

IN-DEPTH ORAL PRESENTATIONS

HIP ARTHROPLASTY REVISION 1

Preoperative planning for femoral and acetabular revision hip arthroplasty

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Preoperative planning for revision hip arthroplasty is different form and more complex than planning for primary hip replacement. The surgeon has to keep in mind a variety of issues, including existing implants, techniques of removal implant, bone quality, evidence of infection, soft tissue healing, neurovascular injuries, leg-length discrepancy. A special equipment, implants or bone graft required should be anticipated. Revision of a femoral stem and acetabular component can be a complex and technically demanding procedure due to poor bone stock, periprosthetic fracture, infection and complexities in cement or removal implant. It is mandatory to have clear management strategies with a variety of techniques available. Surgical intervention should be performed only when there is clear evidence of loosening or sepsis. Exploratory procedures without documentation of loosening or sepsis are rarely productive. In aseptic cases with no evidence of loosening, observation is prudent and not harmful.

Acetabular revision with reinforcement ring: clinical results

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In this analysis we retrospectively evaluated the outcome of Muller acetabular ring as a method for implant revision. This kind of device has been used in case of serious bone loss (grade III or IV); in order to classify the acetabular bone loss we referred to the guide lines proposed by the *Associazione Italiana di Ripotesizzazione* (Pipino 2000); this classification considers that the acetabulum must be surrounded by stable bony walls and that the center of rotation must be similar to the physiological one. There are four different degrees of bone loss, the Muller ring is used in the setting of III grade of bone loss characterized by widening and deformity of the cup associated to

loss of two or more walls and fundus. The acetabulum cannot mechanically contain the cup and the whole biomechanics of the hip is altered.

The advantage of this classification has the worth to typify the degree of acetabular bone loss relating it to surgical strategy.

Muller's ring strengthens the load-bearing part of the hip joint, it is fixed by 3–5 screws without cement. The stability of the implant is assured through different optional techniques such as allograft bone chips, platelet gel (platelet rich plasma PRP) and growth factors (osteogenic proteins OP, bone morphogenetic proteins BMPs, transforming growth factors).

Between 1994 and 2006 we have performed 91 acetabular revisions using Muller's ring, the evaluation has been made using Harris Hip Score. The result has been: 1 bad (H.H.S. < 70), 12 satisfying (H.H.S. among 70–80), 16 good results (H.H.S. inclusive among 80–90) and 9 excellent cases (H.H.S. > 90).

The serious acetabular defects have three surgical needs: anatomical, mechanical and biological, with the purpose to restore the centre of rotation of the hip, to assure a primary stability of the implant and to reconstitute the bony patrimony through the use of bony grafts. The use of the rings of reinforcement is shown effective in restoring the geometric constants of the hip and in furnishing a suitable protection to the bony grafts up to their complete incorporation into the bone. The Muller's ring offers a good function of support, especially in the defects of the superior portion of the acetabulum and it is possible to use mini-invasive surgery techniques.

The use of growth factors or bone morfogenic recombinant proteins (BMPs) together to the bony graft is able to accelerate the integration of the graft reducing the risks related to the interface bone-graft that influences for a long time in conclusive way the result term.

Intrapelvic migration of acetabular cups. Clinical experience and strategies of prosthetic revision

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Introduction Intrapelvic migration of acetabular cups is uncommon in hip prosthesis loosening. Pelvic discontinuity and proximity of prosthetic implants to iliac neuro-vascular axis are often observed. In most cases non-conventional prosthetic revision strategies are required after a careful preoperative planning. In this study we discuss the surgical issues related to this specific condition and report our clinical experience in a series of ten patients treated at our institution.

Material and methods Starting from 2000 to 2008, 10 out of 191 patients who underwent hip prosthesis revision for acetabular component loosening presented with intrapelvic migration of the acetabular cup. The study group included 9 women and 1 man and the mean age was 64 years old (range 29–82 years). The migrated component was a primary implanted cup in 5 cases and a revision cup in 5 cases. The acetabular bone defect was grade IV in 8 cases and III in 2 cases according to the GIR classification. In 5 cases an inguinal approach has been used to identify and protect the intrapelvic neurovascular iliac axis before acetabular cup removal and implant revision. In 8 cases the acetabular reconstruction was performed with reconstructive rings (6 Burch-Schneider, 1 Ganz, 1 Mueller) and morcellised bone allograft. In 1 case we used a stemmed acetabular cup (McMinn) and morcellised bone allograft. In 1 case with massive hemipelvic bone defect the reconstruction has been performed in two stages by means of a structural acetabular bone allograft and a constrained cemented cup. Clinical results have been evaluated with the Merle d'Aubigné hip score.

Results The patients underwent periodical controls and the mean time of follow-up was 4.5 years (range 1–8 years). In 9 out of 10 acetabular implants the cup was stable and the radiographs did not show signs of bone graft failure. One patient sustained successfully a revision with a constrained acetabular cup for recurrent hip dislocation. A periprosthetic infection (*E. Coli*) was observed in 1 patient with rheumatoid arthritis and treated with early debridement and prolonged antibiotic therapy. As for functional results, 5 patients walked with crutch and 5 without support. A light or moderate residual pain was present in 2 patients and severe pain was never reported.

Discussion Before hip revision for intrapelvic dislocation of the prosthetic cup every patient should be carefully investigated in order to select the most appropriate surgical treatment. The additional inguinal approach is required when preoperative studies show the loosened cup in proximity to the neuro-vascular iliac and femoral axis. In most patients the acetabular reconstruction can be performed with reconstructive rings which by-pass the bone defect and protect bone graft allowing the insertion of cemented polyethylene cups.

included types IIIA (26 cases) and IIIB (35 cases) according to Paprosky classification. Surgical procedure included filling periprosthetic bone defects with massive allografts supported with a Burch-Schneider APC. A polyethylene socket was cemented into the metal cage. Ambulation was allowed 1 week after surgery, but weight bearing was delayed 2 months. Average follow-up was 12.9 years (range 10–17.9 years). Clinical assessment was performed using Harris Hip Score (HHS). X-ray examination evaluated the signs of instability of the cage and the progression of the bone graft. Failures were considered revision of the acetabular component for any cause, migration or loosening of the acetabular construct, and severe resorption of bone graft.

Results Two patients underwent resection-arthroplasty for deep infection. In 11 cases, an extensive resorption of bone graft was followed by loosening of the acetabular cage, requiring re-revision in 6. The breakage of the socket occurred in 2 hips, related to a marked wear of the polyethylene cup, and 1 of them already was operated on using the same procedure. X-ray signs of graft incorporation were observed in 46 hips. Average HHS increased from 34 points preoperatively to 77 points at the time of follow-up. The cumulative survival rate of the acetabular construct was 75.4% at an average of 12.9 years.

Discussion In massive acetabular bone loss, the application of reinforcement devices combined with structural allografts has been advocated in order to prevent early bone graft resorption and cup loosening. Burch-Schneider APC proved out to protect the graft spanning the defects and promoting augmentation of periprosthetic bone stock [3].

Conclusions The use of APC and massive allografts resulted an effective procedure in the long-term reconstructive treatment of severe acetabular bone deficiencies.

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HIP ARTHROPLASTY REVISION 2

Reconstruction of periprosthetic acetabular bone loss with Burch-Schneider Anti-Protrusion Cage and massive allografts

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Objective Filling acetabular bone defects with structural allografts resulted in early failure because of the resorption of the graft. The application in combination with reinforcement devices already provided successful midterm outcomes [1, 2]. Long-term results in the reconstructive treatment of acetabular osteolysis using massive allografts supported with a Burch-Schneider Anti-Protrusion Cage (APC) are reported.

Material and methods From January 1992 to December 1998, 98 total hip replacements (THR) underwent acetabular revision with use of APC. Thirty-five patients (2 bilateral implants) died for unrelated causes, with a well-functioning THR in situ. The group under examination consisted of 61 hips in 60 patients, 18 males and 42 females, aged from 29 to 83 years (median, 61 years). Bone loss

Outcome of isolated acetabular revisions in total hip arthroplasty

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Introduction The acetabular component of a total hip arthroplasty has a higher rate of early aseptic loosening than the femoral component in the survivorship curve of hip replacement registries. With a well fixed femoral stem the indication for isolated revision of the loose acetabular component is controversial: retention of femoral stem leads to a tissue sparing surgery for bone and soft tissues and may be beneficial for survival of the whole implant; on the other hand it can create problems in the correct exposure of acetabulum and in restoring correct hip offset. The purpose of this study is to report mid-term results of isolated revisions of acetabular component in total hip arthroplasty and to analyse the fate of the unrevised femoral stem.

Material and methods Thirty patients who underwent isolated revision acetabuloplasty without removal of a well-fixed femoral component between 1997 and 2002 were evaluated prospectively. Patients mean age was 70.6 years. The loosed acetabular components were in 12 cases cemented and in 18 cases cementless. Out of 30 femoral components, 13 were cemented and 17 were cementless. All femoral components had a modular femoral head with a morse taper. In 16 cases the acetabular reconstruction was made with reinforcement ring and cemented polyethylene cup. In 14 cases a cementless oblong cup was implanted. For filling bone defects morselized allograft was used in 20 cases. The average duration of follow-up from the index revision was 8.5 years (min 6, max 11 years).

Results Postoperative complications were: one case of dislocation and one case of femoral nerve palsy. Clinical results with Harris Hip Score were satisfactory in 65% of patients with an improvement from a mean of 46 points before the revision to a mean of 90.4 points at 1 year follow-up. Acetabular components were judged radiographically stable in 26 cases and in 4 cases of reinforcement ring (13%) we classified as probable loosened because of the presence of progressive lines. At the last follow-up seventeen (100%) of the primary cementless femoral components were judged stable. Four of the 13 cemented femoral stems showed developing radiolucent lines at the bone-cement interface.

Conclusions The data obtained by the present study show good mid-term results of isolated acetabular revision in cases with loose acetabular components and well fixed femoral component. The femoral components can be retained without adversely affecting the acetabular exposure and reconstruction surgery. Isolated revision of the acetabulum is a surgical technique particularly useful in elderly patients because of a reduced operation time and limited blood loss.

Prevention of luxation in THA with dual mobility cups. A 18-year follow-up

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Objective The aim of this study is to communicate the results in prevent luxation in THA in elderly, neuromuscular diseases, etc. with dual mobility cups. The concept of dual articulation was proposed by Prof. Gilles Bousquet in France in 1976. The rationale is to increase joint stability while reducing component wear. The implant consist of a metal shell with a mobile polyethylene acetabular liner (first articulation) and the femoral head is captive in the liner (second articulation). This implant gives high stability minimize loosening forces with high range of motion. This acetabular cup system high force for dislocation of the cup and luxation is very exceptional.

Material and methods In our Department of Orthopedics and Traumatology in Rimini this cup was applied from 1991 to December 2009 in 775 implants. The indications were fracture of the femur neck (82%) and arthrosis of the hip (18%) in patients with neuromuscular disorders or brain degenerative diseases over 65 years. In particular from 1991 to 2001 were applied 547 cups (first group). From 2001 to December 2008 were applied 228 cups (second group).

Results The results of first group were deduced by analysis of Hospital record players and by a questionnaire sent to Patients at home. Only 18 cups were replaced in this series and the results of the test send home was positive in most case high. But this is not a scientific

method and is too subjective. We wanted to analyze the survival of cups of the second group with a safe and serious method and we requested to know the results of survival THA at Register of our country (RIPO Emilia Romagna) that is active from 2001 (RIPO Emilia Romagna is a Register that, like Swedish register, collects all Implants – hip, knee, shoulder – in our region). Therefore the data are quite serious and perfectly controlled junction with the DRG system from the regional and Italian national health system. These data are controlled and cannot be altered and we want to communicate the results of the survival of these prostheses. Thus we have data that document the survival of 228 cups inserted from 2001 to 2008. The cups removed are four on 228 implants: 1 for fracture of the bottom cup and 3 for aseptic loosening with a survival rate of 8 years equal to 98.6 percent above the regional average for other cups which equal to 97.5%. The best result is due to the fact that we have never had to remove the cups for recurrent dislocations. Only three cups were replaced for aseptic loosening and this is a good performance at 8 years and the low rate of loosening replacements in this series shows a low production of polyethylene debris, a sign that double articulation reduces debris.

Discussion and conclusions We wish to communicate this positive experience that we believe is particularly good in luxation prevention in arthrosis and fracture of neck femur in elderly patients with neuromuscular disorders or lack of cooperation due to dementia or other degenerative neurological diseases.

