

SURGICAL TREATMENT FOR DISTAL FEMORAL FRACTURES - A 2-YEAR RETROSPECTIVE STUDY

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Keywords: distal femoral fractures, Retronail, LISS, NCB

Abstract: Background: The treatment of distal femoral fractures has been associated with a high rate of complications for a long period of time. Although implant and surgical techniques have improved, plate osteosynthesis and intramedullary nailing have been accompanied by a high rate of infection, non-union and malalignment. The gently manipulation of the soft tissue envelopes by using "biological" osteosynthesis and minimally invasive approaches has resulted in a decrease in complications rates and led to the concept of the less invasive stabilization system (LISS). This is an extramedullary-applied internal fixator (locking plate) shaped according to the local anatomy of the distal femur. One of the limits of this system is the fixed-angle position of the locking screws into the plate. In the last years, the poliaxial locking plates had evolved, over passing the inconvenient of the fixed-angle position of the screws. This type of the screw allows also interfragmentary compression across the plate for intercondylar fractures. The purpose of this study was to review the experience and evolution of our practice from intramedullary device to polyaxial locking plates, in the last two years (2010 and 2011). Material and method: In a retrospective consecutive study, 21 patients with 22 distal femoral fractures where treated with: S 2 retrograde nail Stryker (2 patients – 9.1%), LISS Synthes (5 patients – 22.7%) or NCB plate Zimmer (14 patients – 15 fractures – 68.2%). We lost 5 patients after 1 month of follow-up. The medium follow-up for the rest of the patients was 6.2 months. Results: We had no deep wound infection (0%). We had 1 fracture (5.9 %) of the proximal end of the plate (solved with a long Gamma nail) and 2 non-unions (11.75%) which consolidated after the treatment (one solved with a vascularised bone graft fibula and one associated with a plate failure, solved with plate changing and bone grafting). From the functional point of view, 11 patients (64.7%) had a knee flexion greater than 110°, 4 patients (23.5%) had a knee flexion between 90° – 110° and 2 patients (11.8%) had a knee flexion between 75°-90°. The average consolidation time for the 14 non-complicated fractures was 16 weeks. Conclusions: The minimally invasive techniques (intramedullary or paracortical) for distal femoral fractures stabilisation promotes early mobilization and rapid rates of bony and clinical healing, without primary bone grafting and very low rate of infection (in our study 0%).

Cuvinte cheie: fractura femur distal, Tija retrograda, LISS, NCB

Rezumat: Generalități: Tratatamentul fracturilor femurului distal a fost asociat, pentru o lunga perioada de timp, cu o frecventa mare a complicatiilor. Desi materialele de osteosinteza si tehnicile chirurgicale au evoluat, atat osteosinteza cu placa si suruburi cat si osteosinteza centromedulara au fost acompaniate de o incidenta ridicata a infectiei, pseudartrozei si calusului vicios. Manipularea blanda a involisului muscular folosind o tehnica «biologica» de osteosinteza si aborduri miniminvasive au avut ca rezultat o scadere a incidentei complicatiilor si la aparitia conceptului de «less invasive stabilisation system»(LISS). Acesta este un fixator intern aplicat extramedular avand o forma in concordanta cu anatomia locala a femurului distal. Una dintre limitele acestui sistem este pozitia fixa, monoaxiala a suruburilor blocate in placa. In ultimii ani s-au dezvoltat placile poliaxiale cu stabilitate angulara care depasesc acest inconvenient, al pozitiei fixe a suruburilor in placa. Acest nou tip de surub permite si o compresie interfragmentara prin placa pentru fracturile intercondiliene. Scopul acestei lucrari a fost acela de a prezenta experienta si evolutia practicii noastre chirurgicale de la tija centromedulara retrograda la placa poliaxiala cu stabilitate angulara in ultimii doi ani (2010 si 2011). Material: Intr-un studiu retrospectiv consecutiv au fost tratati 21 de pacienti cu 22 de fracturi ale femurului distal, pentru care s-a practicat o osteosinteza cu tija retrograda S 2 Stryker (2 pacienti 9.1%), LISS Synthes (5 pacienti – 22.7%) sau placa NCB Zimmer (14 pacienti – 15 fracturi – 68.2%). Au fost pierduti din urmarire la 1 luna postoperator 5 pacienti. Urmarirea medie postoperatorie pentru restul de 17 pacienti a fost, in medie, de 6.2 luni. Rezultate: nu am avut nicio infectie postoperatorie profunda (0%). Am avut o fractura (5.9%) la partea proximala a placii (rezolvata prin osteosinteza cu tija Gamma lunga) si 2 pseudartroze (11.75%) carea au consolidat dupa tratament adecvat (una dupa grefa cu peroneu vascularizat si cealalta, asociata cu ruptura placii, rezolvata prin schimbarea placii si grefa osoasa

