

Fractures around TKA : Fixation

Jean-Noel Argenson,
Julien Druel, Matthieu Ollivier, Maxime Fabre-Aubrespy,
Christophe Jacquet, Damien Lami, Pierre-Olivier Pinelli,
Sebastien Parratte, Xavier Flecher

11th Advanced Course on Knee Surgery, January 19-23, 2025

Epidemiology



➤ TKA 2012-2018 : **+43%**

Prevision 2050 : **+33%** increase

> [Orthop Traumatol Surg Res.](#) 2020 Sep;106(5):893-902. doi: 10.1016/j.otsr.2020.02.018.
Epub 2020 Jun 4.

Knee surgery trends and projections in France from 2008 to 2070

Roger Erivan ¹, Anna Tardieu ², Guillaume Villatte ³, Matthieu Ollivier ⁴, Christophe Jacquet ⁴,
Stéphane Descamps ³, Stéphane Boisgard ³

Epidemiology

- **Supra-condylar Fracture +++**
- 0.3 to 2.5 % between 2 and 4 years
- Low energy : torsion or compression



+212% from 2016 to 2032

> [J Arthroplasty](#). 2024 Oct;39(10):2615-2620. doi: 10.1016/j.arth.2024.05.033. Epub 2024 May 15.

Risk and Epidemiology of Periprosthetic Knee Fractures After Primary Total Knee Arthroplasty: A Nationwide Cohort Study

Stefan K Risager ¹, Kristine B Arndt ², Charlotte Abrahamsen ², Bjarke Viberg ¹, Anders Odgaard ³, Martin Lindberg-Larsen ¹

> [J Bone Joint Surg Am](#). 2024 Jun 19;106(12):1054-1061. doi: 10.2106/JBJS.23.00868. Epub 2024 Jun 19.

Fixation or Revision for Periprosthetic Fractures: Epidemiology, New Trends, and Projections in the United States

Gregory T Minutillo ¹, Jaret M Karnuta, Joseph Koressel, Bijan Dehghani, Ryan D DeAngelis, Derek J Donegan, Samir Mehta



Risk Factors

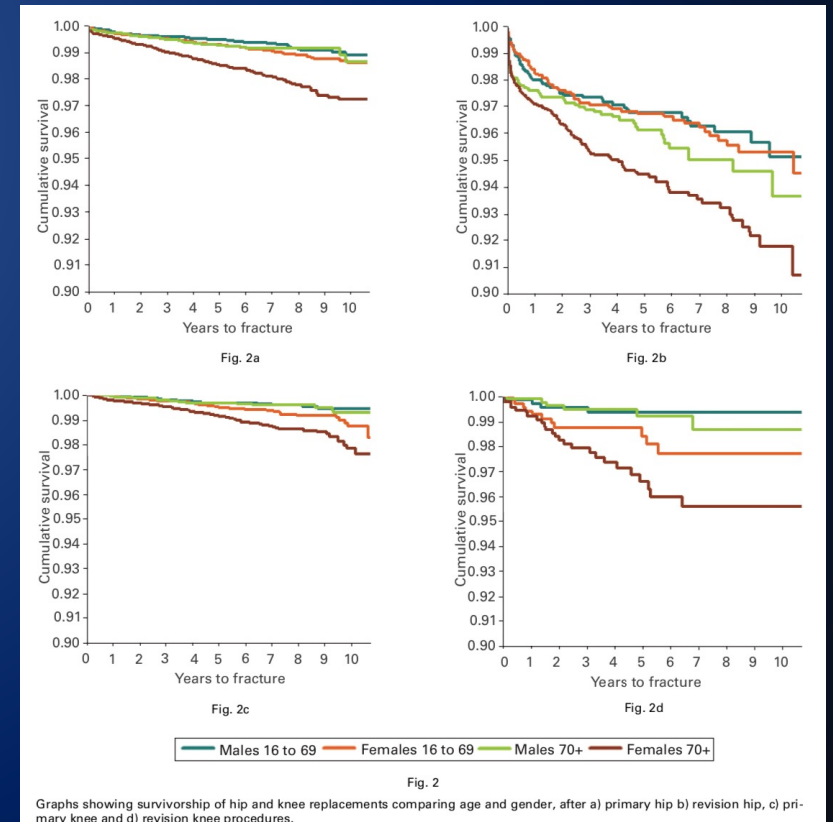
R. M. D. Meek,
T. Norwood,
R. Smith,
I. J. Brenkel,
C. R. Howie

*From the Scottish
Arthroplasty Project,
Edinburgh, United
Kingdom*



The risk of peri-prosthetic fracture after primary and revision total hip and knee replacement

- Women RR=2.3
- > 70 yrs RR=1.6
- Revision TKA RR=3



Localisation

FEMUR 65%

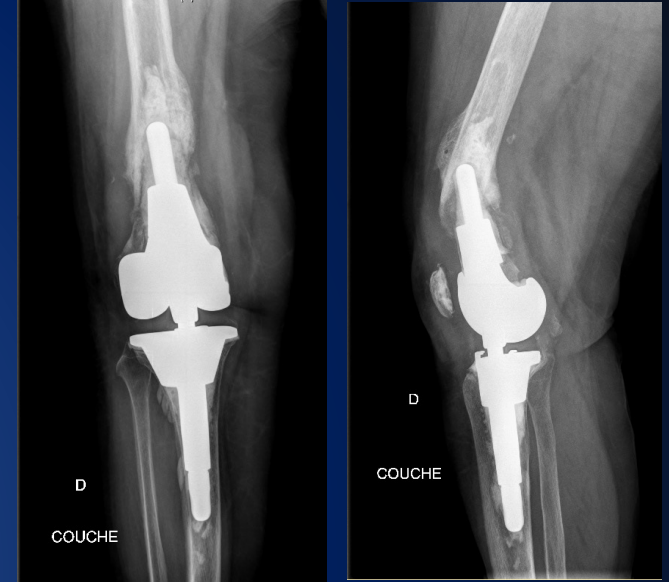
TIBIA 20%

PATELLA 15%

Classifications

Many +++

- Specific Tibia : **Félix** 1997 Clin Orthop
- Specific Femur : **Engl** 1997 JBJS Am
- Classification **C.Trojani & P.Neyret**
- **SOFCOT**
Described from Neyret & Trojani
(all types TKA, with or without stem)