Suggested readings

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HIP ARTHROPLASTY REVISION 3

Microstructural analysis of failed cemented femoral stems revision in hip arthroplasty

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Objective Fatigue fracture of the femoral component of total hip arthroplasty is a rare complication [1]. The reported incidence of stem fractures range from 0.23 to 11% [2]. Microstructural analysis after removal of these implants are reported in a few papers. This study aims to investigate metallurgical factors that lead to two different mechanical failure of cemented revision femoral stem in hip arthroplasty.

Material and methods Two cemented revision femoral stems after two different mechanical failure, fatigue fracture and bending deformation, were referred to the Department of Chemistry of the Politecnico of Milan for investigation. Each component was examined macroscopically to assess for mechanical damage. Stereomicroscopy, SEM, spectrometry and microhardness tests were performed.

Results Large grain size, above 100 micron of diameter, and less microhardness tests were found in stem with the bendig deformation

due to a low rate of annealing of the steel. Uniform and fine grain size was found in the stem with the fatigue fracture, but this stem had a small diameter that caused the rupture.

Discussion Several factors are involved in failure of the femoral stem in hip arthroplasty. Our results suggest that the types of failure of the stem are related to the microstructural features of the steel besides the diameter of the stem. The bending deformation in particular was due to a low rate of annealing of the steel.

Conclusions In hip revision surgery, the femoral component of the prosthesis is always subjected to high stress of load due to anatomical situation of the femur so therefore microstructural features of the implants should be warrant a greater safety margin and allow a longer survival.

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Revision hip arthroplasty with stemmed cup

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Introduction The iliac stemmed cup guarantees immediate primary stability, even in the presence of important acetabular deficiencies. A stemmed cup can be employed together with bone grafts to increase the bone mass, in order to ensure a long-lasting implant. Primary stability allows incorporation process of bone grafts by protecting them from mechanical solicitations.

Material and methods The McMinn stemmed cup is suitable for those cases where a press-fit cup implant is not feasible (due to osteolytic defect of acetabular walls) without resorting to additional surgical acts aimed to guarantee primary stability (screws), or to cages. From June 2000 until December 2006, at the Department of Orthopaedics and Traumatology, S. Maria del Prato Hospital (Feltre, BL), we implanted 154 McMinn stemmed cup, of which 118 were used in revision hip arthroplasty. We observed 90 patients (118 total, 8 patients died in the meantime): 26 male, 64 female, avg. age: 71.8 ± 6.6 aa. Mean postoperative control: 44.3 months; G.I.R. 1: none; G.I.R. 2: 21 cases; G.I.R. 3: 50 cases; G.I.R. 4: 19 cases.

Results Patients have been evaluated before and after surgical operation using the Harris Hip Score. Statistical significance of results has been evaluated using the Student *t* test and the Wilcoxon test. The preoperative mean of the Harris Hip Score was 37.7; the postoperative mean of the Harris Hip Score was 70.8 (Student *t* test $p < 0.0001$, Wilcoxon test $p < 0.0001$). Excellent–good: 42 (46.6%); Fair: 25 (27.7%); Poor: 13 (14.4%); Failed: 10 (11.1%). Complications: 1 TVP, 1 temporary femoral nerve palsy.

Conclusions The McMinn stemmed cup can be useful to deal with complex clinical cases where, due to different reasons, it is necessary to cope with a serious bone defect, roof insufficiency, acetabular deformity. It allows to achieve an effective primary stability without

resorting to additional means of bone fixation. The primary stability accrued is sufficient to ensure the incorporation process of bone grafts and allows to apply an immediate load in the post-operative period. Because of the short follow-up, the results we have obtained would require further investigation. However, it is certainly interesting to observe that 74.3% of patients were satisfied with the results.

HIP ARTHROPLASTY REVISION 4

Revision of septic hip prosthesis: difficulties and solutions

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Main challenges of septic hip prosthesis revision are:

1. Bone loss
2. High dislocation risk
3. Infection recurrence
4. Implant long term fixation

In the last years every one of these problems has been addressed and solutions proposed. In our practice, the following options have shown to improve the results:

1. Bone loss may be efficiently overcome, at the femoral level, through the use of long stem preformed antibiotic-loaded interval spacers and, at revision, through long stem, modular non cemented prosthesis, with or without bone grafts and growth factors (platelet rich plasma); bone loss in the acetabulum requires the knowledge and availability of revision prosthesis for large bone defects reconstruction.
2. Dislocation risk may be effectively reduced by the use of modular stems, that allow intra-operative choice of the offset, and by using large diameter femoral balls;
3. Overall infection recurrence may be reduced to less than 5%, through accurate two-stage revision surgery and targeted antibiotic treatment. However, compromise hosts still present a high risk of infection recurrence. All of the patient with infection recurrence, in our experience, were B-hosts. Changing B-host to A-host will be the work of the next decades. At the moment host's type represent the strongest factor for infection recurrence.
4. Implant long term fixation with uncemented prosthesis is remarkable good, in our experience, with only aseptic femoral loosening in 130 patients at a follow-up ranging from 1 to 8 years.

In conclusion, septic hip revision surgery still represents a major challenge for the orthopaedic surgeon and the patients. New technological advances and better knowledge of the failure risk factors allowed to significantly improve our result in the last decade. However costs associated with this difficult surgery are elevated and higher than those calculated for aseptic revision procedures, while reimbursement of the Italian health care system remain the same for septic and aseptic procedures. This condition may induce care providers to reduce the offer of the highest standard solutions today available to these unfortunate patients.

Preliminary report on the use of modular resection femoral stem in the revision of infected hip prosthesis with large femoral bone defect

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Introduction In case of massive bone defect, femoral stem revision may cause significant problems to the orthopaedic surgeons. The periprosthetic infection introduces a further element of complication which often leads to complex surgical strategies. The aim of this study was to assess the preliminary results of femoral revision with modular resection femoral stems in a selected group of patients with infected total hip arthroplasty and extensive bone defect (Paprosky grade III-B).

Material and methods The study group included five patients (three women, two men) with an average age of 72 year-old (range 62–81 years). From 2006 to 2008 the patients underwent a prosthetic femoral revision with resection modular stems to treat a septic loosened primary hip prosthesis (one case) or revision hip prosthesis (four cases). The bacteria responsible for the infection were Meticillin Resistant *Staphylococcus epidermidis* (MRSE) in three cases, Meticillin Sensible *Staphylococcus epidermidis* (MSSE) and *Streptococcus Agalactie* in one case, *Proteus Mirabilis* in one case. Three patients were treated in election for septic loosening of hip implant and two were admitted in our Department as emergency for a periprosthetic femoral fracture (Duncan type B3). In all the patients the femoral bone defect was grade III-B according to Paprosky classification of femoral bone deficiency. One patient with periprosthetic femoral fracture underwent a one-stage prosthetic revision and four patients sustained a two-stage prosthetic revision. In one patient a local flap was performed and Vacuum Assisted Therapy was applied in order to treat an associated loss of substance. The patients underwent periodical clinical controls in which the result has been evaluated by means of Merle-d'Aubigné hip score.

Results The follow-up period ranged from 10 to 28 months. We observed one case of recurrence of infection in the patient treated with a one-stage revision. At present, we did not observe signs of infection in the remaining four patients who underwent a two-stage revision. As for functional result, four patients walked with supports and one without them. No patient referred moderate or severe residual pain. One patient sustained with success a revision with application of a constrained acetabular cup because of a recurrent dislocation of the previously revised hip implant.

Discussion and conclusions The preservation of bone stock is one of the most important goals in prosthetic revision procedures. In some circumstances the amount of femoral bone loss can be so wide to prevent the application of conventional or modular uncemented femoral stems. In these selected cases cemented modular resection femoral stems may represent the only available option for femoral reconstruction. In our clinical experience this solution offered altogether successful outcomes. In our opinion two-stage revision is the preferable surgical choice.

Two-stage reimplantation for knee peri-prosthetic infections. Use of articulated spacers

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Introduction Infection is one of the most devastating complications in total knee replacement. Treatment of a patient with periprosthetic knee infection requires often costly and prolonged hospital stays, weeks or months of antibiotic therapy, and multiple surgical procedures. Despite the use of systemic antibiotic prophylaxis, strict hygienic protocols, and special sterile enclosure with laminar flow, the infection rate in primary total knee replacement is between 1 and 3% [1]. The optimal outcome of the knee periprosthetic infection treatment, is represented by restoration of a painless and well functioning joint, and eradication of the infection.

Use of spacers The first stage involves irrigation and debridement of all necrotic and infected tissues, complete synovectomy, and removal of all components and cement. Intraoperative cultures have to be performed from synovial fluid and membrane, and at polyethylene-implant, cement-implant and bone-cement interfaces. Successively, an impregnated-antibiotic cement spacer is positioned into joint.

Articulated spacers The impregnated-antibiotic cement spacers allow to maintain joint space and keep the collateral ligaments from becoming contracted. Moreover, the cement spacers deliver high-dose local antibiotics to the knee in concentrations greater than could be achieved with intravenous administration. Articulated spacers allow both weight bearing and motion during the antibiotic therapy, so avoiding stiffness of the knee and osteopenia, without compromising the eradication of infection. The reimplantation procedure is facilitated by decreased quadriceps scarring, maintenance of collateral ligament integrity, and preserved bone stock [2].

Revision In general, intravenous antibiotics, appropriate to the infecting organisms, are administered for 6–12 weeks, followed by a second stage implantation of a permanent revision prosthesis fixed with antibiotic-impregnated cement. It is widely recognized that knee revisions represent more complex procedures than primary replacement, with less successful results and a higher rate of complications [3].

Conclusions This strategy of using antibiotic-impregnated cement spacers and intravenous antibiotics with delayed exchange arthroplasty, has been considered state-of-the-art in cases of infected total knee replacement and has reported success rates of 88–96% in eradicating infection [2].

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KNEE ARTHROPLASTY REVISION I

Hydroxyapatite and microporotic surface in total knee replacement with rotating platform: a prospective randomised study

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Objective Many current total knee implants derive from two principal categories: anatomic and conforming design; in either the choice between cemented and press-fit is controversial. The clinical results with one design can not be readily extrapolated to a different design. Thus, we performed this prospective randomised study in order to compare in the same prosthetic design the clinical-radiographic results at a follow-up of 4 years of a cemented versus a press-fit total knee arthroplasty (GKS Prime[®] system, Permedica, Merate, Como, Italy).

Material and methods One hundred consecutive osteoarthritis with varus knee which should be replaced using total knee arthroplasty (36 men, mean age 68.2; 64 women, mean age 70.1) and were randomised into two groups: (A) completely cemented (46 knees) and (B) completely press-fit (54 knees). They were well matched and no patient was lost during follow-up. All the operations were performed by three surgical equipe from 2000 to 2004. Clinical and radiographical evaluation was performed by Knee Society Score (KSS), TKA Scoring System, pre-operatively and at 6, 24, 48 months of follow-up. Visual Analogical Score (VAS) and patient satisfaction (expressed in 5 levels) were also considered at 12 and 48 month. Statistical analysis was performed by Student *t* test for unpaired data.

Results No case of infection was observed. Relief from pain, correction of deformity, stability and function were comparable in both groups: KSS was 92 (84–100) in group A and 95 (88–100) in group B; this difference was not statistically significant ($p > 0.05$). The mean of knee flexion was 116° in either group. The mean of level of satisfaction was 3.8 in either group. Some radiolucencies were observed at the tibial medial site in 1, 2, 3 and 5 zones (by TKA Scoring System), 8% of cases in group A, but none was awaiting revision for loosening at 4 years follow-up.

Conclusions By clinical and radiographic results, we cannot support a clear advantage between the cemented or press-fit in our protesic model at 4 years of follow-up. The great satisfaction and knee flexion of patients lead us to prefer this model (rotating platform) of artroprothesis in varus knee with osteoarthritis, but it is indifferent to use cemented or porotic surface with hydroxyapatite (press-fit), by results of the short follow-up. Up to date a study with a longer follow-up is performed to define wear and mobilisation of prosthetic components in the same patients.

Retained versus resected posterior cruciate ligament in total knee arthroplasty: a prospective randomised study

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Objective Many current total knee implants derive from two principal categories: anatomic and conforming design; in either the

choice between retaining or resection of posterior cruciate ligament (PCL) is controversial. The clinical results with one design can not be readily extrapolated to a different design. Thus, we performed this prospective randomised study in order to compare in the same prosthetic design the clinical-radiographic results at a follow-up of four years of a retained vs a resected posterior cruciate ligament total knee arthroplasty (GKS Prime[®] system, Permedica, Merate, Como, Italy).

