



MINIMALLY INVASIVE TOTAL KNEE ARTHROPLASTY.

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ABSTRACT:

We present our experience with the MIS TKA through a mid-vastus approach. The indications and contraindications of the technique are discussed. Our series include 104 patients. The Knee Society Score is used to rate the results. The average KSS score on 6-th month is 89 points. Eleven patients had skin necrosis. Eight had transient stiffness. One developed late infection. The MIS-TKA is recommended for selected patients and must be performed by an experienced surgeon and prepared team.

Key words: minimally invasive total knee arthroplasty, indications, contraindications, results, complications

The standard total knee arthroplasty (TKA) is an invasive procedure that leads to substantial postoperative pain, prolonged rehabilitation and sometimes suboptimal functional results. In recent years this has inspired the creation of less traumatic methods. The encouraging results of the minimally invasive (MIS) unicondylar knee replacement pioneered by JA Repicci lead to the adoption of the same principles in the TKA surgery. [1]

The main focus of the debates about the MIS TKA surgery is on the advantages and the problems this surgery creates. The major advantage of the procedure is the limited postoperative pain and faster early recovery, although there are no long term differences compared to the conventional technique.

Some authors quite longer operative time, increased risk of infection and components malposition after a MIS TKA. At the same time the results of the procedure should not be worse than the conventional technique [2]. Bonuti et al suggested that the aim of a MIS is not only to decrease the skin incision, but to reduce the soft tissue trauma by sparing the quadriceps muscle damage and avoiding the patella eversion [3]. In recent years the MIS TKA is under constant development, new surgical approaches are introduced and there is a general tendency toward reduced soft tissue damage. According to all of the authors there should not be any compromise with the alignment and fixation of the prosthetic components, or the soft tissue balance.

We must stress that the definition of the MIS TKA is still not standardized, there is limited data on the medium and long term longevity and functional results [3].

MATERIAL AND METHOD

Our indications for a MIS TKA include:

Angular deformity from 10° varus to 15° valgus. Flexion contracture of maximum 10° and ROM greater

than 90°.

We considered patients with active infection, bleeding disorders, compromised soft tissue coverage, problematic vascularity and innervation to be contraindicated for the procedure [4, 5]. Patients with cardio-vascular and respiratory problems, rheumatoid arthritis, diabetes, chronic corticosteroid use and previous knee surgery are also not good candidates because of the expected prolonged operative time [6]. The same applies for obese patients and patients with stronger quadriceps muscle where the components can not be positioned properly through MIS incision [7, 8, 9, 10, 11].

Surgical technique

According to the surgical approach the arthrotomy is divided in four types and that's the key to the real MIS. Three of the approaches are used by many authors and they are mini-medial parapatellar approach, mini-subvastus approach and mini-midvastus approach. There is also the mini-lateral approach, but there is paucity of published data about it. The computer assisted navigation (CAN) is necessary to establish the visual reference points, because they can be lost during the exposure and thus precision is enhanced. The electromagnetic CAN has an even greater advantage [2]. The basic osteotomy and ligamentous balance techniques are the same as the conventional TKA. Some surgeons resect the tibia first in order to gain better orientation of the surgical field, while others start with the patella. Most prefer to use the Whiteside's line to determine the femoral rotation.

Key steps in our surgical technique:

We begin with a limited skin incision-approximately twice the length of the patella (8-11 cm) and slightly medial to the patellar tendon (figure 1). The second step is a mid-vastus arthrotomy (figure 2). The muscle is transected from 1,5 to 3 cm. We then proceed with patella preparation, without eversion, just lateral retraction (figure 3). It is considered that prolonged eversion of the patella can cause permanent quadriceps dysfunction and muscle weakness. Similar detrimental effect can be caused by the inflated tourniquet.

The next step in our technique is a complete osteophyte excision (figure 4.) in order to clear space for the femoral resection (figure 5.). The tibial resection is performed after a further clearance of the remaining osteophytes through the so called "mobile window technique" (figure 6.). Then we finish the femoral resection and use the Whiteside's line as a AP distal femoral orientation (figure 7.). We try to avoid the articular dislocation in order to minimize the capsular and ligamentous damage and

the postoperative pain respectively. In order to achieve ligamentous balance we use the Whiteside's spacer-block technique (figure 8.). The next step implies the application of the trial implants and necessitated anterior subluxation of the tibia, by a limited distal release of the postero-me-

dial tibial corner (figure 9.). The procedure ends with an implantation of the final components (figure 10.). Because of the limited access, the tibial component is cemented first, followed by the femoral component and the tibial inlay.

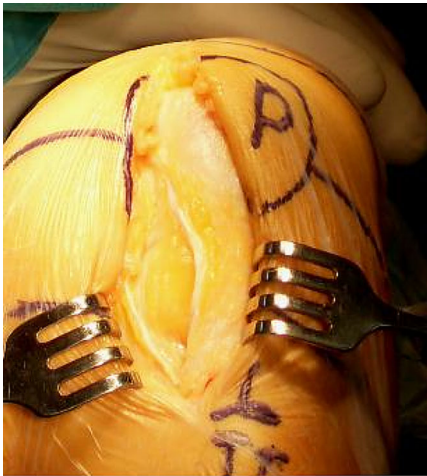


Fig. 1. limited skin incision.