Classification

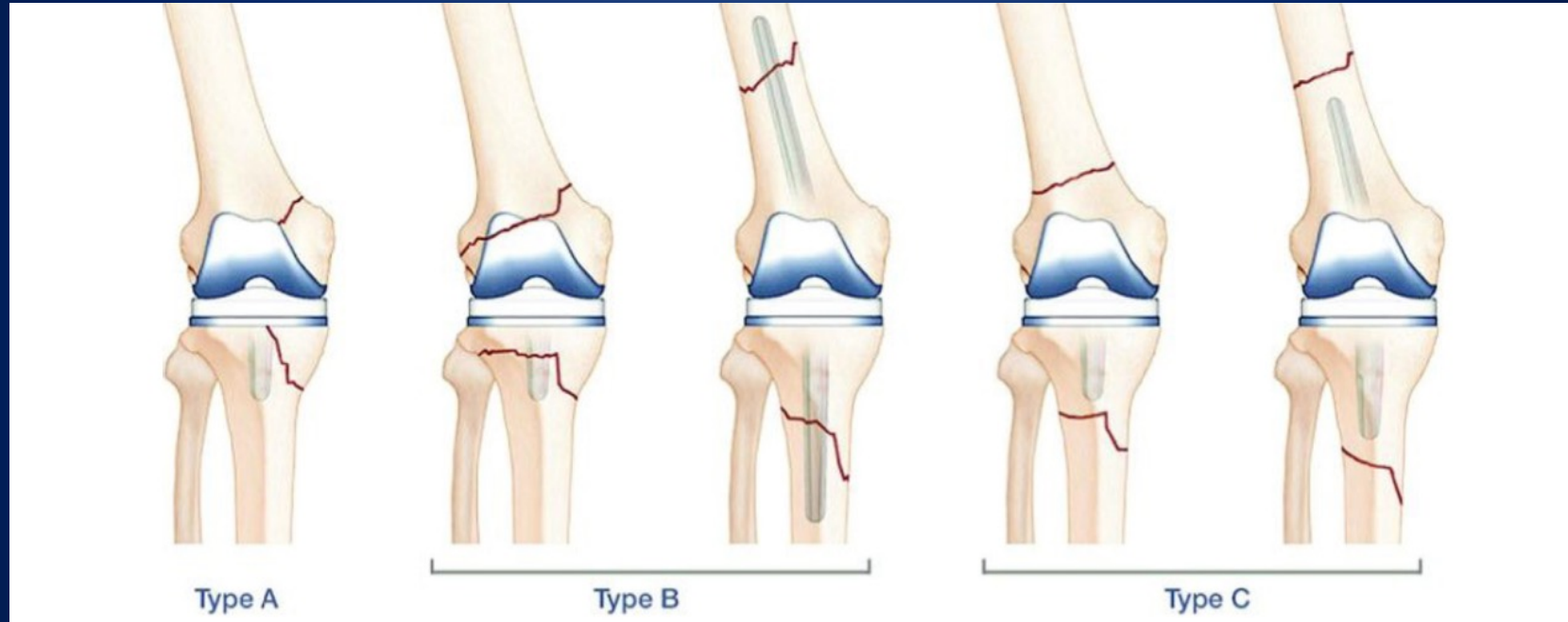
S.O.F.C.O.T

> Rev Chir Orthop Reparatrice Appar Mot. 2006 Sep;92(5 Suppl):2S34-2S36.

[Periprosthetic fractures around total hip and knee arthroplasty. Introduction and study objectives]

[Article in French]