Material and methods One hundred consecutive osteoarthritis with varus knee which should be replaced using cemented total knee arthroplasty (23 men, mean age 70.1; 77 women, mean age 72.0) and were randomised into two groups: A) retained PCL (41 knees) and B) completely resected PCL (59 knees). They were well matched and no patient was lost during follow-up. All the operations were performed by two surgical equipe from 2000 to 2004. Clinical and radiographical evaluation was performed by the Knee Society Score (KSS), TKA Scoring System pre-operatively and at 6, 24, 48 months of follow-up. Visual Analogical Score (VAS) and patient satisfaction (expressed in 5 levels) were also considered at 12 and 48 month. Statistical analysis was performed by Student *t*-test for unpaired data.

Results No case of infection was observed. Relief from pain, correction of deformity, stability and function were comparable in both groups: KSS was 94 (83–100) in group A and 97 (86–100) in group B; this difference was not statistically significant ($p > 0.05$). The mean of knee flexion was 109° in group A and 119° in group B; this difference was statistically significant ($p < 0.01$). The mean of level of satisfaction was 3.5 in group A and 4.1 in group B; this difference was statistically significant ($p < 0.01$). Some radiolucencies were observed at the tibial medial site in 1, 2, 3 and 5 zones (by TKA Scoring System), 8% of cases in both groups; no differences between groups, but none was awaiting revision for loosening at 4 years follow-up.

Conclusions By clinical and radiographic results, we cannot support a clear advantage between the retaining or resection of PCL in our protesic model. The greater satisfaction and knee flexion of patients belonging group B, associated with a better articular cleaning during surgery, lead us to prefer the resection of PCL. Up to date a study with a longer follow-up is performed to define wear and mobilisation of prosthetic components in the same patients.

Total knee arthroplasty with constrained endo-model prosthesis: ten-years follow-up clinical results

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In this study we retrospectively evaluated the short-, mid- and long-term functional and clinical outcomes of a series of patients treated with the constrained Endo-Model prosthesis, either for primary TKA or revision (TKR). Indications for primary implants were serious valgus deformity (60%), severe joint instability (33.3%) and collateral ligamentous deficiency (6.6%).

In case of revision we have followed these indications: infections after primary implants (30.8%), aseptic loosening (38.5%), implant failure (23.1%) and periprosthetic fracture (7.8%).

Between 1997 and 2009 we implanted 101 Endo-Model prosthesis (97 patients) at our institution, of which 66 primary implants and 35 revisions. A total of 69 patients were lost during follow-up or died for

unrelated causes. At the time of this study we could evaluate 28 patients (14 primary and 14 revision TKAs). Clinical and radiological evaluations of the Endo-Model prosthesis were performed at latest follow-up. We referred to the Knee Society Rating System in order to assess the postoperative clinical and functional outcome: data were collected and statistically analyzed.

During follow-up period, two patients reported failure of the device (one for mechanical complications and one for infection) and underwent explantation. The average postoperative *knee score* in the evaluated series was 94.3 (95.8 for primary and 92.2 for revision TKAs). 54.2% of patients had excellent clinical results, with a range of motion major of 111° in flexion and complete extension. No signs of joint instability or misalignment were noted. Pain was absent at rest, and present in a minority of the patients during walking (18%) or ascending/descending stairs (29%), but always at a mild/occasional extent. Majority of patients walks autonomously or with the aid of a single cane in the domestic setting (80.8%) and outside (76.9%). No evidence of loosening or implant failure has been reported at the radiographic control.

Reported overall results are good or excellent in both the groups of primary implanted and TKR patients, without statistically significant differences. The Endo-Model prosthesis provides excellent pain relief, restoration of walking capacity and intrinsic knee stability both in complex primary and in TKR.

Knee revision: evaluation of bone loss and the implant choice

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Revision total knee arthroplasty presents several complex challenges to the adult reconstructive surgeon, including management of bone loss and ligamentous insufficiency. Bone loss patterns can be anatomically categorized and the surgical treatment can be algorithmically approached based on the bone loss pattern. Bone loss is managed usually with bone grafts and prosthetic augmentation. The options for repairing bone deficiency include cement fill with the support of screws, implants with modular augments, custom components, structural allograft, impaction grafting and metallic augments as trabecular metal.

Structural allograft and impaction grafting are reproducible methods for managing the tibial bone loss. Intramedullary stems in revision cases are necessary to offload the excessive stress on the distal femur and proximal tibia to diaphyseal bone. Moreover, stems increase the surface area for implant fixation and help ensure restoration of optimal implant alignment.

Computer assisted revision of failed UKR

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Introduction Computer assisted surgery has been developed to help surgeon in reconstructive procedure in improving implants alignment

and performances and in literature it has been different already demonstrated its efficacy in traditionally knee replacement surgery. Nevertheless very few studies have analysed its results in revision of failed TKR and none of failed UKR. The Authors reviewed their experience in using computer assisted surgery in revision of failed UKR. They hypothesized that navigation helps in preserving both bone stock and soft tissues in a real tissue sparing surgery with less invasive implants and lower costs.

Material and methods Among 603 computer assisted knee replacements performed since 1999, 42 cases were revisions of UKR for aseptic failures. The reason of failure were: uncorrect indications, implant failures, uncorrect surgical techniques and unexplainable painful implants. In all the cases intra-operatively a CT-free computer assisted navigation system was used to address the bone cuts, soft tissue balancing implants and limb alignment. The Authors matched 16 patients according to diagnosis and grade of bone loss to a similar group performed using a conventional technique to point out any significant difference in implants used, surgical time, limb alignment, restoration of the joint line and hospital costs.

Results This matched-paired study demonstrated a different implant distribution with an higher percentage of PS and CCK implants in the conventional group. Likewise the adoption of augmentations, stems and offsets was clearly more frequent in the conventional group. There were no statistical differences in the post-operative mechanical axis but with a significant lower number of outliers in the computer assisted group. Between the 2 groups there were no statistical differences in surgical time and hospital staying. There was a statistical significant difference in blood transfusion for each patient with a higher rate in the conventional group. The cost analysis demonstrated an higher cost (about 300 euros more) in the conventional UKR revision group

Conclusions In this study the Authors demonstrated better aligned implants, lower use of “invasive” implants with no constrained implant and blood savings using navigation to assist revision of failed UKR. The costs were cheaper using a computer assisted techniques. These results underline how computer assisted surgery helps the surgeon in overcome the difficulties using traditional alignment systems in high demanding cases. Improved results can also overcome higher costs cause of systems purchasing.

Knee revision in haemophilia

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Total knee arthroplasty in haemophilic arthropathy has been shown to be effective in reducing both pain and tendency to bleed, resulting in a dramatically improvement of function and quality of life in this group of patients.

The use of a new-generation implant, advanced and more aggressive hematological care, combined with the decline of HIV epidemic has resulted in a lower rate of complications and better functional results.

It is undisputed nowadays that haemophilic arthropathy could requires a modular total knee implant with stems, wedges and augmentations to address all the bony abnormalities. Revision implants are required as primary implants in case of bone loss, risk of instability, severe muscle atrophy and chronic dysfunction of the extensor mechanism. However the use of hinged knee prosthesis as primary implant is not always

necessary, especially in young patients like haemophilic patients and the use of cemented stems must be avoided whenever possible.

The major complications are infection, restricted range of motion and cutaneous problems. Revision procedure in these patients is a technically demanding procedure due to bone loss, altered anatomy, soft tissue fibrosis and flexion contracture.

The causes of revision are mainly severe osteolysis and septic loosening. Where severe osteolysis happens we used mesenchymal stem cells coupled with biological scaffolds which guide the cells during repair and regeneration of the tissue. To enhance bone repair and osteointegration of the implants

This technique results in the filling of bone defects and secondary stability of the implants. The clinical result is good especially in young patient who probably will need further surgery.

Infection of total knee replacement is considered a devastating complication especially in haemophilic patient. In this case we recently performed the one stage revision using cancellous allograft bone impregnated with antibiotics.

We addressed osseous defect in this case with allograft bone impregnated with high levels of antibiotics and it act as a carrier providing to sustained high local concentration. The high cost of the prophylactic treatment with bolus infusion of concentrates in haemophilic patients and the good clinical result of this procedure justify our choice.

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Revision surgery after total knee replacement in haemophilic patients

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Introduction Revising a total knee replacement (TKR) is a challenging surgery considering the lack of bone stock, ligamentous instability, stiffness and tissues necrosis.

Methods Clinical data on 17 revision surgeries (10 deep infections, 7 aseptic loosening) performed at a single Centre in 15 patients with haemophilia A or B (3 with inhibitors) were reviewed. The Hospital for Special Surgery knee-rating score (HSS), data on knee flexion contracture and range of motion were collected before, after surgery and during a short-mid-term follow-up.

Results The median duration of follow-up for revision surgery is 35 months (range: 14–140). One patient died 15 months after surgery for causes unrelated to TKR. The two-stages exchange technique was used in all cases of deep infections. In 4 cases a total knee replacement had been reimplanted, in 3 cases an arthrodesis was performed. For the persistence of infection, 3 cases needed resection arthroplasty. Three deep infections and 1 aseptic loosening of the revised implant occurred after a median of 18 and 84 months, respectively. In all these cases a re-revision was performed.

Conclusions Our results show that knee revision arthroplasty is often complicated with infections. The higher risk of post-surgical infection in haemophiliacs could be correlated to the prolonged post-operative bleeding and the presence of chronic infections.

ORAL COMMUNICATIONS

SESSION 1

The fracture-dislocations of the elbow: articular reconstruction and stabilization with external fixator

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Objective This work wish to demonstrate that the treatment of fracture-dislocations of the elbow should achieve 2 objectives: adequate stability and early mobilization to prevent stiffness. Latest medical literature recognizes three types of instability: postero-lateral rotatory instability, postero-medial and posterior direct. In this report we study the different types of instability with its lesion models, anatomical details, diagnosis e imaging diagnosis indications and type of surgical treatment.

Material and methods From January 2006 to January 2009 we treated 14 cases of fracture-dislocation of the elbow. A combination of different techniques were used, such as the radial head prosthesis, reconstruction of coronoid process with anchors and/or screws, ligaments reconstruction or sutures, olecranon ORIF and external fixation.

Results The results were generally satisfactory, in 11 cases we obtained higher or similar ROM like Morrey functional arc, in 1 case there was a sufficient recovery ROM with just few degrees under Morrey functional arc, in 1 case there was an important stiffness, while in 1 case there was a failure with residual postero-lateral rotatory instability along with subchondral stiffness.

Discussion Because of the recent increase in road traumas, fracture dislocation of the elbow are observed with greater frequency. The fracture-dislocation of the elbow injuries are extremely complex; the results are often unsatisfactory and the treatment is difficult. It is important to identify the damaged structures and rebuild them in precise sequence, which varies depending on the type of instability using various surgical technics.

Conclusions Clinical and imaging investigation is fundamental in order to have a right surgical planning. The clinical examination must be improved on an accurate imaging investigation: it should be well-typed the lesion and the type of instability, to plan the adequate reconstruction of the primary stabilizing. The clinical examination should be performed even in narcosis to understand the direction of residual instability. The X-ray standard, performed before and after the reduction, must often be supplemented by CT. At the end of the treatment, range of motion of joints, although not complete, it must be at least within a defined functional arc that allows the performance of normal daily activities, and identified by Morrey in 30°–130° of flexion–extension and 50°–50° to prone-supination.

Complex tibial plateau and lower tibial fractures treated with hybrid external fixation

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This paper presents our experience in the treatment of complex fractures of the tibial plateau and of the lower tibia with hybrid external fixation.

We operated 16 patients, 10 with fractures of the tibial plateau and 6 with fractures of the lower tibia. All the fractures were pluri-fragmentary and in many cases there were lesions of the soft tissues. In all the cases we applied hybrid external fixation, formed by a semi-circular ring with 3 or 4 Kirschner wires plus pins with single-axial fixation, sometimes associated with a synthesis with trans-cutaneous screws. In a case of lower tibia, we used a device with 2 semi-circles of which the upper one had pins. We allowed early joint mobilization and total loading was allowed after 50–60 days. The fractures healed and the fixation devices were removed on average between 5 and 10 months.

Fracture reduction and the reconstruction of the joint surface were excellent in 10 cases, good in 4 and fair in 3. In 4 cases the results were unsatisfactory because of the onset of complications: in one case there was an infection; one patient with rheumatoid arthritis suffered another fracture after the fixation device was removed; in one patient there was a delay in consolidation (the device was removed after 10 months and there was a new fracture with varus deviation and so we had to resort to further corrective surgery and a synthesis with a plate; finally, in another patient in dialysis with severe kidney problems, who had an exposed fracture, there was a delay in consolidation.