Fig. 2. mid-vastus arthrotoomy.

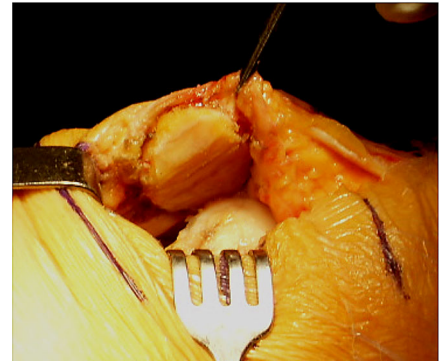


Fig. 3. patellar preparation.



Fig. 4. osteophyte excision.



Fig. 5. femoral resection.



Fig. 6. tibial resection through a "mobile window".

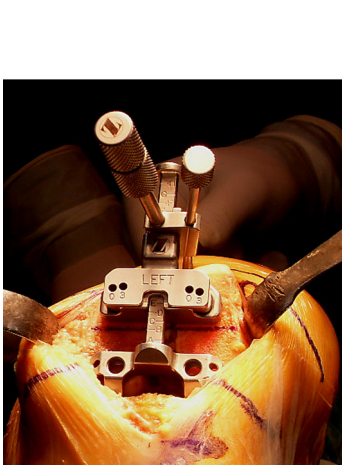


Fig. 7. final femoral resection.



Fig. 8. ligamentous balance.

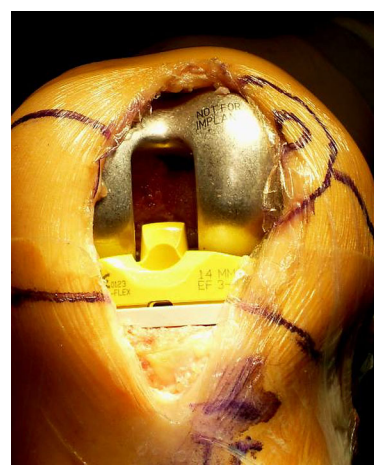


Fig. 9. trial implantation.



Fig. 10. final implantation

For the period 2007 - 2014 MIS TKA was performed on 104 patients. The average age was 68 years (ranging from 62 to 78). 64 of the patients were female and 40 were male.

The average incision length was 9,5 cm (8-12)

The average operative time -125 min (90-140)

The blood loss averaged 270 ml (40-520)

In most of the cases patients regained full extension on the 10-15 postoperative days and the flexion reached 90 - 100°

The average Knee Society Score (KSS) at the 6 month was 89 points.

Eleven of the earlier patients had skin necrosis. Eight had transient stiffness. One case developed a late infection one year after the procedure.

DISCUSSION

What is today's understanding of MIS TKA?

By some authors MIS is defined as an incision no greater than 14cm, but this is not the only characteristic. Other compulsory prerequisites include [3, 12, 7, 13]:

- Limited ligament, capsule and recessus dissection
- Preservation of the m. quadriceps femoris tendon
- Avoidance of patella eversion
- Avoidance of tibio-femoral dislocation
- Specific surgical instrumentation
- Utilization of the "mobile window"
- Substantial surgical experience

The main advantage and purpose of the MIS TKA is to limit the blood loss and pain, to shorten the hospital stay, to hasten the recovery and make the rehabilitation easier,

to lessen the complications and improve the cosmetics.

All this is connected with a higher patient and surgeon [12, 14].

The MIS TKA is not without its potential flaws. This procedure allows limited access and visualization to the knee joint which makes it technically demanding compared to the conventional TKA [3, 15]. This inevitably prolongs the operation time especially in the beginning of the learning curve. The alignment and cementing of the implants is also difficult, there is a higher incidence of skin necrosis [7, 16]. These complications can be avoided with proper patient selection, better surgical technique and surgical experience [8]. There is lack of long term evidence for the MIS TKA, because the procedure is relatively new.

CONCLUSION

MIS TKA is not related only to the length of the incision and the good cosmetic result. The main purpose is limited soft tissue and biomechanical damage. The technique allows faster recovery and less postoperative pain. It is obvious that "MIS TKA can lead to real results, only if the real technique is utilized" [17]. It demands a proper attention to detail, to assure that the basic principles are not ignored in an attempt to lessen only the skin incision [18]. It is appropriate for most but not all of the knees. Sure enough the technique is not for every surgeon or hospital, because a good organization and substantial surgical experience is highly recommended [19]. Although the procedure is in its early stage of development and there are many skeptics, the MIS TKA has led to promising early results and will most probably be endorsed in the future.