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spongiosa). Din punct de vedere functional, 11 pacienti au avut o flexie a genunchiului mare mare de 110 grade, 4 pacienti (23.5%) au avut o flexie a genunchiului intre 90 si 110 grade iar 2 pacienti (11.8%) au avut o flexie a genunchiului intre 75 si 90 de grade. Timpul mediu de obtinere a consolidarii osoase pentru cele 14 fracturi necomplicate a fost de 16 saptamani. Concluzii: Tehniciile miniminvasive (intramedulare sau paracorticale) favorizeaza mobilizarea postoperatorie rapida si durate scurte de consolidare osoasa radiologica si clinica, fara a fi nevoie de grefa osoasa primara, si cu o rata foarte scazuta de infectie (in studiul nostru 0%).

INTRODUCTION

The treatment of distal femoral fractures in the last decades has evolved from non-operative, conservative treatment to more aggressive, operative treatment. In the mid-1970s, the AO/ASIF (Association for the Study of Internal Fixation) recommended open, anatomical reduction and rigid internal fixation with a blade plate. The aim was to achieve fast bone healing and to allow early, active mobilization of the patient and of the associated joints, thus minimizing the side effects of joint stiffness and severe muscular atrophy encountered in the conservative treatments. This type of fracture management becomes the gold standard in comparison with the conservative treatment. Although the results were encouraging, a significant number of complications of the surgical treatment were encountered: non-union, mal-union, infection, joint stiffness of the knee, intraoperative and postoperative significant blood loss, the need for bone grafting.

In the last years, with the explosive evolution of the technological possibilities, new implants evolved, with better design, better materials and improved instruments.

On the other hand, it was emphasised the necessity of a "biological" osteosynthesis, avoiding wide approaches and periosteal stripping. Direct, open reduction was progressively replaced with indirect, closed reduction techniques, and osteosynthesis techniques and corresponding implants evolved through the "minimal-invasive" techniques.

In a first period of time, the use of retrograde nail was preferred. In the last years, the use of LISS plates, which combines the advantage of an angular stable device with a minimal invasive technique, is increasing. The main critics of the LISS system – monoaxiality of the screws end lack of feedback when tightening the screw seems to be over passed by the poliaxial angular stable plates. For some of these, the screw can be locked in the plate after tightening.

PURPOSE

The purpose of this study was to overview the experience and analyse the evolution of our practice, at St. Luc University Hospital – Orthopaedic and Trauma Department, from intramedullary device to polyaxial locking plates in the last two years (2010 and 2011) for the treatment of distal femoral fractures.

METHODS

In a retrospective consecutive study, 21 patients with 22 distal femoral fractures were reviewed.

Criteria for inclusion in the study were: any distal femoral fracture with or without intra-articular extension or bone loss, closed or open.