The association of soft tissue lesions can compromise the results since it has been shown that in dislocated and complex fractures of the upper and lower leg, usually caused by high energy trauma, there is a direct correlation between soft tissue lesions and delayed healing. In cases in which the soft tissues are involved and the fractures are particularly fragmentary, the use of hybrid axial external fixation has proved a useful alternative to synthesis with plates, even if it does not always allow a perfect reconstruction of the joint surface.

Tibial plafond fractures: our experience using percutaneous distal tibial LCP plates with limited incision reduction

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Objective Distal tibial fracture is a complex injury which continue to challenge orthopaedic surgeons in achieving anatomic reduction, while allowing early weight bearing and return to activity. The purpose of this study was to evaluate the outcome of limited incision reduction with percutaneous fixation.

Material and methods This retrospective study was based on a series of 50 patients who were operated on from January 2005 to December 2008 for distal tibial fractures. All the fractures were classified using the AO/ASIF classification. There were 24 type B, 15 type A, and 11 type C. We considered the following inclusion criteria: adult patients (>18 years) who were operated on from January 2005 to December 2008 for distal tibial fractures. All the fractures were classified using the AO/ASIF classification. There were 11 type C, 24 type B and 15 type A. We considered the following inclusion criteria: adult patients (>18 years), closed fractures, T-Scherne. Exclusion criteria were: previous distal tibial fractures or deformities, politrauma (but not patients with more fractures) closed fracture. Exclusion criteria were: previous distal tibial fractures or deformities; politrauma (but not patients with more fractures). 20 patients were female and 30 were male. Average age was 41 years old. The mean follow-up was 26 months (8–48). For pre-operative evaluation ankle and leg anterior-posterior and lateral view X-ray was performed as well as in many cases

a CT with tridimensional reconstruction. All the patients included in this study underwent a unique and definitive treatment using percutaneous distal tibial LCP plates with limited incision reduction. This treatment was in some cases combined with initial fibula fixation, which aided in re-establishing length and alignment. The time of fixation was 5–12 days from injury. Clinical outcomes were evaluated according to the AOFAS score, time to union and ROM. Ankle and leg anterior-posterior and lateral view X-ray was performed at 4 weeks, 6 months and 12 months postoperatively and at the last follow-up.

Results All the fractures union without cases of primary malpositioning or secondary loss of reduction. Union was achieved completely in all patients. The union time average was 23 weeks. AOFAS average value was 91 ± 10.6 points out at final follow-up with a good range of motion (the final ankle dorsal flexion average value was 13° and the plantar flexion average value was 38°). Ankle and leg anterior-posterior and lateral view X-ray was performed at 4 weeks, 3, 6 months and 12 months postoperatively and at the last follow-up

Discussion Treatment of fractures of the distal tibia is challenging. This type of plates provide greater angular stability, better biomechanical properties and the limited incision reduction and the percutaneous technique reduced the risk of soft tissue complications. Due to these advantages, early post operatively rehabilitation is possible with an improvement of functional outcome.

Conclusions These results indicated that limited incision reduction and percutaneous plate fixation in selected cases gave very satisfactory results. Clinical and radiological results are promising with good range of motion.

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2. Dunbar RP, Barei DP (2008) Early limited internal fixation of diaphyseal extensions in select pilon fractures: upgrading AO/OTA type C fractures to AO/OTA type B. *J Orthop Trauma* 22(6):426–429
3. Tarkin IS, Clare MP (2008) An update on the management of high-energy pilon fractures. *Injury* 39(2):142–54

Fractures of distal radius in association with scaphoid fracture: diagnosis and treatment

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Combined fractures of distal radius and scaphoid are uncommon. The injury is often the result of high-energy trauma, as a motor vehicle accident or as a fall from a height. The distal radial fracture are not so difficult to be diagnosed, but the scaphoid fracture can be missed, leading to a delay in diagnosis and adequate treatment.

During the period 2002–2007 we treated 28 cases of simultaneous fractures of radius and scaphoid. We treated the radial fracture with plate or external fixation and the scaphoid fracture with percutaneous screw fixation or K-wire pinning. Early mobilization of the wrist is very important. All the patients were evaluated for wrist range of motion, radiographic healing, residual pain and return to work status. The healing of the radial and scaphoid fractures depends on the early diagnosis and the best choose of treatment.

Suggested readings

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2. Smith JT et al (1988) Simultaneous fractures of the distal radius and scaphoid. *J Trauma* 28(5):676–679

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Treatment of lateral femoral neck fractures with Trigen Intertan nail: our experience

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The incidence of lateral femoral neck fractures has increased significantly, in parallel with life expectancy of the general population. Among the various systems of bone fixation, the antegrade intertrochanteric nail Trigen Intertan (Smith-Nephew, Memphis, TN) represents a valuable system for the treatment of the lateral femoral neck fractures. This system offers anatomically shaped trapezoidal implants as opposed to conventional circular shaped intramedullary nails and an integrated interlocking screw option to increase stability and resistance to intraoperative and postoperative femoral head rotation.

Between June 2007 and September 2008, 33 patients (28 women, 5 men) with a lateral femoral neck fracture were treated with Trigen Intertan. All fractures were classified using the Kyle-Gustilo classification: 25 patients had stable fractures (type II) and 8 patients had unstable fractures (5 type III and 3 type IV). The mean age of the patients was 82.8 years (range 61–95 years); 32% were in ASA III and 63% were in ASA IV class. The mean operative time was 35 minutes. No intraoperative or postoperative complication occurred. One patient died in 7th postoperative day. All patients were allowed full weight bearing on the affected extremity 3–10 postoperative days. Clinic and radiographic healing occurred after about 3 months (10–14 weeks). At radiographic evaluation neither loss of reduction, nor femur neck collapse, pseudoarthrosis, failure of the implant was found. All patients were able to perform activities of daily living. At 12 months follow-up functional levels were examined with the Bartel Index.

The antegrade intertrochanteric nail Trigen Intertan for lateral femoral neck fractures treatment provided good results in the present series. It supplies rotational stability and maintenance of compression at the fracture site, thus reducing pseudoarthrosis and loss of reduction development. Furthermore this nail gives a clinic-radiographic fracture healing, a good functional recovery and a lower incidence of complications. This device is particularly performing in those patients whose comorbidities prevent them from more invasive surgical treatments.

SESSION 2

Treatment of subtrochanteric fracture with LISS or LCP DF “reverse”

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Ten subtrochanteric fractures in 10 patients, mean age 63.4 years (range 19–92 years), were treated between 2006 and 2008 with

locking plates with angular stability. There were 6 female and 4 male patients. 7 fractures were recent: according to the Seinsheimer classification, 4 fractures were type V, 1 was type IIIa, 1 type IIb, 1 type IIc; 4 patients were affected by severe osteoporosis.

Fractures were not recent in 3 patients: 1 case of pseudoarthrosis, 1 case of loss of synthesis in patient treated with cervical-trochanteric nail and 1 patient treated with temporary external fixator (damage control in severe polytrauma).

All patients were treated with LISS plates with angular stability or LCP DF “reverse” plates (reversing the contralateral femoral distal plate). We performed MIPO technique in all recent fractures and in the patient initially treated with external fixator, in association with a massive bone cortical implant in the case of pseudoarthrosis.

All fractures healed; we observed no infections or loss of osteosynthesis.

In conclusion, with cervical-intramedullary nailing being the best procedure, locking plates with angular stability are indicated for the treatment of selected cases:

- Proximal fractures with extension toward the great tuberosity, in which intramedullary nails may not guarantee a good control of the varus, with risk of hyatrogenic loss of reduction of the fracture.
- Fractures in osteoporotic patients, in which angular stability and MIPO technique may afford high mechanical stability and low invasivity.
- Mechanical obstacles performing the nailing procedure (narrow medullary canal, prosthesis, etc.).
- Pseudoarthrosis or severe loss of postoperative reduction in patients treated with intramedullary nailing.

Percutaneous trans-ileo-sacral screws in the unstable pelvic injuries

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Total unstable pelvic injuries are caused by major trauma. Therefore, patients who are injured often involved in other districts or bodies. The stabilization and treatment of the sick is the result of a work team involving several specialists. Orthopedic surgeon’s task is to ensure the stabilization of the skeleton. Total unstable pelvic injuries characterized by the break of the complex joint and ligament sacro-iliac back, require, like other segments, the stabilization in emergency. There are various way available: the simple restraints, traction, the C-clamp, the external fixation, orif.

The percutaneous trans-ileus-sacral- screws is a technique to stabilize mini-invasive surgery of the sacro-iliac dislocations and sacral fractures. It is not easy to carry, especially in obese subjects, anatomical variations in the sacrum (sacralization fifth lumbar vertebra) and in the hands of the not experienced surgeon. The technique in fact provides for the introduction of one or two screws directed into the body of S1, driving under x-ray in the three projections of Pennal. The main difficulty lies in finding the only corridor available for their bone smooth harm adjacent structures: the cauda equina in the sacral canal, the root L5 laterally to the sacral promontory, the root of S1 output from the first sacral foramen. Our survey includes 18 cases of percutaneous screwing together or not at the symphysis stabilization or reinforcement plate back to the sacrum.

Four were executed in association with external fixation in emergency room. The results show a consolidation 12 cases, 4 cases have still pain in the posterior sacro-iliac region, 2 cases are of recent performance and show no major problems so far. Of the 4 cases with pain, two had other associated injuries consisting of acetabular and iliac fractures and two are being studied to assess the residual stability of the complex sacro-iliac rear. We believe this is a relatively quick and non invasive method, which allows early verticalisation and particularly allow a final stabilization of those injuries that otherwise treated, would encounter a pseudoarthrosis or chronic instability

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The nonunion of the tibial plateau: radiographic aspects and treatment

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Objective The nonunion of the tibial plateau is a rare complication of the fractures of the proximal region of the tibia. The purpose of this study is to analyze the useful radiographic aspects for an early diagnosis and the results of the surgical treatment precociously effected.

Methods In the case histories of 93 patients affected by articular multifragmentary fracture of the tibia we found 11 cases of nonunion. Nine of them within the fifth month have again been operated for the treatment of the nonunion.

Results We found similar radiographic characteristics in all the patients. The posteromedial region of the tibial plateau was interested in the nonunion because of the reduction or insufficient synthesis of this fragment. The surgical treatment consisted in the early removal of the synthesis and in the reduction of the articular posteromedial region. In seven cases, an autogenous bone graft has been associated with the synthesis with screws. At the end of the treatment the clinical evolution varied from a middle score of 34,714 to 72 (Lysholm-II Knee Score).

Discussion The increase of the tibial plate pseudoarthrosis incidence, as shown in our casuistry, is probably also due to technical-diagnostic reasons. It was only in the last decade that the topographic studies and the 3D reconstructions enabled to describe this pathology more precisely. The essential requirements for the treatment of the tibial plate pseudoarthrosis are the same as for all the articular fractures. In the pseudoarthrosis there must be a stable and anatomical fragment synthesis, in order to grant joint motion as soon as possible, and to minimize the cartilaginous degeneration. The reduction also avoids the penetration of the sinovial fluid in the cancellous bone, that would hinder the consolidation by scattering the ossification factors. Therefore an insufficient reduction exposes the patient to a recurrence, even if it is associated to a bone graft.

Conclusions In the context of an articular multifragmentary fracture, an early identification of a portion of the tibial plateau in nonunion, can be effected through a radiographic examination and CT. The interested

region is the posteromedial one. The surgical intervention of revision of the synthesis allows to restore the articular morphology, the functional recovery and it avoids the rapid degeneration of the articulation.

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SESSION 3

Treatment of femoral shaft fractures with trochanteric nails

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Introduction Intramedullary nailing through the piriformis fossa is the standard for the treatment of femoral shaft fractures (FSF). Proper identification of the piriformis fossa can be difficult in obese or muscular patients, especially when supine on a traction table, leading to severe complications. Recently the use of anatomic nails inserted through the great trochanter has gained popularity. We present our experience with two trochanteric nails for the treatment of FSF.

Material and methods Between 2005 and 2008 we treated 71 patients with trochanteric nails for FSF. The Long PFN and the SIRUS nail were used according to the surgeon preference. The intraoperative complications were registered. Patients were followed-up monthly until consolidation with attention to the consolidation time and the quality of reduction.