T Bégue¹, P Adam, M-H Fessy, D Veillard, A Ingels, M Andrieux, H Thomazeau



Localisation of fracture regarding TKA

Classification

S.O.F.C.O.T



Fracture involving femoral or tibial condyle

= Affect interface bone/cement

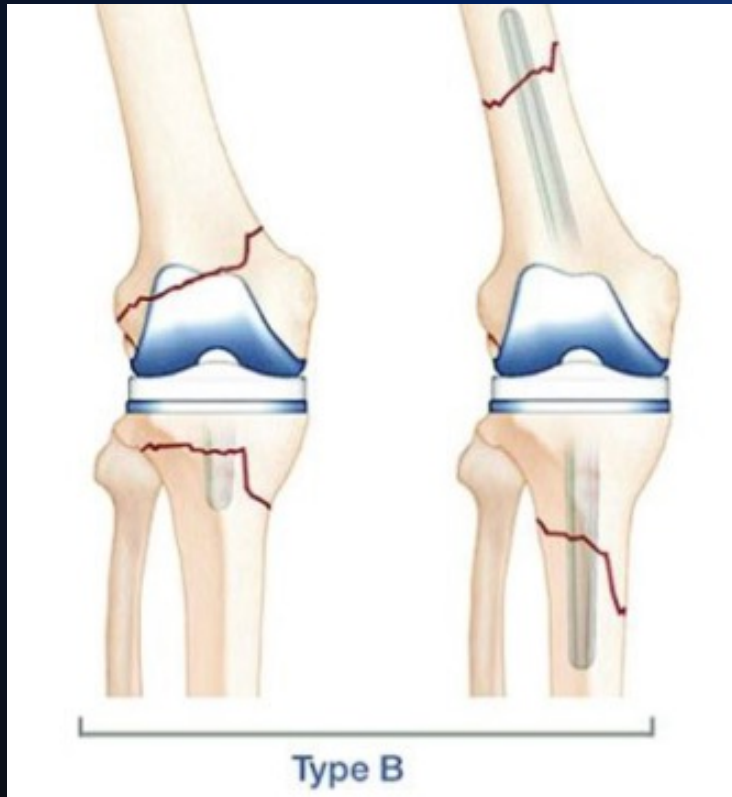
= Prosthesis Stability



Classification

S.O.F.C.O.T

Fracture involving two condyles
or prosthesis stem

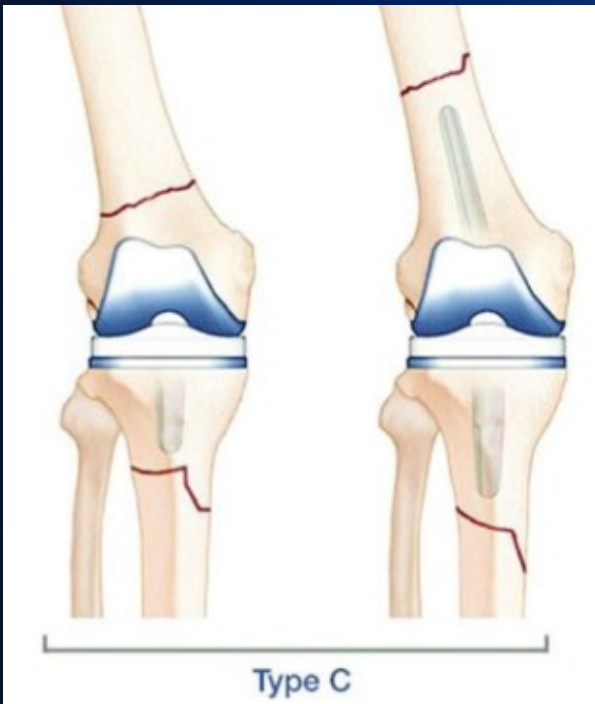


= Prosthesis Stability ?