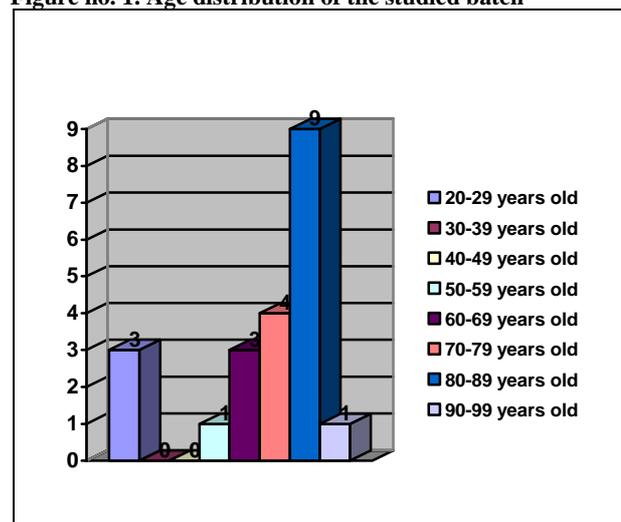
Exclusion criteria were: skeletal immaturity and severe articular comminution not amenable to reconstruction.

Demographic details of the patients, mechanism of injury, associated injuries, type of fracture, open or closed injury, time to union, mal-union, local complications were retrospectively recorded.

The average age of the patients was 70.9 years old (range 21–95 years old).

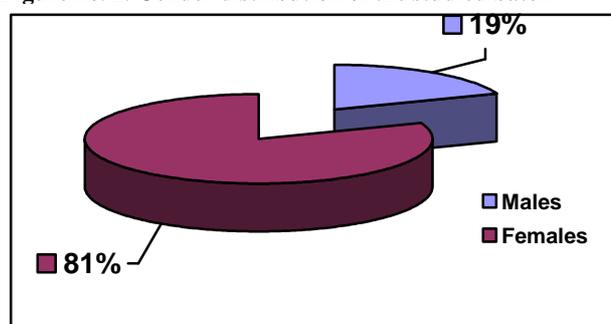
The patients' distribution by group of age is represented in figure no. 1

Figure no. 1. Age distribution of the studied batch



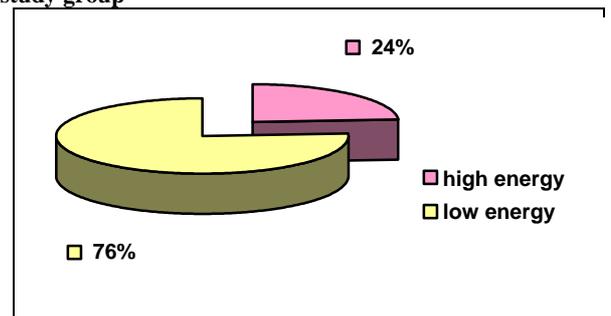
There were 4 males (19%) and 17 females (81%) (figure no. 2).

Figure no. 2. Gender distribution of the studied batch



There were 5 cases of high-energy trauma out of which 2 were open fractures (type III A according to Gustilo and Anderson classification). The rest of 16 patients had low-energy trauma (5 of them in a nursing home) (figure no. 3).

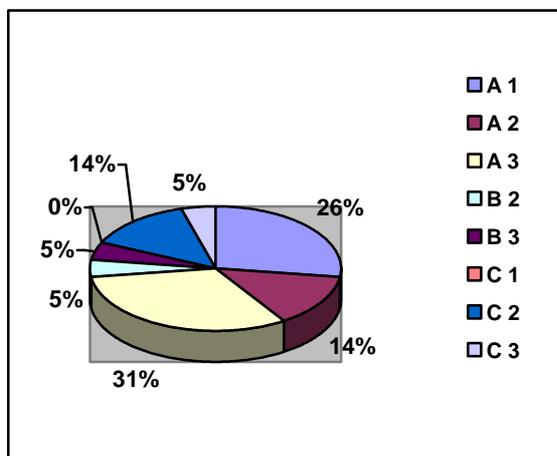
Figure no. 3. High-energy versus low-energy trauma in the study group



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AO fracture classification in the study group (figure no. 4) was as follows: 33A 1 – 6 cases, 33A 2 – 3 cases, 33A 3 – 7 cases, 33B 2 – 1 case, 33B 3 - 1 case (associated with a diaphyseal fracture), 33C 2 – 3 cases, 33C 3 – 1 case.