Results All fractures but one healed within 6 months. One bifocal fracture did not unite (SIRUS) and needed a second operation to heal. There were 3 iatrogenic fractures of the great trochanter (LPFN) that needed no further intervention. In 3 cases (LPFN) the longest nail available failed to control a short distal fragment leading to malalignment in one case and needing an antirotational plate in the other two.

Conclusions The use of trochanteric nails is a valid and safe option for the treatment of femoral shaft fractures. We believe that the use of nails specifically designed for the purpose can help the surgeon to minimise the complications especially when dealing with distal fractures.

Treatment of distal femoral fractures with LCP-DF plates

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Recently the treatment of distal femoral fracture obtained many big steps forward its better resolution.

Last 20-year-experience showed the surgical treatment as the gold standard, but now we get a further step: we tried to solve this clinical problem with a mini invasive technique, with new plates and new surgical procedures preserving as much as possible soft tissues around the fracture.

Aim of this study is to explain our three-year-old experience of distal femoral fractures by LCP-DF plates.

Resurfacing prosthesis of the tibiotarsal joint (mobility)

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Objective The total ankle arthroplasty is conditioned by the difficulties of obtaining a stable and small sized implant on the talus. The failures of this type of prosthesis are in fact mainly due to the difficulties of the bone to bear the prosthesis (talar-prosthetic subsidence) in addition to the usual problems related to the prosthesis implant such as stiffness, lack of stability and excessive wear. The third generation prosthesis (B.OX., Eclipse, and Mobility) seem to have solved these inconveniences. We present the preliminary results concerning the “Mobility” (De Puy) prosthesis we are using as from July 2008.

Material and methods Such prosthesis is made by three components, unconstrained, and cementless. The talar component resurfaces only the superior dome of the talus, without violating the native medial and lateral aspects of the talar dome. The tibial component has an extensive surface with a metaphyseal conical stem. Its implant requires the opening of an anterior window on the bone. The polyethylene component allows variable joint ligament strengths. The indications for the implant of the “Mobility” are: (a) non severe talar degeneration; (b) sufficient residual range of motion; (c) absence of tibial and calcaneal deformities; (d) absence of instability. We have performed seven implants, three on patients with primary arthrosis, and four cases on post-traumatic arthrosis. The mean age is 56 years (min 44, max 73). The weight bearing has been promptly allowed with a cast and crutches until the 60th day. The active articular recovery has begun after the 15th day.

Results All patients experienced an immediate relief from pain and were able to walk freely within 2 months from surgery. The radiographic evaluation criteria for the correct positioning of the prosthesis are: AP varus 3° max; valgus 7° max; in the lateral view the tibial axis must match the talar axis. Complications can arise from the skin, the malleolus (fracture), infections, the mobilization of the prosthesis (subsidence, osteolysis). After about one year from the surgery, the AOFAS average score was 80. In two cases a modest suffering of the skin occurred, and in one case the malleolus fractured.

Discussion and conclusions The need to perform limited thickness cuts on the talar dome limits the prosthesis indication only in cases of non advanced degeneration, and with an adequate bone stock. Therefore, in spite of the usual indications, the total ankle arthroplasty with a covering prosthesis and bone saving, shall be performed early.

Suggested reading

- Huber M, Rippstein P (2006) The step from arthrodesis to arthroplasty – early results with the mobility ankle prosthesis. JBJS – British Volume 88-B[Suppl II]:206-c

SESSION 4

Femoral neck fracture in the elderly subjects affected by secondary hyperparathyroidism: the role of the calcium-sensing receptor

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The femoral neck fracture in the elderly is considered as the most important complication of osteoporosis. With the progressive increase

in the life expectancy of the population there is consequently an exponential increment of this fracture.

It has been decided to formulate a metabolic study on elderly patients affected by femoral neck fracture in order to evaluate the presence of specific alterations of the mineral metabolism and the bone remodelling that characterize this population.

Firstly, we studied 142 subjects recovered in our Department of Orthopaedics and Traumatology with a diagnosis of femoral neck fracture; the metabolic profile has been studied for all the patients with the evaluation of the mineral metabolism and bone remodelling. The results demonstrated that in patients affected by femoral neck fracture it is frequently observed a secondary hyperparathyroidism complicated by vitamin D deficiency that leads to the activation of bone remodelling with a prevalent osteoclastic activity. We have defined this specific alteration as *bone metabolic disease in the elderly with femoral neck fracture*. Secondly, considering the absence of significant correlation between the serum levels of PTH with both vitamin D and ionized calcium—a discrepancy that could be explained by the hypothesis proposed by Fisher and Davis (Osteoporosis Int 2007) by an alteration of the “Calcium-sensing receptor”—the PTH suppression test was performed on a selected group of 10 patients. Two subgroups of 5 patients each, according to serum levels of calcium and vitamin D, were selected; the results showed that there was an altered PTH serum levels response to the increase of calcium serum levels due to intravenous calcium infusion, in both subgroups, during the experimentation time. Hence, it was possible to conclude the increase in the PTH levels in the elderly patients affected by femoral neck fracture cannot be simply explained by the low serum level of vitamin D and ionized calcium alone, hence we recommend the consideration of an *aspecific alteration of the Calcium-sensing receptor*.

This study could have an important application in clinical field in both the prevention and the treatment of femoral neck fractures in the elderly. We propose that the combined treatment with vitamin D and antiosteoclastic drugs should be considered as the ideal pharmacological treatment for the prevention of femoral neck fracture in the elderly.

Arthroscopic reduction and internal fixation (ARIF) of tibial plateau fractures: Ravenna’s experience

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Success in surgical treatment of tibial plateau fractures depends on the quality of reduction, synthesis’ stability and early recovery of joint function.

Arthroscopy is a support for the achievement of these goals and enables to view directly the reduction and stabilization of the articular surface without the need for a arthrotomy, removal of hematoma and osteochondral debris, diagnosis and treatment of meniscal and ligament injuries. Between January 2005 and November 2008 were treated with arthroscopic reduction and internal fixation (ARIF) 11 fractures of the tibial plateau. The technique we used is that described by Caspari, which allow all operators to achieve accurately the site of fracture with a bone tunnel and introducing a special batter. By arthroscopic view is possible to check the correct reduction and treat associated injuries. For the synthesis we used one or more cannulated screws and to reach greater stability we used synthetic bone. Mobilization began in the early postoperative period, while the load bearing was granted in 2 months. All patients were clinically and radiographically evaluated according to the Rasmussen criteria. 8 patients had a type III Schatzker fracture, 2 fracture type II and 1 type

I. The medium follow-up was 22 months (range 6–32 months). From a clinical point of view 7 patients achieved an excellent result and 4 good results. The clinical outcome did not show any correlation with the type of fracture, but it appears to be influenced by the presence of associated injuries: 2 lesions of the external meniscus was treated with meniscectomy, 2 lesions of the LCA (one patient is waiting for intervention of reconstruction) and 3 chondral injuries. All cases reached very good results from radiographic point of view. Arthroscopy could be an important option for treatment of tibial plateau fractures. Although in medical literature its use in every type of fracture is advocated, we reserve the ARIF technique only to type 1, 2 and 3 of Schatzker classification fracture where traditional arthrotomy requires longer time of recovery and doesn't permit the assessment of associated meniscal, ligament and condral injuries. Following these indications complications (in particular compartmental syndrome) described in the literature are virtually nonexistent. Finally, ARIF it is a safe and effective technique that requires good knowledge of osteosynthesis and arthroscopy techniques.

“Sapienza” classification system (SCS) for complex fracture-dislocations of proximal ulna and radius

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The term complex fracture-dislocations of the proximal ulna and radius includes extremely various anatomic lesions. These fractures are rare, their treatment is still a challenge for orthopaedic surgeons and the results are frequently poor. In 1814 Giovanni Battista Monteggia first described the fracture of the proximal ulna associated with anterior dislocation of the radial head.

Numerous classifications have been proposed. In 1962 Bado proposed a classification based on the direction of the radial head displacement and angulations of ulnar fracture. In 1991 Jupiter et al. further subdivided the Bado type II injuries based on the pattern of radial ulnar fracture. In 1974 Biga e Thomine described a particular lesion called trans-olecranon fracture dislocation, in which failure of the ulno-humeral articulation occurs through the olecranon with the forearm dislocated anteriorly. However, none of these classifications appears complete and consistently has a therapeutic and prognostic value. Moreover, the absence of a comprehensive classification makes it difficult to compare clinical results and propose therapeutic protocols.

The purpose of this study was to design a comprehensive classification for complex fracture-dislocations of the proximal ulna and radius. It can be a guide for surgeon in the operative management in order to improve the results of treatment of these complex injuries. This classification was designed by considering the recent progress either in the functional anatomy of the elbow and in the diagnostic imaging (particularly 3D CT-scan).

The new classification distinguishes specific pathoanatomic lesions able to influence the surgical treatment and prognosis. They are: (1) the site of ulnar fracture in respect of collateral ligaments insertion and possible coronoid fracture; (2) severity of damage of the joint capsule and ligaments; (3) radio-humeral or ulno-humeral dislocation; (4) proximal radio-ulnar dislocation; (5) radial fracture; (6) distal radio-ulnar joint\interosseous membrane lesion.

The classification is based on an alphanumeric code. The numbers from 1 to 6 identify the Type of ulnar fracture. The letters A–D identify joints dislocation, soft tissue lesions and radius fracture, namely: (AI–AII) radio-humeral joint lesion associated with olecranon fracture; (BI–BII) radio-humeral and proximal radio-ulnar joint lesion; (CI–CII) radius fracture; (D) distal radio-ulnar joint\interosseous membrane lesion. The symbol (+) identifies ulno-humeral dislocation. The aim of the management and the type of surgery stems automatically from the classification of the injury with a certain number and alphabetical letter.

In conclusion, we conceived a new validated classification which has a therapeutic and prognostic value.

SESSION 5

Minimally invasive surgery in humeral shaft fractures. Comparison of osteosynthesis techniques

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Introduction A variety of different treatments for humeral shaft fractures are available: conservative methods or surgical procedures, as ORIF by plates, intramedullary nailings (I.M.) and external fixations [1]. There is still no definitive agreement regarding surgical treatments as confirmed by scientific literature. The most used methods are ORIF and I.M. antegrade or retrograde, considered now as the gold standard. In the last decades, plating techniques have developed with the introduction of fixed angle plates and with the increasing respect for the soft tissues and the healing process, reaching the concept of minimally invasive surgery.

Objective Considering the evolution of the plates [2] and our experience in the treatment of humeral shaft fractures using MIPO (lateral access with 2 or 3 openings) and I.M. techniques with Seidel nail [3] (by antegrade access), we want to compare the results of the two methods in patients that had the same type of fracture.

Results and conclusions Similar good results were obtained in 18 cases; however, intramedullary nailing procedure with a special distal expansion screw, seems to be a simpler and faster technique, even if a period of immobilization is indicated to assure rotational stability. MIPO technique is technically more difficult and must be performed by experienced surgeons and indications have to be rigorous. On the other hand, it reduces the X-ray exposition of the operators, allows prompt mobilization and saves endosteal and periosteal blood supply.

References

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Mini-invasive techniques in traumatology

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Recently the mini-invasive technique has been involved in all the fields of the orthopaedic surgery. For minimum-invasive surgery (or MIS) we mean a surgical procedure with reduced soft tissues incision than the traditional one.

We analysed 95 patients treated by MIS technique during all 2008 in our Unit. The involving criteria of the study were: the area of fracture, the time passed from the trauma, the way of the traumatic event. During the post-operative and rehabilitation period, the considered parameters were: the degree of pain to the immediate assisted passive mobilisation after surgery, the income of infection, the loss of the primary reduction, the delay of consolidation (or pseudoarthrosis), the income of functional limitation after the surgical treatment.

We used the Trigen nail (smith and nephew) for the intramedullary nailing and plates LCP (Synthes) for the osteosynthesis, using them both as single internal fixator, and as an hybrid-type assembly (associating the use of angular screws fixed to the plate onto that one of free screws). As concerning intramedullary nailing, new instruments gave us the possibility to remarkably reduce the size of the skin access not reducing the surgical precision.

In osteosynthesis with plates we replaced, when possible, the traditional technique AO (core fracture opening and internal reduction—Open Reduction and Internal Fixation) with new mini-invasive techniques named Minimally Invasive Plate Osteosynthesis (MIPO).

In intramedullary nailing is extremely important the use of new dedicated and specific instruments while, on the other side, in the MIPO technique the point is the new osteosynthesis concept: new plates, for philosophical and biomechanical principles, are more similar to an external fixator than to traditional plates. The external fixators have the advantage to be closer to the bone surface (the screws fixed to the plate, like the fishes of a fixator, are shorter) and therefore they are able to create a stabler plate-bone system, even after surgery.

