabling soft tissue balance measurement under quantitative joint distraction force and the measurement with more consistent and physiological joint conditions after femoral trial prosthesis placement with patello-femoral (PF) joint reduced as well as conventional osteotomy gap[1, 2].

The purpose of the present study is to analyze the influence of the magnitude of joint distraction force on the soft tissue balance measurement evaluated in the conventional manner between osteotomized bone surfaces and physiological joint condition with femoral trial prosthesis placed with PF joint reduced.

· Materials and Methods ·

Forty three varus type osteoarthritic knees implanted with primary posterior stabilized (PS) TKAs were subjected to the intra-operative soft tissue balance measurement. All TKAs were performed using measured resection technique with a conventional resection block. Femoral rotation angle was preset at 3 or 5° according to the condylar twist angle measured with preoperative CT.

Following each bony resection and soft tissue release, we fixed the newly developed offset type tensor

to the proximal tibia, and applied a joint distraction force between osteotomized bone surfaces. The measurements were performed at extension and flexion of the knee. After conventional osteotomy gap evaluations, the femoral trial component was placed with tensor on the tibial bone cut surface, and PF joint was temporally reduced. We also loaded distraction force at 0 and 90° of knee flexion.

Soft tissue balance was evaluated by the center joint gap (mm) and ligament imbalance (°; positive in varus) applying different joint distraction forces at 20, 40 and 60 lbs (89, 178 and 267 N). We performed ANOVA to compare the joint gap and varus imbalance among different joint distraction forces in both joint conditions. $P<0.05$ was considered statistically significant.

· Results ·

Firstly soft tissue measurements between osteotomazed bone surfaces were follows. Center joint gaps were 23.0, 26.0, 28.0mm and 22.8, 26.0, 28.0mm with joint distraction force at 20, 40 and 60 lbs at extension and flexion each respectively. Varus ligament imbalance were 4.9, 6.6, 7.6° and 1.3, 3.6, 4.2° with each joint distraction force at extension and flexion each respectively. Secondary center joint gap after femoral trial placed with reduced PF joint were 9.8, 12.3, 14.4mm and 13.6, 17.1, 18.4mm with each joint distraction force at 0 and 90° of knee flexion each respectively. Varus ligament imbalance were 3.0, 3.6, 4.4° and 2.8, 5.0, 5.2° with each joint distraction force at 0 and 90° of knee flexion each respectively.

Joint center gap were significantly increased with increasing joint distraction force at knee extension and flexion in both joint conditions. Furthermore, varus ligament imbalance was also significantly increased with joint distraction force increase at both extension and flexion in each joint condition.

· Discussion and Conclusion ·

In the present study, both center join gap and varus ligament imbalance were significantly increased with the increase of joint distraction force during soft tissue balance evaluation in the joint condition before and after femoral trial component placement. The increase in the join center gap was theoretically expected as the result of structural properties of soft tissue envelop.

In the varus type osteoarthritic knee, medial soft tissue structures were pathologically contracted, and that of lateral side was elongated. And the structural properties of soft tissue envelops also different between medial and lateral compartment. The stiffness of the medial soft tissue might be higher than that of lateral, which caused more joint gap increase at lateral joint compartment with joint distraction force increase than that at medial side. These differences in the structural properties between medial and lateral soft tissue would cause the increasing varus ligament imbalance with the increase of joint distraction force.

Although femoral rotation angle with gap technique was determined depending on the ligament imbalance at knee flexion, ligament imbalance was found to change as much as 3° in average with the range of joint distraction force from 20 to 60 lbs. This change might be a cause of incorrect osteotomy, and unexpected flexion instability. The femoral rotational osteotomy in gap technique is thought to be difficult to reproduce especially for the less experienced surgeon. We should aware of this biomechanical issue and carefully determine the femoral rotational osteotomy angle depending on not only soft tissue balance evaluation but also anatomical orientation such as AP axis and trans-epicondylar line.

・References・

1. Matsumoto T, Muratsu H, Tsumura N, Mizuno K, Kuroda R, Yoshiya S, Kurosaka M. Joint gap kinematics in posterior-stabilized total knee arthroplasty measured by a new tensor with the navigation system. J Biomech Eng. 2006; 128: 867

2. Muratsu H, Matsumoto T, Maruo A, Miya H, Kurosaka M, Kuroda R. Femoral component placement changes soft tissue balance in posterior-stabilized total knee arthroplasty. Clin Biomech. 2010; 25: 926