Classification

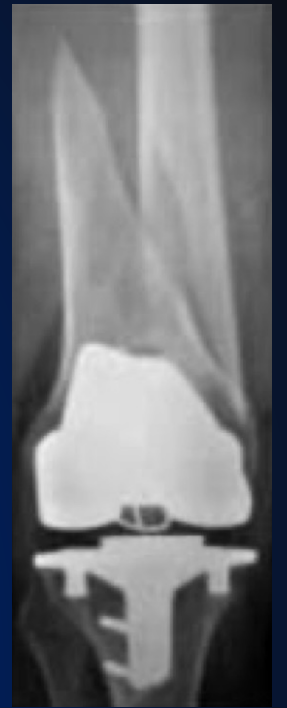
S.O.F.C.O.T



Fracture away from implant or stems

= Does not affect Bone-Cement interface

= Prosthesis Stability



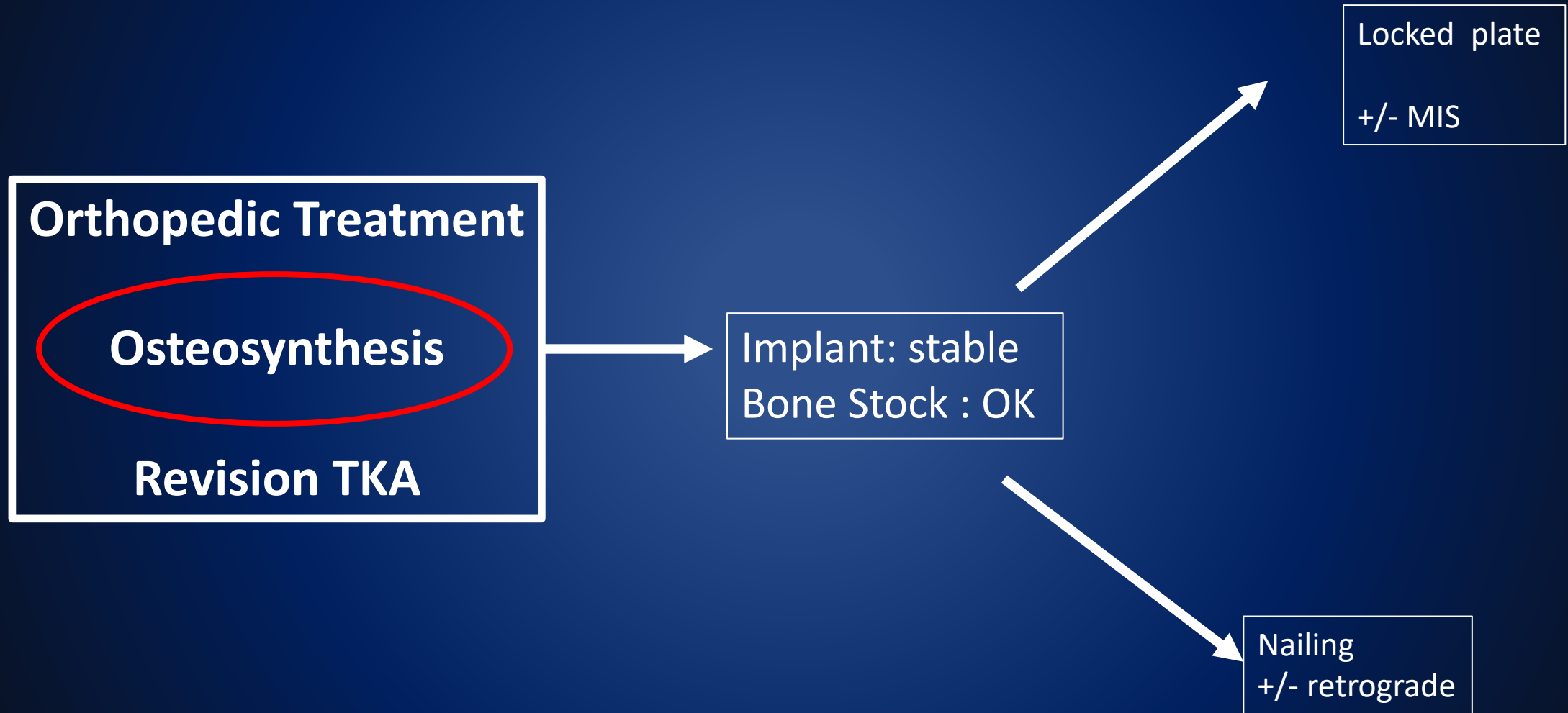
3 Goals for Treatment

Quick Mobilisation

Early standing

+/- Weight-bearing

3 Means



Figgie MP, Goldberg VM, Figgie HE 3rd, Sobel M. The results of treatment of supracondylar fracture above total knee arthroplasty. J Arthroplasty. 1990;5:267-76.

Femur

Indication for fixation ?

Displaced Fracture / Stable Implants



Surgical Treatment



Osteosynthesis



Plates



Nailing

- Retrograde
- Anterograde



Femur

Locked lateral Plate

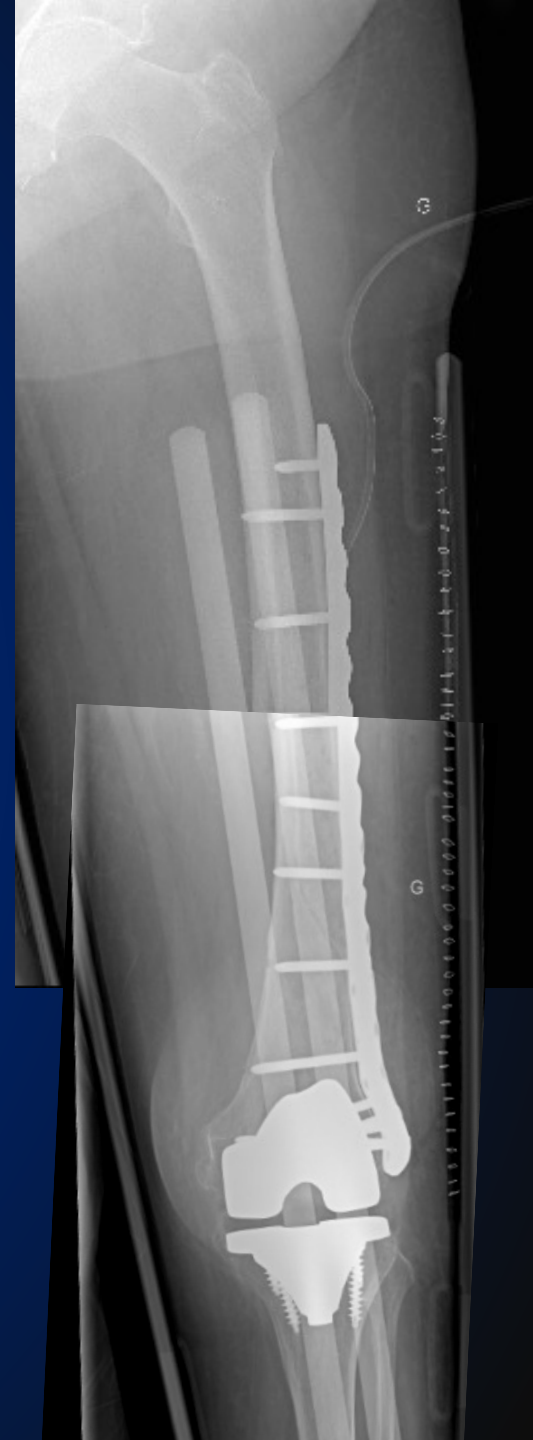
- All bone segment
- Bone union 80% (4-5 months)
- 4 proximal bi-cortical screws
- Complication 20% (Non union / Infection / Varus malunion)
- Unicortical screw + cerclage if stem
- 5 distal metaphysal locked screws
- Mobility preserved (97%)



Edit Comparative Study > [J Arthroplasty](#). 2017 Jan;32(1):189-192. doi: 10.1016/j.arth.2016.06.056.
Epub 2016 Aug 3.

Wh Outcomes of Surgical Management of Supracondylar fixa Periprosthetic Femur Fractures