Above all the older patients take benefit using mini invasive technique to fix bone fractures typical of their age: in particular we found best results in fractures treated with internal fixation plates, thanks to higher stability of the screws fixed to the osteoporotic bone.

Retrograde nailing, between mini invasive option and obliged choice in the treatment of distal femur fractures

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Blocked nailing and condylar plate osteosynthesis represent the most usual treatment choice in case of distal femur fractures, diaphysary and upper condylar. The choice of one or the other method generally depends on the level and on the complexity of the fracture.

During the past 5 years, we treated 49 distal femur fractures; 17 of these fractures were stabilized by means of a condylar plate with or without mini invasive technique; in 9 cases an antegrade blocked nailing was performed, while in the remaining 23 cases the fracture was synthesized with a retrograde blocked nail. In 3 cases,

the unsuccessful consolidation of the fracture, previously treated with an antegrade blocked nail, required a further retrograde blocked nailing. In all 26 cases, the retrograde nailing led to quick recovery of the fracture, in 3 cases the synthesis implied the exposure of the fracture focus. Only 2 patients had a limitation of the ROM caused by the prominence of the nail.

We reckon therefore that the retrograde blocked nailing, against an absolutely strict surgery technique, should be a more largely used treatment method, due to undeniable stability and mini invasion advantages and also considering the major potentialities of the new generation nailing systems.

Mini-invasive surgery of humeral multifragmentary or complicated fractures

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Patients and methods From 2001 to 2008 we treated at Caserta Hospital 657 patients with single humeral fracture or with multiple injuries and exposure, often comminuted fractures of various skeletal segments involved in politrauma. We treated such patients with different techniques of external fixation, intramedullary nailing, plate and screws, Kirschner's wires. The choice of device is related to the type, number, aspects of the fragments, open or close fracture, loss of bone or involving of the soft tissues, at the end to ability and experience of the surgeon. We applied 173 external fixators, 142 intramedullary nails, 273 plates and screws, 69 Kirschner's wires. The techniques used in external fixation were linear, ibrid or circular, reamed interlocking intramedullary nailing will be used depending on associated injuries.

Results Follow-up was on average 24 months and evaluation of patients satisfied the clinical and radiological criteria. The outcomes were satisfactory (62%), fair (28%), bad (10%). Healing time of the tibia was 3.6 months (range 3–7 months). To stimulate the healing of the bone a platelet gel was applied into the fracture trough the skin. In 2 cases we substituted broken synthesis, we observed 8 cases of delayed union with slow healing of bone, 5 infected pseudoarthrosis (most in the fixator). In these last cases we did local toilette, applied O₂ therapy with substitution of synthesis. In the 5 infections (3 fixators and 2 intramedullary nails), 4 cases needed a plastic surgery, 4 brachial vascular lesions, 2 amputations, 1 broken plate, 2 refractured. If necessary we used cortical or spongy bone transplantation. Another case was affected by pulmonary embolism and we took medical care. We also had 1 thrombosis.

Discussion It is necessary to distinguish among the different existing possibilities in the use of external fixator and intramedullary nailing depending on the grade of exposure and the presence or absence of bone contamination. Neurovascular, abdominopelvic or thoracic complications represent important problems in these cases. It is important to choose correct timing of treating and to use modern methods knowing advantages and disadvantages of each one. Surgical solutions adopted are ratified but it is possible to change and choose the best technique for each patient. We not always reached the results expected by the surgeon and sometimes the patient needed to undertake surgery again.

Conclusions It is important to combine the expertise of many professionals in order to choose the best therapeutic protocol. The correct choice of synthesis improves the nursing and allows a quick rehabilitation of severely injured patients.

SESSION 6

Transarticular reduction and percutaneous osteosynthesis tarpo and minimal invasive percutaneous osteosynthesis MIPO with locking and compression plate in different patterns of proximal tibia fracture: indications and results

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Objective Fractures of the tibial plateau involve one of the major joint and require for good function joint congruity, axial alignment, stability of the joint a sufficient range of motion. Early motion must be instituted to prevent joint stiffness and help cartilage vitality. Indication for surgery must be guide by Schatzker's principles.

Methods and results The review of patients is complete of 43 patients on 52 treat with new locking plates. We had 27 male and 16 female on 43 patients with proximal tibial fractures. The average age was 46 years with a minimum of 24 years and a maximum of 89 years. The average follow-up was 29.8 months with a minimum of 14 months to a maximum of 51 months. We evaluated every patients with a subjective scale of quality of live, with KSS. We reviewed the time of healing radiographically and ROM for every patients. With an average follow-up of 29.8 months we checked the secondary displacement for every patients. The average time of healing was 13.2 months with a minimum of 9 and a maximum of 22 in a fracture Type 6 of Schatzker. The average ROM was 4° – 111° ($r = 0$ – 13) ($r = 86$ – 150). On KKS score the results was Excellent in 46% of cases, 37% good, 10% sufficient and 7% poor. We think that this is a good results if we compare the complexity of pattern of fracture and the extremity of age fracture in our series. In our series the bad prognosis was related to soft tissue condition for high energy pattern of fractures, poor bone stock and highly fragmentary in elderly, perfect reconstruction of frontal axis, joint congruity, meniscal injury or grossly instability and associated ligament injury. We minimized the approach through TARPO technique (arthroscopically aided if necessary) to the joint and MIPO to the metaphysis in order to avoid additional soft tissue stripping, additional instability or source of joint stiffness.

Conclusions The locking plate offers sure advantages but does not allow the fracture healing "per se". The fracture often appears in different way putting in difficulty also really expert trauma surgeons. The message that I want to leave from this personal experience is that in order to avoid to get in worst prognosis of difficult fractures it's mandatory for the surgeon take care of reading of the pathoanatomy of the fracture, works with correcting timing after to have planned the reduction, choices the fixation method, choices of the implant but also the function that the system will have to carry out in this particular pattern of fracture.

Minimally invasive arthroscopic treatment of tibial plateau fractures

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Objective Arthroscopic reduction and internal fixation (ARIF) in tibial plateau fracture is one of the treatment options. We had applied

this technique on a patients series developing a "custom made" instrumentation.

Patients and methods From 2001 to 2006, 23 patients with tibial plateau fractures were treated with ARIF. There were 3 patients with type-I, 6 patients with type-II, 10 patients with type-III, 4 patients with type-IV. 82% of the patients had concomitant intra-articular lesions (meniscus, cruciate ligaments, intercondylar eminence avulsion). Average follow-up was of 31.6 months.

Surgical technique Knee flexed at 60° . We used the classic arthroscopic portals. After irrigation of the knee, morphology and displacement of fracture fragments and associated intra-articular lesions were evaluated under direct arthroscopic view. Through a cortical window on the other side of fracture, the depressed fragment was elevated using a guide-wire and then a cannulated impactor. 6.5 mm titanium cannulated screws or FTS (double threaded screws) were used to fix the fracture and bone defects could be filled using human allograft bone or by injection of adsorbable cement.

Postoperative management CMP for passive mobilisation the first day, the patients were not allowed to bear weight for 10–12 weeks, a brace (range of motion of 0° – 90°) was used for 1 month.

Results Evaluations were performed according to Rasmussen functional score system: 16 patients (88.8%) had clinical satisfactory results and 15 (94.4%) patients had radiographic satisfactory results. We had complication in 3 cases: 1 case of loss of extension resolved with arthroscopic debridement, 1 case of algodystrophy and 1 case showing a sural hematoma.

Discussion Tibial plateau fractures represent the 1% of skeleton's fractures. 60–70% of these fractures involves lateral plateau and traumatic mechanism is a valgus stress; 10–20% involves medial plateau and it's due to valgus trauma with knee bended at 80–90 degrees and tibial extra-rotation. Arthroscope combined with minimally invasive internal fixation is suitable for Schatzker tipe-I, tipe-II and tipe-III fractures (or B1, B2 and B3 according to AO classification), but more discussed for tipe-IV. Benefits of ARIF are principally the chance to diagnose and, at the same time, to deal with associated intra-articular lesions (meniscus, cruciate ligaments, cartilage), decreasing the post-operative complications.

Conclusions International literature recommends ARIF technique for treatment of type-I, type-II and type-III fractures according with Schatzker classification, but we suggest to use dedicated instruments to improve fractures reduction.

Mini-invasivity in tibial plateau fractures: indication of arthroscopically assisted treatment and medium term results

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Objective The aim of this study was to evaluate our short-medium term results.

Material and methods Between January 2006 and December 2007 we treated 66 tibial plateau fractures with arthroscopically assisted reduction and internal fixation with percutaneous buttress plates or cancellous screws. The patients had a mean age of 43 (18–68). Data were gathered retrospectively. All the fractures were classified using the Schatzker classification. All patients underwent a-p and lateral plain radiography and computed tomographic CT scanning with tri-dimensional reconstruction of their injured knees. Clinical and radiological outcomes were evaluated according to the system of

Rasmussen. The follow-up period ranged from 6 to 84 months, with an average of 50 months.

Results 24 patients had associated intra-articular soft tissue lesions which were treated both in conservative and surgical manner. Full weight bearing was allowed after 12 weeks. According to the Rasmussen grading system 42 patients scored an excellent functional result and 24 a good result.

Discussion Despite the fact that they account for just 1% of all fractures, tibial plateau fractures are associated with a diverse spectrum of injuries (to the menisci, collateral and cruciate ligaments, arteries and nerves) that can have severe consequences if not treated appropriately. Open reduction and internal fixation has a significant complication rate which has encouraged interest in percutaneous techniques. Arthroscopically assisted reduction (percutaneous osteosynthesis) provides a good view of the fractured articular surface and any other intra-articular lesion, while limiting soft tissue damage.

Conclusions Arthroscopically assisted treatment of tibial plateau fractures yields satisfactory results and can be accepted as an alternative and effective method of treatment even if not all types of tibial plateau fractures are amenable (suitable) to arthroscopic reduction. On the other side the mini-invasively percutaneous treatments with plates or screw decrease soft tissue dissection, reduce the risk of complications and promote rapid recovery.

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Articular fractures of the distal radius: a surgical treatment comparison

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Objective The study compares the results obtained in the treatment of type B and C fracture according to AO classification with closed reduction and percutaneous wiring (associated or not to external fixator) with the results obtained with open reduction and L.C.P. plating.

Material and methods Seventy-six (76) fractures were treated: 36 were type B and 40 type C. First type (B) were treated with percutaneous wiring in 16 cases and in 20 cases (14 of subtype B3) with L.C.P. plates. Second type (C) were treated with percutaneous wiring in 18 cases (associated to external fixator in 10 cases) and in 22 cases with L.C.P. plates. 59 patients were evaluated with a mean follow-up of 11 months after surgery.

Results Patients were evaluated according to Mayo Wrist Score. In the group B the results were excellent/good in 65% of patients treated with percutaneous wiring and in 80% in those operated with L.C.P. plates. In the group C the results were excellent/good in 55% of patients treated with percutaneous wiring and were excellent/good in 68% of those operated with L.C.P. plates.

Conclusions The treatment of distal radius articular fractures evolved in the last years with the aim to obtain an anatomical reduction and to

maintain a stable sintesis of all fragments. Traditional systems like closed reduction and percutaneous wiring or/and external fixator are giving up place to open reduction and sintesis with L.C.P. plates that allow a stable anatomical reduction and a faster and better functional recovery.

SESSION 7

Is anatomical reduction essential in proximal humerus fractures? A biological indirect reduction approach is a promising solution

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Objective The aim of this study was to describe a new surgical indirect reduction technique for proximal humeral fractures and to evaluate the radiographic and clinical outcomes.

Material and methods Closed and minimally invasive indirect reduction was performed using the angular plate fixation in patients that had displaced 2–3–4 proximal humeral fractures from April 2001 to April 2007. 16 patients on 96 where Type A fractures (16.7%), 51 pz on 96 (53.1%) where Type B fractures and 29 pz on 96 (30.2%) where Type C fractures of the proximal humerus.

Surgical technique A closed reduction is achieved. A gentle and atraumatic dissection of the deltoid muscle is performed and stopped when the sub-muscular plane was reached (Larghi approach). The supraspinatus and subscapular tendon is pre-sutured. Both the tuberosities were usually pulled distally and a quadrilateral suture technique is used to link the tuberosities together along with shaft. Therefore, and only now, due to a ligamentotaxis technique the assistant should reduce the fracture by indirect maneuvers. The “gothic arc” and the fracture reduction is checked fluoroscopically. Afterwards locking-compression plates is used percutaneously as internal fixator (Locking splinting) to achieve primary stability, to avoid secondary displacement, to respect the vascular blood supply of the humeral head and of the both tuberosity too. At the end of the bony fixation the rotatory cuff is sutured on the plate.