Figure no. 4. AO fracture classification in the study group



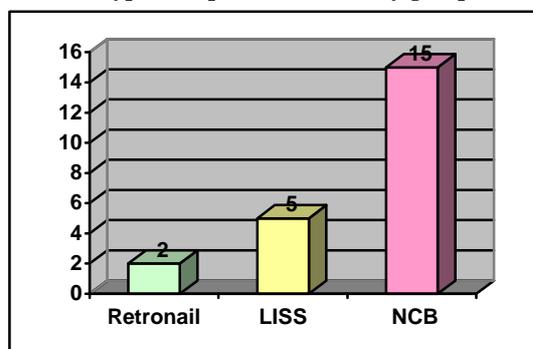
Advanced osteoporosis was observed in 12 patients.

8 from 22 fractures were periprosthetic fractures (1 total hip prosthesis, bipolar hip prosthesis – 2 cases, revision hip prosthesis – 1 case, total knee prosthesis – 2 cases).

We lost 5 patients after one-month of follow-up. The medium follow-up for the rest of the patients was 6.2 months.

The method of fracture fixation was as follows: S 2 retrograde nail Stryker (2 patients – 9.1%), LISS Synthes (5 patients – 22.7%) or NCB plate Zimmer (14 patients – 15 fractures – 68.2%) (figure no. 5)

Figure no. 5. Type of implant used in study group



Retrograde intramedullary nailing of distal femoral fractures is a common technique. The classical indication includes extra-articular fractures of the distal femur (type-A fractures after AO classification) for the patients with a good bone stock.

With the development of new implants and locking options, the indications for the procedure have broadened to include fractures with joint involvement (AO type-C fractures).

On the one hand, these fractures need adapted locking options for the fixation of the distal fragments, whereas, on the other hand, the implants have to be adapted to the needs of the osteoporotic fractures and poor bone stock.

In our practice, we used the S 2 retrograde nail (Stryker), but a better adapted implant for the treatment of the distal femoral fractures is the T2 supracondylar nail (Stryker).

Recently, the biomechanical superiority of this nail over others was confirmed. To minimize the operative mistakes

and complications, it is important to clearly understand and employ accurate surgical technique when using this implant (figure no. 6)

Figure no. 6. Distal femoral fracture (AO – 33 A-1) - stabilisation with retronail. Preop X-rays and postop X-rays at 4 months



The LISS plate (Synthes) represented a revolutionary step forward in the treatment of distal femoral fractures. It was designed to be used with minimally invasive approaches and indirect reduction techniques, with the aim to preserving the local biology around the fracture site. Designed as an “internal” fixator, the plate stands off the bone.

This way, it is not crushing the periosteum and thereby, in theory, blood supply is preserving. The proximal end of the plate is shaped to allow the easy submuscular insertion, with less dissection than the traditional implants.

There are seven distal screw holes, designed to receive convergent locking screws. The plate/screw combination is acting as a fixed angle device, very resistant to pull out. The screws are inserted through an aiming device, allowing an percutaneous insertion (figure no. 7).

Figure no. 7. Distal femoral fracture (AO – 33 A-3) stabilisation with LISS plate. Preop X-rays and postop X-rays at 3 ½ months



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Figure no. 7. Distal femoral fracture (AO – 33 A-3) stabilisation with LISS plate. Preop X-rays and postop X-rays at 3 ½ months



The Zimmer NCB (Non Contact Bridging) plating system for distal femur is a locking plate system which offers the surgeon a variety of options during surgery. We can use the system through an open, classical approach, but MIS guides also allow also a percutaneous targeting of screws (figure no.8, figure no. 9).