REFERENCES:

1. Repicci JA, Eberle RW. Minimally invasive surgical technique for unicompartmental knee arthroplasty. *J South Orthop Assoc.* 1999; 8(1):20-27
2. Cho W. Knee Joint Arthroplasty. Chapter "Optional Techniques". *Springer-Verlag Berlin Heidelberg.* 2014; 307-310. [[CrossRef](#)]
3. Bonutti PM, Mont MA, McMahon M, Ragland PS, Kester M. Minimally invasive total knee arthroplasty. *J Bone Joint Surg Am.* 2004; 86-A Suppl 2:26-32. [[PubMed](#)]
4. Maloney WJ. The stiff total knee arthroplasty: evaluation and management. *J Arthroplasty.* 2002 Jun;17(4 Suppl 1):71-73. [[PubMed](#)] [[CrossRef](#)]
5. Walton NP, Jahromi I, Dobson PJ, Angel KR, Lewis PL, Campbell DG. Arthrofibrosis following total knee replacement: does therapeutic warfarin make a difference? *Knee.* 2005 Apr; 12(2):103-6. [[PubMed](#)] [[CrossRef](#)]
6. Scuderi GR, Tenholder M, Capeci C. Surgical approaches in minimally incision total knee arthroplasty. *Clin Orthop Relat Res.* 2004 Nov;(428):61-67. [[PubMed](#)]
7. King J, Stamper DL, Schaad DC, Leopold SS. Minimally invasive total knee arthroplasty compared with traditional total knee arthroplasty. Assessment of the learning curve and postoperative recuperative period. *J Bone Joint Surg Am.* 2007 Jul;89(7):1497-503. [[PubMed](#)] [[CrossRef](#)]
8. Haas SB, Manitta MA, Burdick P. Minimally invasive total knee arthroplasty: The mini midvastus approach. *Clin Orthop Rel Res.* 2006; 452:112-116
9. Tria AJ Jr, Coon TM. Minimal incision total knee arthroplasty: early experience. *Clin Orthop Relat Res.* 2003 Nov;(416):185-90. [[PubMed](#)]
10. Laskin RS, Beksac B, Phongjunakorn A, Pittors K, Davis J, Shim JC, et al. Minimally invasive total knee replacement through a mini-midvastus incision: an outcome study. *Clin Orthop Relat Res.* 2004 Nov;(428):74-8. [[PubMed](#)]
11. Song EK, Seon JK, Yoon TR, Park SJ, Bae BH, Cho SG. Functional results of navigated minimally invasive and conventional total knee arthroplasty: a comparison in bilateral cases. *Orthopedics.* 2006 Oct;29:Suppl 10:S145-S147. [[PubMed](#)]
12. Katz JN, Barret J, Mahomed NN, Baron JA, Wright TP, Losina E. Association between hospital and surgeon procedure volume and the outcomes of total knee replacement. *J Bone Joint Surg Am.* 2004 Sep;86-A(9):1909-16. [[PubMed](#)]
13. Leopold SS. Minimally invasive total knee arthroplasty for osteo-

arthritis. *N Engl J Med.* 2009 Apr 23; 360(17):1749-58. [[PubMed](#)] [[CrossRef](#)]

14. Hervey SL, Purves HR, Guller U, Toth AP, Vail TP, Pietrobon R. Provider volume of total knee arthroplasties and patient outcomes in the HCUP-Nationwide Inpatient Sample. *J Bone Joint Surg Am.* 2003 Sep;85(9):1775-83. [[PubMed](#)]

15. Kim YH, Sohn KS, Kim JS: Short-term results of primary total knee arthroplasties performed with a mini-incision or a standard incision. *J Ar-*

throplasty. 2006 Aug;21(5):712-718. [[PubMed](#)] [[CrossRef](#)]

16. Cheng T, Liu T, Zhang G, Peng X, Zhang X. Does minimally invasive surgery improve short-term recovery in total knee arthroplasty? *Clin Orthop Relat Res.* 2010 Jun;468(6):1635-48. [[PubMed](#)] [[CrossRef](#)]

[17] Choi YJ, Tanavalee A, Pak Ho Chan A, Coon TM, Tria AJ Jr. Minimally invasive surgery for total knee arthroplasty. In: MIS of the Hip and the Knee. A Clinical Perspective. Scuderi GR, Tria AJ Jr. (Eds.) *Springer-Verlag*

New York, Inc. 2004; pp 187-197. [[CrossRef](#)]

18. Scuderi GR, Tria AJ Jr. Minimal Incision Total Knee Arthroplasty. In: MIS of the Hip and the Knee. A Clinical Perspective. Scuderi GR, Tria AJ Jr. (Eds.) *Springer-Verlag New York, Inc.* 2004; pp 175-188 [[CrossRef](#)]

19. Aglietti P, Baldini A, Giron F, Sensi L. Minimally invasive total knee arthroplasty: is it for everybody? *HSS J.* 2006 Feb;2(1):22-6. [[PubMed](#)] [[CrossRef](#)]

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