Results The average follow-up was 48 months (min18–max 76). These patients were then regularly seen in the clinic with X-ray on follow-up. Constant shoulder score and the individual Constant score were assessed in every patients. We reviewed 84 patients out of 96 patients (50 female and 34 male) with an average age of 56.9 years. The average follow-up was 48 months. The overall union rate was 95.24% (80 out of 84). Sign of delayed union were noted in 3 pz and a non union in 1 pz. Clinical assessment showed an average CS of 21.77% points and an individual average CSindiv of 82.4% points.

Discussion A number of studies have evaluated the functional outcome after locking plate osteosynthesis for displaced proximal humerus fractures. The delto-pectoral approach was used in all the studies, but approach and reduction technique were not addressed.

Conclusions Closed reduction and internal fixation with locking plate for proximal humeral fractures is a safe method, which produces promising functional and radiological outcomes. The suggested surgical approach provides a pain free early functional recovery.

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Biological minimally invasive treatment in traumatic injury: damage control orthopaedics

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Traumatic injury leads to systemic inflammatory response counteracted by an anti-inflammatory response. Depending on the severity of the trauma and the host condition, this balance may not act sufficiently. Severe systemic inflammatory response (SIRS) can lead to acute organ failure until death, even if an excessive compensatory anti-inflammatory response (CARS) may induce a prolonged immunosuppressed state. Thus there is a therapeutic window placed between SIRS resolving and CARS establishing which allows definitive surgical treatment at the lowest risk of acute systemic complications. The modern surgical treatment of traumatic injuries provides a plan strategy including the biological context of the patient. The overall injury weight is the addition of trauma weight and the needed surgical weight counteracted by the biological host resources. Of these three, only surgical trauma can be modulated with respect to the timing of treatment and the invasiveness of treatment. The Damage Control Orthopedics (DCO) is an approach that contains and stabilizes orthopaedic injuries in order to improving the patient's overall physiology and the reduction of post-injury complications. According to the DCO, patients who have sustained orthopaedic trauma have been divided into four groups: stable, borderline, unstable, and in extremis.

1. Stable patients (single fracture in traumatic injury without chest injury) should be treated with the local preferred method for managing their orthopaedic injury.
2. Borderline patients (single fracture with chest injury AIS 2–4) should be treated as group 1 or without reamed or with DCO strategy.
3. Unstable patients (critical conditions with chest injury AIS > 4) should be treated with damage control orthopaedics for their orthopaedic injury.
4. Patients in extremis should be treated in ICU with damage control orthopaedics for their orthopaedic injuries.

While patients in groups 1, 3, 4 are quite easily classified, borderline patient are more difficult to define and there is no agreement on the including criteria. Clinical data have shown no increase risk of infection when intramedullary stabilization is realized within the window of opportunities following the use of spanning external fixation. DCO strategy has proven to have encouraging results in the early surgical management of injured patients. No definitive data are found on advantages in terms of mortality and morbidity.

SESSION 8**Contraindications to mini-invasive surgery in long bone fractures**

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The respect of biology in bone healing is the principle on which the current treatment of fractures is based. Sometimes, in clinical experience, more importance is given to the respect of biology than to the biomechanical validity of the osteosynthesis, leading to implant failure. Basing on a strong belief in the validity of the Perren's theory about absolute stability in simple fractures and relative stability in complex fractures, we undertook an accurate review of those patients who sustained a mini-invasive treatment, with respect of biology but insufficient mechanical resistance of the implant, with a failure of the osteosynthesis.

In this study we reviewed every delayed- or non-union occurred in the last 5 years at the Department of Traumatology II at "Istituto Clinico Humanitas" (Milan).

Our results confirm Perren's theory and show that often, mainly in the case of a simple fracture of the humeral or tibial shafts, the exposure of the fracture site (with respect of soft tissues) and the osteosynthesis with absolute stability obtained by interfragmentary compression screws and neutralisation plates, can provide better outcomes compared to a mini-invasive surgery which, according to our experience, is even contraindicated.

Retrospective study on unstable fractures of the distal radius treated with external fixation

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This study was designed to investigate the clinical and radiographic results of the technique of external fixation in unstable fractures of the distal radius, and to define the indications and limits of this technique. Between January 2001 and January 2006 one hundred and five patients underwent surgery for distal radius fractures using external fixation; 90 patients were analyzed retrospectively. According to the AO classification we observed 35 A type fractures (39%), 10 B type (11.1%), 45 C type (49.9%). There were 42 male (47%) and 48 female (53%) with an average age of 62 years (range 33–79). The functional and radiographic results were analysed at a mean follow-up of 53.3 months (range 24–84). The valuation considered grade of satisfaction measured by satisfaction visual analogue scale (SVAS); patients pain was measured with the visual analogue scale (VAS); strength with Jamar Hand Dynamometer; range of motion (ROM) and functional outcome was evaluated using the Disability of the Arm, Shoulder, and Hand Questionnaire (DASH) and Gartland and Werley score. Fracture reduction was studied from radiographs taken at the post-operative and last follow-up visit; we considered intra-articular parameters (gap, step-off) in according to Knirk and Jupiter (1986) and Gliatis (2000), extra-articular parameters in according to Van der Linden (1981) and Fernandez'

criteria were used for acceptability evaluation. Therefore results were statistically analyzed. The mean active wrist ROM at the final follow-up evaluation was 68 degrees extension (range 40–80), 64 degrees flexion (range 35–80), 12 degrees radial inclination (range 5–15), 15 degrees ulnar inclination (range 10–25), 70 degrees pronation (range 30–80) and 65 degrees supination (range 40–80). In 73 cases we registered a strength >60% compared to an healthy wrist. The mean DASH score was 24, mean VAS score was 2.4 and mean SVAS score was 7.6. Final radiographic measurements for radial inclination was a mean reduction of 1.5 degrees and for step-off was 0.40 mm. In 68 cases (76%) the patients were satisfied, in 19 cases (21%) the patients lament slight pain without any functional limitations and in 3 cases (3%) the results were negative and it a partial arthrodesis was necessary. This retrospective study confirms that satisfactory functional results are obtained even if the reduction is not anatomic, but it is important to respect Fernandez' criteria. Our orientation is in C2–C3 type fractures where the results are not always predictable for fracture's complexity, to use external fixation.

Treatment of fractures of the distal end of the radius in elderly: ORIF with a fixed-angle plate versus external fixation

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Background The fractures of distal radius are the most common fractures of the upper extremity. Fractures of the distal radius are experienced by all ages and demonstrate a bimodal distribution, with peak ages of 6–10 and 60–69 years. In the older and osteoporotic patients, simple falls with outstretched hand can cause a distal radius fracture. Closed treatment of distal radius fractures are generally reserved for nondisplaced or displaced fractures that are reducible and stable. Surgical treatment is indicated for displaced and unstable fractures.

Material and methods We analyzed results of treatment of unstable distal radius fractures in elderly. 83 wrists in 82 patients older than 60 years (15 males, 67 females, range 60–88 years) with unstable distal radius fractures were treated in our operating room in 2005, 2006 and 2007. We performed ORIF with a fixed-angle plates in 42 cases (group I), external fixation in 41 cases (group II). Fractures were classified as follows (AO-ASIF): 11 type A, 41 type B, 31 type C (19 C3).

Results 75 patients (76 fractures) returned at follow-up (37 cases group I, 39 cases group II). Mean follow-up was 12 months (range 4–26 months). Results were evaluated according to a scheme which analyzed pain, mobility, strength, radiographic measurements, return to occupation and homework (D.A.S.H. score). In group I, results were deemed optimal in 24 patients (64.9%), good in 11 (29.7%), fair in 1 (2.7%) and poor (EPL rupture) in 1 (2.7%). In group II, results were deemed optimal in 22 patients (56.4%), good in 14 (35.9%), fair in 2 (5.1%) and poor (reflex sympathetic dystrophy syndrome) in 1 (2.6%). Nevertheless, subjective patient assessment did not show poor results.

Discussion and conclusions With a progressively older yet healthy population, more and more frequently patients remain physically active and engaging in sports. Post-traumatic deformities and wrist dysfunctions are not well accepted outcomes in this population. In our opinion external fixation continues to have a role in the management of distal radius fractures. Other hand free articular fragments are not reducible and pose one of the limitations of

treating fractures with external fixation. ORIF with a fixed angle plate facilitate accurate reduction and earlier implementation of activity. In our as well as other Authors experience, evolution of distal radial fractures shows that these fractures can and should be treated according to the same principles that apply to other fractures involving joints.

Suggested readings

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SESSION 9

Modular prostheses in revision surgery

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Objective Aim of this study was to review the results of revision implants with an uncemented modular prosthesis in the lower limb (GMRS[®] Stryker) in the Rizzoli experience.

Material and methods This is a modular system with a rotating hinge knee mechanism, uncemented stems, curved and straight-fluted, with hydroxyapatite coating. Adaptors are available to revise previous designs of the prosthesis in hybrid implants. From 2003 to 2007, 175 modular prosthesis GMRS were implanted at Rizzoli. These series included 108 primaries reconstructions after resection for bone tumors and 67 cases of revisions: 55 cases in failures of previous reconstructions after resection of bone tumors (30 aseptic loosening, 9 infections, 5 breakages, 5 allograft or composites fractures, 4 non-unions of grafts, 2 aseptic loosening in composites) and 12 cases in non oncologic settings (2 aseptic loosening in THA, 6 infection in TKA, 4 non-unions). Revision included 38 cases with GMRS[®] components only and 29 with hybrids GMRS[®]-HMRS[®]. All patients were periodically followed in the clinic and functional results were assessed according to Musculo Skeletal Tumor Society (MSTS) system. Analysis of results focused on revision implants.

Results At a mean time of 2.5 yrs (min 1– max 5 yrs) 3 cases of infection occurred (4.5%) at mean time 22 months from surgery and 1 case of aseptic loosening of femoral stem at 21 months. No cases of breakage of stems or other components were observed. Functional results were good or excellent in 10 pts (84%) of 12 non oncologic cases, in 24 pts (92%) of 26 pure GMRS[®] and in 27 pts (93%) of 30 hybrid implants. Statistical analysis of implant survival of primary versus revision implants did not show significant differences.

Discussion Indications for modular prostheses are well defined in orthopedic oncology, still investigational in non oncologic settings. Although a higher incidence of complications was expected in revision implants, statistical analysis showed similar survival.

Conclusions At mid-term follow-up, GMRS[®] prosthesis showed promising results in revision surgery, both for oncologic and non oncologic failures.

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3. Ruggieri P et al (2007) Revision surgery in modular prostheses of the lower limb for bone tumors at long-term follow-up. 14th ISOLS, Hamburg

Long-term results of femoral revision with the Wagner tapered stem

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Objective In femoral revision surgery, implant fixation should be gained in preserved cortical bone. Fluted, tapered stems provide secure axial and rotational stability in the distal femur [1]. Long-term clinical and radiographic results with the Wagner SL stem are reported.

Material and methods From September 1992 to March 1998, 68 femoral revisions with use of Wagner stem were performed. Twenty-five patients (2 bilateral implants) died for unrelated causes, with a well-functioning total hip replacement in situ. The study group consisted of 41 patients, 12 males and 29 females, aged from 29 to 80 years (mean, 61 years). Bone loss included types 2 (6 hips), 3A (19), 3B (4), and 4 (12) according to Weeden and Paprosky classification. A transfemoral approach was used in 32 cases. Bone grafting was never supplemented. Ambulation was allowed 1 week after surgery, but weight bearing was delayed 2 months. Average follow-up for the survived hips was 13.9 years (range 10.4–15.8 years). Clinical evaluation was performed using Harris Hip Score (HHS). The signs of osseous integration of the stem and the progression of periprosthetic bone remodelling were assessed radiographically. Failure was considered revision of the femoral component for any cause.

Results In 5 hips the stem was revised because of marked complications. Two patients underwent resection-arthroplasty for deep infection. In 2 cases a significant subsidence of the stem occurred, requiring re-revision for prosthetic joint instability and for head-neck disassembly. One stem finally was replaced for old dislocation following acetabular component failure. Four hips (11.1%) dislocated, and 8 stems (19.5%) subsided. Thirty-three cases (91.6%) showed radiographically stable bone fixation of the stem. A partial restoration of the femur was detected in 95.6% of the patients, both in the proximal part and in the cortical diaphyseal bone. Average HHS improved from 36 points preoperatively to 76 points at the latest follow-up. The cumulative survival rate of the Wagner stem was 87.8% at an average of 13.9 years.