Figure no. 8. Periprosthetic distal femoral fracture (AO – 33 A-3), stable implant. Preop X-rays



The radiolucent guide allows inserting the plates in a MIPO technique manner, to help reducing stripping and damaging the soft tissues and enhancing the healing process, like for LISS plate. Diaphyseal screws are angled at 8° in an alternating pattern to resist pull-out and to reduce stress-risers.

In the Distal Femur MIS Guide, the metaphyseal screws are allowed 30° of freedom, where needed.

The NCB Screw is secured with a locking cap that allows for a range of 0°–15° off-centre, or a 30° cone of polyaxiality, which is particularly interesting when we want to “stay away” from certain regions, or we want to “target” specific areas or fragments.

Cortical and cancellous screws can be used in traditional methods—lagging fragments or preventing rotation, which is also interesting, because of the tightening sensation the surgeon likes to have. These screws can be locked immediately after insertion, after other screws have been inserted, or not at all, as needed. With the ability to lock the construct after all screws have been inserted (and not “during” the screw insertion, like for the traditional LCP), screw directions can be adjusted intraoperatively without having to “unlock” the construct.

Different spacers are available (1mm, 2mm, and 3mm) to be used during the procedure, to hold the plate off the bone. When the plate is locked, the spacers are removed and the hole

construct acts like an internal fixator, with all well known advantages (reduces the potential for periosteal damage and periosteum blood supply impairment).

Figure no. 9. Periprosthetic distal femoral fracture (AO – 33 A-3), stable implant. Postop X-rays at 6 months



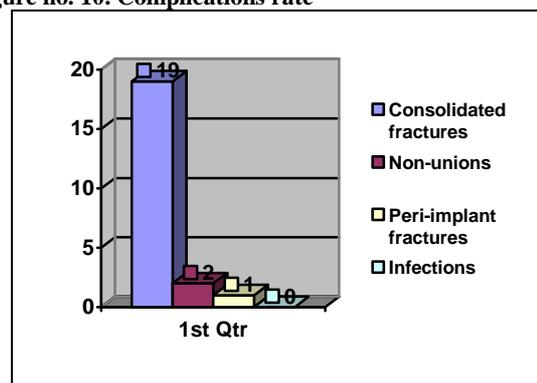
RESULTS

The average consolidation time for the 14 non-complicated fractures was 16 weeks.

From the functional point of view, 11 patients (64.7%) had a knee flexion greater than 110°, 4 patients (23.5%) had a knee flexion between 90° – 110° and 2 patients (11.8%) had a knee flexion between 75°-90°.

We had no superficial or deep wound infection (0%) (figure no. 10). No mal-union was recorded. We had 1 fracture (5.9 %) of the proximal end of the plate (solved with a long Gamma nail) and 2 non-unions (11.75%) which consolidated after the treatment (one solved with a vascularised bone graft fibula, and one associated with a plate failure, solved with plate changing and bone grafting).

Figure no. 10. Complications rate



CONCLUSIONS

The minimally invasive techniques (intramedullary or paracortical) for distal femoral fractures stabilisation promotes early mobilisation and rapid rates of bony and clinical healing, without primary bone grafting and very low rate of infection (0% in our study).

The actual trend for the treatment of the distal femoral fractures is to use, more and more the polyaxial angular stable plates, which we have observed in our practice to. But the surgical indications for the intramedullary nailing and plating are not overlapping. The retronail is useful for type 33 – A (extraarticular) fractures and 33 – C 1 (simple articular)

fractures with a good bone stock. Plate osteosynthesis finds a good indication mainly for the articular fractures – type 33 – C 1,2,3 in the AO Classification and in the presence of severe osteoporosis.

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