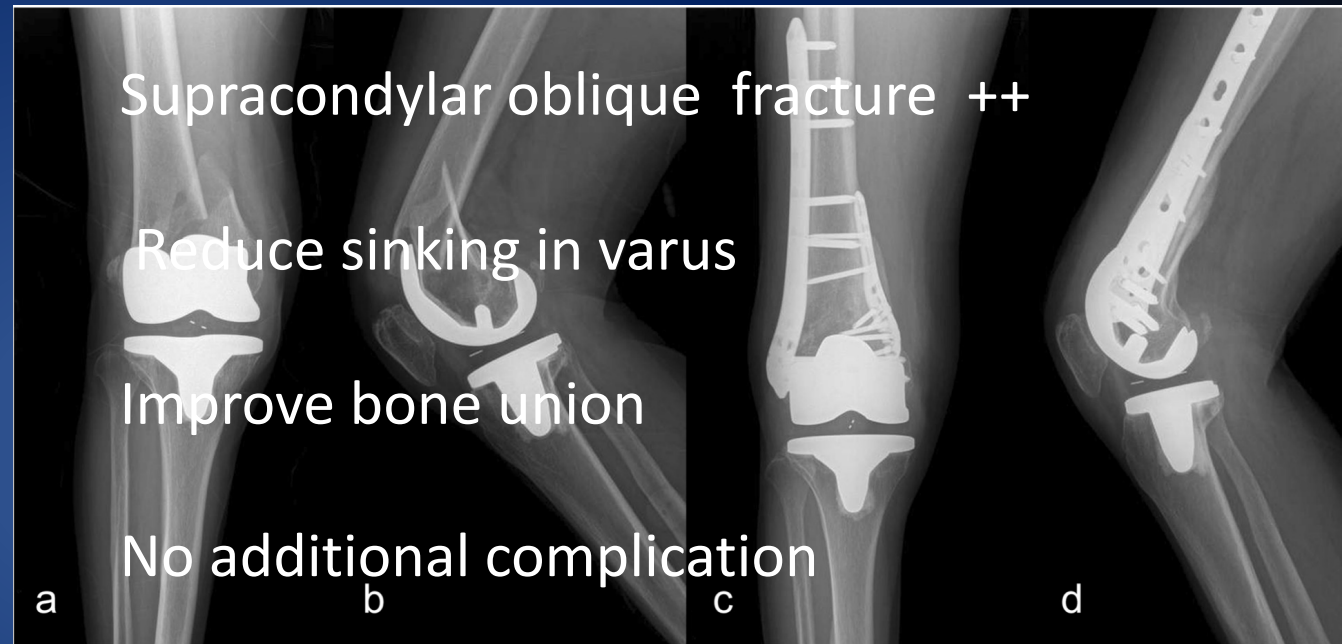
Theod Nicholas F Matlovich¹, Brent A Lanting¹, Edward M Vasarhelyi¹, Douglas D Naudie¹,
Richard W McCalden¹, James L Howard¹



Fe

3
3
Co

Addition of a locked medial plate ?



> J Orthop Surg Res. 2021 Jul 6;16(1):433. doi: 10.1186/s13018-021-02586-0.

Minimally invasive plate osteosynthesis with dual plating for periprosthetic distal femoral fractures following total knee arthroplasty

Yong-Geun Park ^{# 1}, Hyunseong Kang ^{# 1}, Jung-Kook Song ², Jaehwang Lee ¹, Joseph Y Rho ¹, Sungwook Choi ³

Ely L. Steinberg*, Jacov Elis, Yohai Steinberg, Moshe Salai, Tomer Ben-Tov

Orthopaedic Division, Tel-Aviv Sourasky Medical Center, Sackler Faculty of Medicine, Tel-Aviv University, Tel Aviv, Israel

Femur

Mini Invasive System (MIS)

Comparative Study > J Orthop Trauma. 1999 Aug;13(6):401-6.

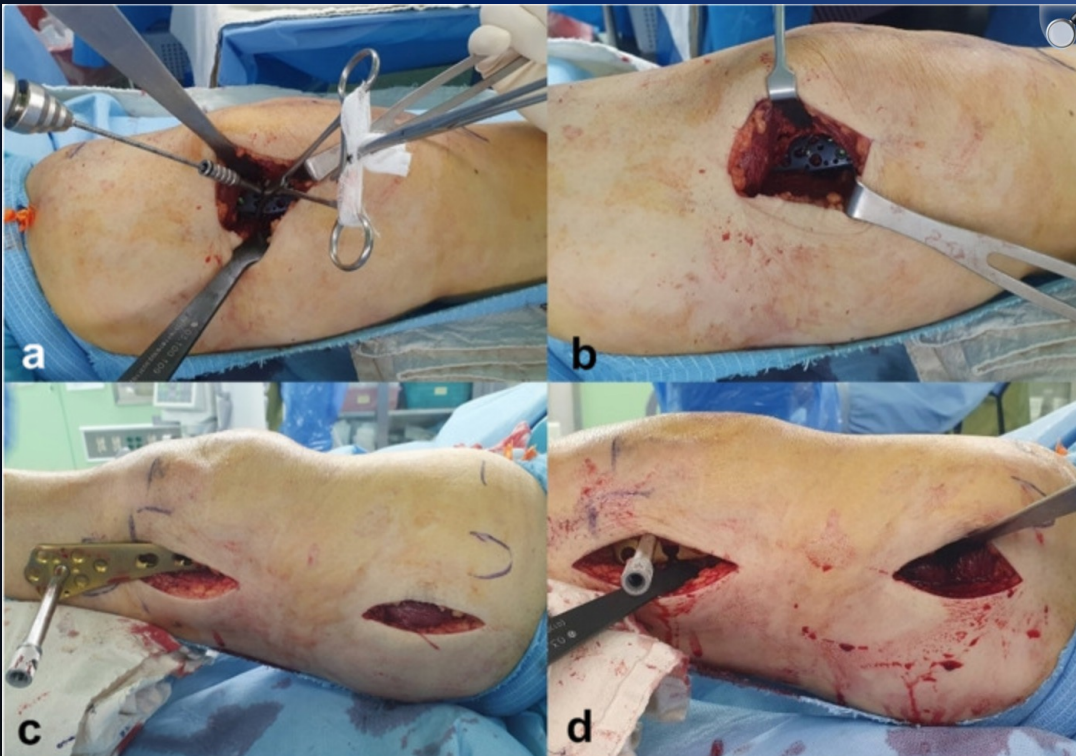
doi: 10.1097/00005131-199908000-00002.

Minimally invasive plate osteosynthesis: does percutaneous plating disrupt femoral blood supply less than the traditional technique?

O Farouk ¹, C Krettek, T Miclau, P Schandelmaier, P Guy, H Tschernke



- Reduce surgical aggression / Complications
 - Bleeding
 - Recovery time
 - Post op pain
- Long plate !!



> Orthop Traumatol Surg Res. 2017 Apr;103(2):263-268. doi: 10.1016/j.otsr.2016.10.007. Epub 2016 Nov 25.

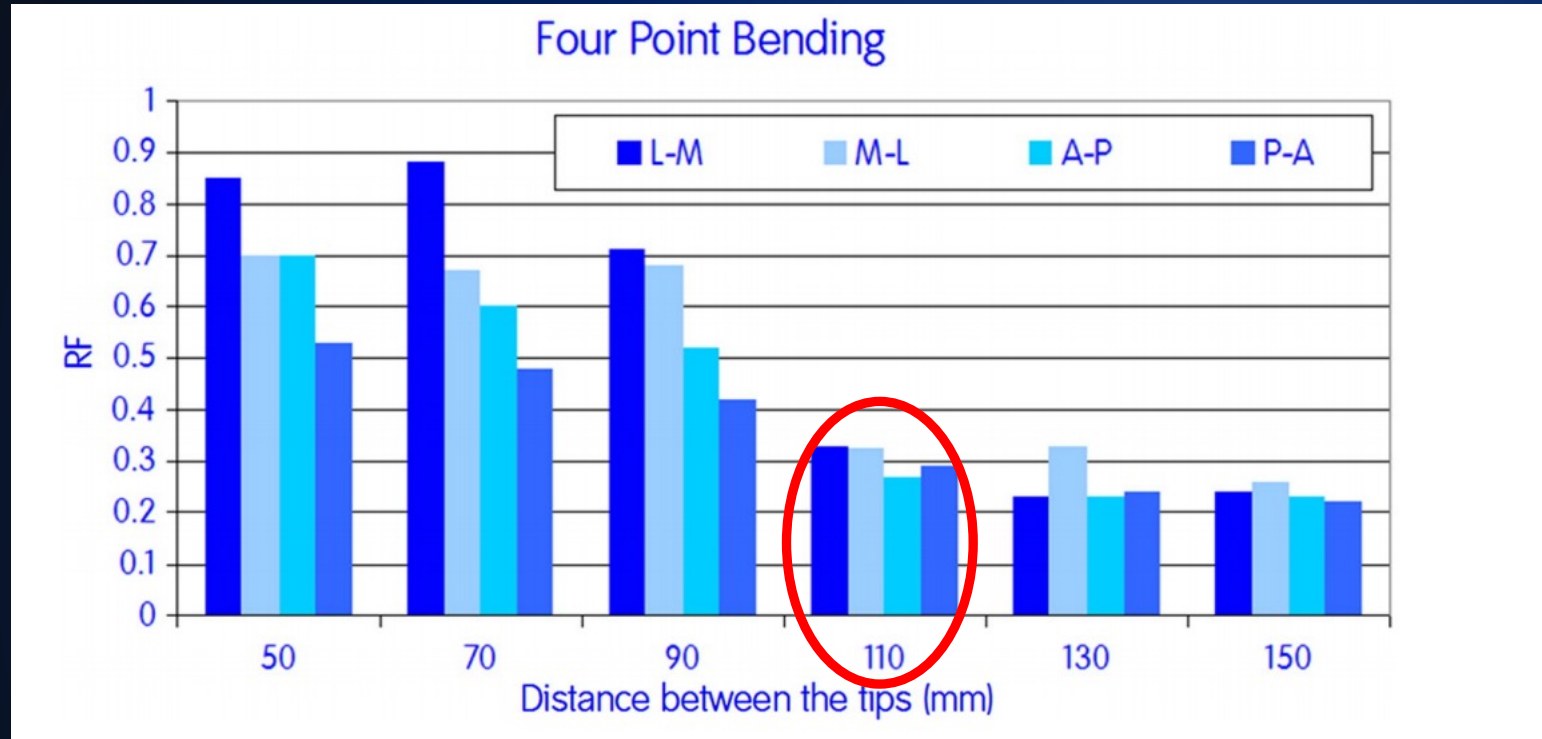
Successful outcome with minimally invasive plate osteosynthesis for periprosthetic tibial fracture after total knee arthroplasty

H-J Kim ¹, K-C Park ², J-W Kim ¹, C-W Oh ³, H-S Kyung ¹, J-K Oh ⁴, K-H Park ¹, S-D Yoon ¹

Minimally invasive plate osteosynthesis with dual plating for periprosthetic distal femoral fractures following total knee arthroplasty

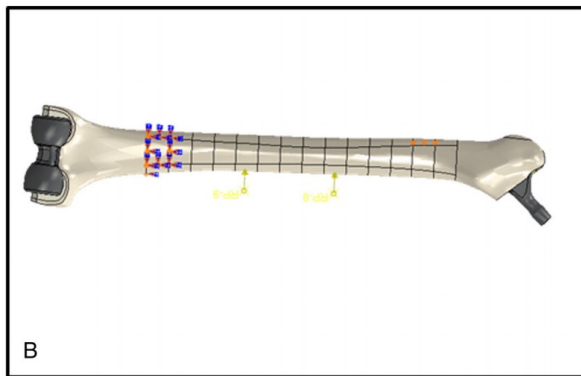
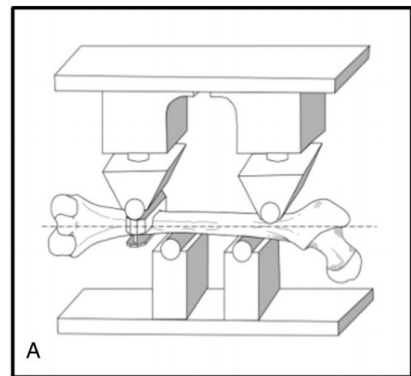
Yong-Geun Park # ¹, Hyunseong Kang # ¹, Jung-Kook Song ², Jaehwang Lee ¹, Joseph Y Rho ¹, Sungwook Choi ³

Inter-prosthetic Fracture



Necessity to bridge the upper implant?

Which remaining distance ?



Comparative Study > [J Arthroplasty](#). 2013 Sep;28(8):1437-45. doi: 10.1016/j.arth.2013.01.010. Epub 2013 Mar 13.

Stemmed TKA in a femur with a total hip arthroplasty: is there a safe distance between the stem tips?

Marc Soenen¹, Matteo Baracchi, Ronny De Corte, Luc Labey, Bernardo Innocenti

Inter-prosthetic Fracture



Femur

Rules for plate fixation:

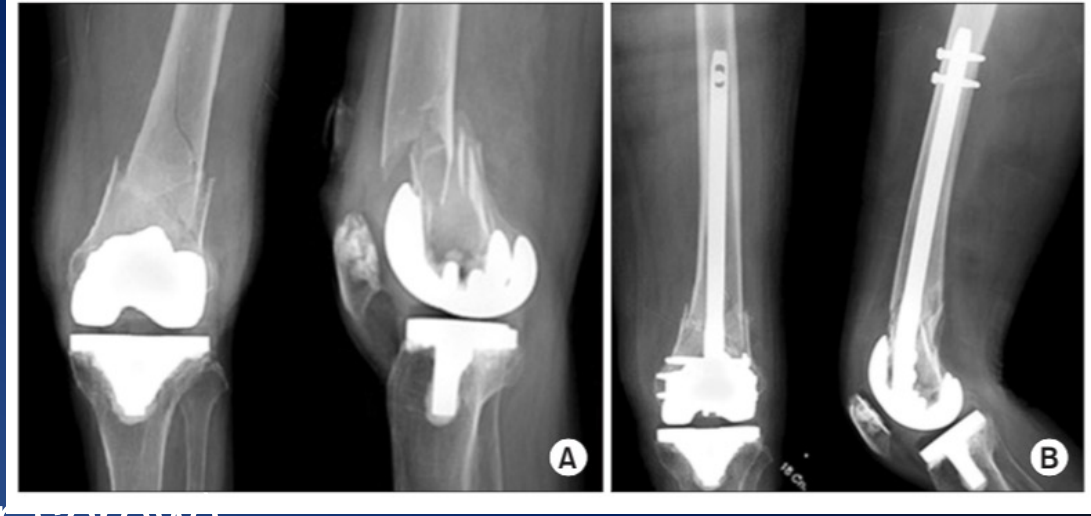
1. Locked plate
2. Offset holes + cerclages
3. Longest plate by MIS
4. Bridge upper implant
5. Screw density
6. Medial plate ?



Femur

Retrograde Nailing

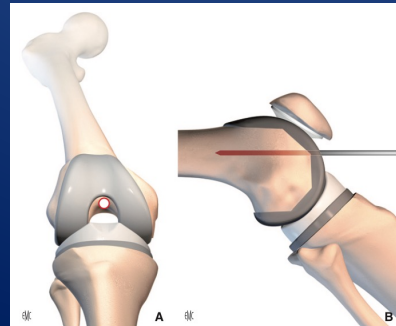
- No opening fracture site
- Longest possible (above isthmus)
- Mal union in hyperextension or valgus (polar screw)



Contra-I : low patella / existing stem / stiffness / narrow medullary cavity / distal fracture or burst / some PS box designs

Requires Operative records TKA

2 locked screws



> [J Orthop Trauma](#). 2013 Mar;27(3):158-61. doi: 10.1097/BOT.0b013e3182629641.

Extension malunion of the femoral component after retrograde nailing: no sequelae at 6 years

Xavier Pelfort ¹, Raúl Torres-Claramunt, Pedro Hinarejos, Joan Leal, Sergi Gil-González, Lluís Puig

> [Orthop Traumatol Surg Res](#). 2017 Apr;103(2):263-268. doi: 10.1016/j.otsr.2016.10.007. Epub 2016 Nov 25.

Successful outcome with minimally invasive plate osteosynthesis for periprosthetic tibial fracture after total knee arthroplasty

H-J Kim ¹, K-C Park ², J-W Kim ¹, C-W Oh ³, H-S Kyung ¹, J-K Oh ⁴, K-H Park ¹, S-D Yoon ¹

Femur

Nailing vs Locked Plate

Review > [Knee Surg Sports Traumatol Arthrosc.](#) 2017 Sep;25(9):2921-2928.
doi: 10.1007/s00167-016-4050-0. Epub 2016 Feb 20.

Similar outcomes of locking compression plating and retrograde intramedullary nailing for periprosthetic supracondylar femoral fractures following total knee arthroplasty: a meta-analysis

[Young-Soo Shin](#)¹, [Hyun-Jung Kim](#)², [Dae-Hee Lee](#)³

> [Injury.](#) 2020 Apr;51(4):1062-1068. doi: 10.1016/j.injury.2020.02.043. Epub 2020 Feb 16.

Equivalent union rates between intramedullary nail and locked plate fixation for distal femur periprosthetic fractures – a systematic review

[Jay K Shah](#)¹, [Patrick Szukics](#)², [Arianna L Gianakos](#)¹, [Frank A Liporace](#)¹, [Richard S Yoon](#)³

Meta-Analysis > [Orthop Traumatol Surg Res.](#) 2023 Sep;109(5):103489.
doi: 10.1016/j.otsr.2022.103489. Epub 2022 Nov 25.

Treatment of supracondylar periprosthetic femoral fractures with retrograde intramedullary nailing versus distal femoral plating: A systematic review and meta-analysis of current evidence

[Rosemary Wall](#)¹, [Farhan Syed](#)², [Mateen Arastu](#)², [Bryan Riemer](#)², [Tarek Boutefnouchet](#)³

> [Sisli Etfal Hastan Tip Bul.](#) 2021 Dec 20;55(4):477-485. doi: 10.14744/SEMB.2021.34270.
eCollection 2021.

Comparison of Two Surgical Techniques for Periprosthetic Supracondylar Femoral Fractures: Minimally Invasive Locking Plate Versus Retrograde Femoral Nails

[Samet Erinc](#)¹, [Necmi Cam](#)¹, [Muharrem Kanar](#)¹, [Haci Mustafa Ozdemir](#)¹

= bone union: **4.5 months**

= similar complication rate : **20-30%**

= Non union rate

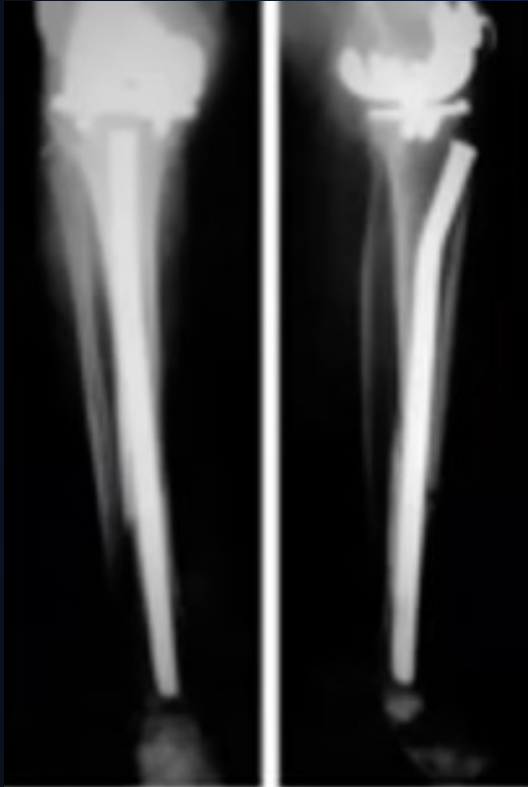
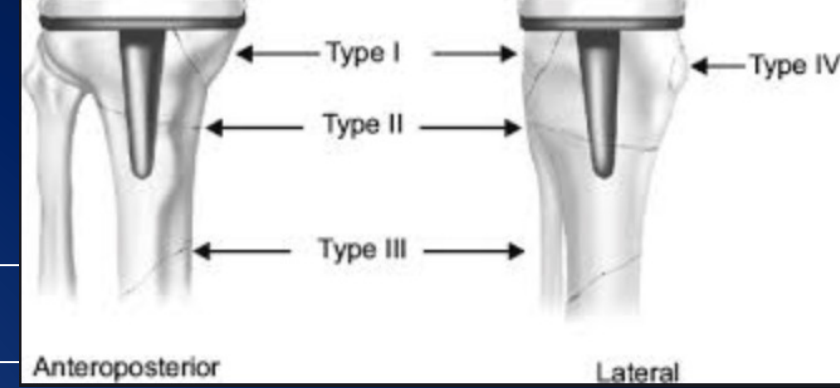
Weight bearing slightly quicker
Nailing > Plate

Mal union/ deformity
Nailing > Plate

Tibia

Indication for fixation ?

Displaced Fracture / Stable Implants



Surgical Treatment

Osteosynthesis

External Fixator

Plates

Nailing

Contra- indications :

- Stems
- Stiffness ($>90^\circ$)

Tibia

Some numbers

Union: 70-100%

Additional surgery rate >30%

Infection rate 25-30%



> [Injury](#). 2019 Apr;50(4):978-982. doi: 10.1016/j.injury.2019.03.014. Epub 2019 Mar 15.

Outcomes of fixation for periprosthetic tibia fractures around and below total knee arthroplasty

Michael P Morwood ¹, Sandra S Gebhart ², Nicholas Zamith ³, Hassan R Mir ⁴

> [J Arthroplasty](#). 2021 Apr;36(4):1429-1436. doi: 10.1016/j.arth.2020.10.035. Epub 2020 Oct 26.

Periprosthetic Tibial Fractures After Total Knee Arthroplasty: Early and Long-Term Clinical Outcomes

Tejbir S Pannu ¹, Jesus M Villa ¹, Eric M Cohen ², Roman A Hayda ², Carlos A Higuera ¹, Matthew E Deren ³

Tibia

Nailing vs Plate

> Orthop Traumatol Surg Res. 2017 Apr;103(2):263-268. doi: 10.1016/j.otsr.2016.10.007.
Epub 2016 Nov 25.

Successful outcome with minimally invasive plate osteosynthesis for periprosthetic tibial fracture after total knee arthroplasty

H-J Kim¹, K-C Park², J-W Kim¹, C-W Oh³, H-S Kyung¹, J-K Oh⁴, K-H Park¹, S-D Yoon¹



- Diaphysal Fracture
- Closed reduction / conservative for fract hematoma
- Quick WB
- CI : *Tibial stem / metaph fracture*

- ***Metaphyso-diaphysal fracture***
- MIS possible
- Delayed weight-bearing
- C-I : *skin lesion*

Conclusion

1. Fracture site ?
2. Implant Fixation ?
3. Bone Stock ?
4. Autonomy ?



1. Non-surgical Treatment
2. Fixation
3. Revision TKA

Specific management



A circular frame with a dark blue background. Inside the circle is a photograph of a modern building with a large sign that reads 'IML' and 'Institut du Mouvement et de l'appareil Locomoteur'. The sign also lists 'Soins', 'Enseignement', 'Recherche', and 'Innovation'. Above the building, several jets fly in formation, leaving blue and red smoke trails against a clear blue sky. The word 'Merci' is written in white text inside a yellow rectangular box in the center of the image.

Merci