Discussion The stems that required further surgery were revised for the development of severe complications. Periprosthetic new-bone formation was seen to occur regularly.

Conclusions The absence of aseptic stem loosening documents the efficacy of fluted, tapered fixation on the diaphyseal cortical bone. Wagner SL prosthesis resulted a successful implant system in femoral revision, promoting bone stock regeneration in extended defects [2, 3]. Higher risk complications (dislocation, subsidence) should be reduced by the use of modular tapered stems.

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2. Böhm P, Bischoff O (2004) The use of tapered stems for femoral revision surgery. *Clin Orthop Relat Res* 420:148–159
3. Gutiérrez del Alamo J, Garcia-Cimbrelo E, Castellanos V, Gil-Garay E (2007) Radiographic bone regeneration and clinical

outcome with the Wagner SL revision stem. A 5-year to 12-year follow-up study. *J Arthroplasty* 22(4):515–524

SESSION 10**Early results with the Revitan modular revision stem**

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Background A retrospective study was conducted to review early results of the Revitan (Zimmer, Warsaw, IN, USA) modular revision stem.

Material and methods From June 2005 to August 2007, 25 consecutive hip revision surgeries were performed with the Revitan straight stem at our institution in 25 patients. There were 12 females (50%) and 12 males (50%) whose mean age at surgery was 74 years (range 71–88 years); one patient was lost at follow-up. The indication for revision was aseptic loosening in 13 cases (54%), septic loosening in 6 cases (25%), 4 periprosthetic fractures (17%) and one stem mechanical failure (4%). Mean post-operative follow-up was 31 months (range 18–36 months). The clinical assessment consisted of the Harris Hip Score, subjective VAS pain and satisfaction evaluation. Standard AP and lateral x-rays of the hip were obtained at each follow-up visit. Various radiographic measurements were used to evaluate the results: bone ingrowth, stress shielding, and vertical subsidence. Leg length discrepancy was also investigated as a factor possibly affecting outcome.

Results Clinical assessment showed a significantly improved mean Harris hip score from 48.58 points (range 19–88) preoperatively to 80.66 points (range 40–96) at follow-up ($p < 0.001$). The subjective VAS and satisfaction scores at follow-up were, respectively 1.63 (range 0–9) and 8.79 points (range 3–10). At last follow-up the subjective perception of pain was significantly lower in those patients that had a Wagner's femoral osteotomy ($p = 0.18$). Average post-operative leg length discrepancy was -10.5 mm (range -70 to $+20$). The only complication reported was a femoral fracture occurred during primary implant removal procedure.

Conclusions The clinical outcome at a mean follow-up of 31 months showed the achievement and persistence of results and complication rate comparable to those of other modular revision implants presented in literature.

Fracture of a polyethylene post in a 9-year-old posterior-stabilized knee prosthesis: light microscopy and SEM evaluation

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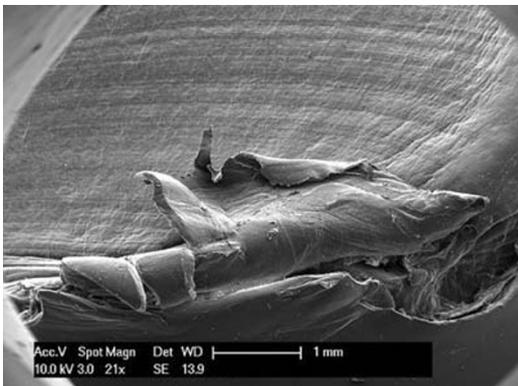
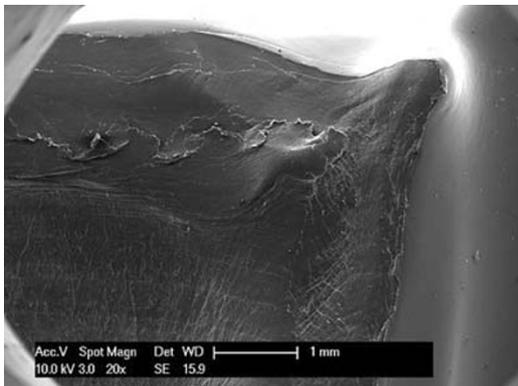
Objective Aim of this study is to evaluate the surface of the TKA polyethylene liner, harvested after the breakage of the post nine years

after the implant in a 63 years old female (BMI 39) after an hyper-extension trauma.

Methods During the revision we harvested sample of the peri-prosthetic tissue which was prepared for the light microscopy evaluation. The samples were stained using both haematoxylin-eosin and Von Kossa. The PE liner was prepared for the Scanning Electron Microscopy.

Results The SEM evaluation revealed two different damage patterns considering the medial part and the lateral aspect of the sample. The medial part presented a fracture line laminated in front and smooth behind and with the tear lines with a medio-lateral and anterior posterior orientation. The lateral part presented a sharp fracture line that ends anteriorly with a laminated tear paralleled to the anterior edge of the polyethylene insert, and which implies that this area could be the terminal failure area of the fractured post. The medial part of the fracture edge appears to be smooth and with a different orientation of the fracture lines.

Conclusions These features could be explained with a “two stage” rupture of the polyethylene post. This could have been caused by a non-optimal ligamentous balance that weakened the post, which was finally broken by a postero-anterior stress.



Suggested readings

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Early acetabular revision with anatomic cup

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Introduction Anatomic acetabular cup, studied in 1999 by Prof. M. D’Imporzano, is born to solve the problem of acetabular revision in grade I and II mobilization (GIR) [1], respectively, characterized by widening and deformation of cavity with eventual superior or posterior wall loss. The problem in these lesions is not such bone stock reconstruction, as correct positioning of new cup. Indeed superior wall loss can set wrong collocation of the cup tending to verticalization and superior migration of rotation centre, while posterior loss can lead to retroversion [2].

Material and methods The hemispheric cup owns a cranial fin for iliac support with 4 holes for stabilization with spongiosa screws. In its equatorial area features 3 holes for posterior and medial screws, according to Pauwels, and circular retention cavities in order to increase the initial stability. The external shell is covered with a porous titanium layer so as to facilitate secondary osteointegration. The tapered liner is in ceramic or polyethylene eventually protruded. The originality of this cup consists in having the insertion seat of the articular liner oriented by 18° in antiversión. This choice was made in order to automatically guarantee the necessary antiversión, even if the supero-posterior iliac wall is eroded, the latter being the reason why normal symmetrical revision cups lead to undesired positioning in insufficient antiversión. Considering these features, the cup can be used, as well as in revision surgery, in treatment of Coxa Profunda, Displasic Coxo-femural Osteoarthritis and acetabular fractures outcomes [3]. In this study we present the results of 60 revisions between 2000 and 2007, with a 1–7 years follow-up.

Results and conclusions The clinical outcome was good with an improvement from 55 to 88 considering the Harris Hip Score. As complications we observed only 1 case of sepsis, neither dislocation nor mobilization. Radiographical study of rotation centre pointed out a reduction of the superior migration from 1.2 to 0.8 cm after surgery. The shortness of follow-up period does not allow to conclude definitively about the effectiveness of this cup as the optimal solution in this surgery; however, we can state that it can be a valid solution for treatment of grade I and II contrasting the two principal problems of these revisions: superior migration of rotation centre and retroversion tendency.

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Evaluation of I-ONE™ therapy in patients undergoing knee joint prosthesis

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Objective The employment of biophysical therapy to accelerate tissue healing is by now a well-established practice in many orthopaedic situations, and is mainly indicated for osteogenesis and chondrogenesis [1]. **Material and methods** We undertook a randomized prospective clinical study envisaging recruitment of 30 patients affected with knee arthrosis and undergoing replacement with prosthesis. The randomization involved subdivision into two homogeneous groups, the first with biophysical treatment with I-ONE therapy (experimental group), the second not undergoing biophysical therapy (control group). In the experimental group, the I-ONE treatment commenced at 3–7 days after surgery, was administered for 4 h daily and was continued for 60 days consecutively. Clinical evaluations were performed by compiling functional reports (Knee score, SF-36 and VAS) before operation and after operation at 1, 2, 6 and 12 months.

Results The results provide significant data with regard to the application of the biophysical therapy as compared with the control group.

Discussion Operations for knee prosthesis are complicated by moderate-severe postoperative pain. Acute pain results from the onset of a loco-regional inflammation since the damaged tissues release interleukines, tissue necrosis factors, histamine, bradykinin, prostaglandin, serotonin, P substance and acetylcholine, which stimulate the nociceptors and cause onset of the nerve impulse [2]. In this way, alteration of the sensitivity of the peripheral neurone occurs, with reduced stimulation threshold. Inadequate management of the treatment for pain relief leads to chronic pain and delay in the programme for rehabilitation and for early recovery of joint function. For this reason, it becomes necessary for the orthopaedic surgeon, in collaboration with the anesthesiologist and the physiatrist, to set a therapeutic, pharmacologic and instrumental protocol such as to reduce the local inflammatory reaction and limit the transmission of the nociceptive stimulus at peripheral and central level. This is the premiss underpinning the application of biophysical treatment in dealing with pain following surgery for joint prosthesis. Exposure to the physical stimulus goes hand-in-hand with transport through the membrane of the calcium ion that is recognized as proliferative signal, causing an increase in cell proliferation and thence an expansion of the pool of progenitor cells. Biophysical stimulation has been found to exert a strong anti-inflammatory action [3].

Conclusions The results of this study will make it possible to provide the basis for clinical employment of biophysical treatment with I-ONE therapy immediately following surgical intervention on joints, enabling control of inflammation and increasing anabolic activity and thence protecting the microenvironment.

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SESSION 11

Biological and mechanical pitfalls in modular prostheses used for bone oncology

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Primary and metastatic bone tumours are currently treated with limb salvage procedures avoiding in the majority of cases limb amputation. Different modalities of reconstruction after bone resection are recommended: modular prostheses, custom made prostheses, composite modular prostheses and rotationplasty. Among these different modalities of reconstruction modular tumour prostheses is considered a well established option for the reconstruction of osseous defects after resection of malignant bone tumours. This system allows today to replace almost every joint and even total bones (e.g., total femur or humerus), and good functional results can be achieved in the different series taking into account the different prosthetic models. We report our experience using modular endoprostheses of different design in the management of 143 cases of malignant primary and metastatic tumours from 1995 to 2008 summarizing the indications, limits, and complications as well as the functional results. Except the major problem consisting in the infection rate, we focus on the biological complication consisting in PE wear in the knee prosthesis, implant loosening in all the joint replaced, implant fracture, especially in the implant system with screws; coxitis in some cases of proximal femur treated with bone resection and reconstruction with modular endoprostheses. On the basis of our experience we conclude that although the complication rate with the use of modern modular endoprostheses is constantly decreasing, the need for revision surgery is still significantly higher than in primary joint arthroplasty.

Omnia: modular system for acetabular revisions

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Objective The Author presents a new system (OMNIA) introducing innovative concepts in the field of acetabular prosthetic revisions: the aim is to provide the surgeon with various options for fixation of the acetabulum so that these can be implemented together as required depending on the seat and the severity of the bone defects actually encountered during surgery, as well as according to the operator's personal preferences. Modularity features are introduced to simplify the surgical technique allowing changes in the inclination and the acetabular rotation subsequent to cup implantation. The method makes it possible to easily handle unexpected intraoperative situations such as bone defects more serious than those encountered during preoperative investigations, and is therefore a suitable solution for all cases of acetabular revision.

Material and methods The system can employ various types of fixation that can be implemented together in different ways, with one common feature, i.e. mechanical principles of angular stability. The cup is hemispherical; it is available in all the most common diameters

thereby ensuring maximum saving of the bone tissue, and making it suitable for implantation also locking it by means of the “press fit” method. There are eight holes having the same diameter (9 mm) distributed at various distances from the pole and can be used to receive the three different auxiliary fixation devices. Three different fixation methods are possible, to be used singly or in association with one another; the selection of the type and implementation of the fixation is done during the surgery on the basis of the complexity of the acetabular defects.

1. *Screws*: characterized by their large diameter (8.5 mm) and the device for angular locking in relation to the cup, obtained by means of a special screw cap. Both these features contribute to increasing the mechanical resistance considerably as compared to systems which use standard screws.
2. *Pegs*: these are nails with six fins and tapered tip; they are available in various lengths, with 9 mm diameter at the base, and are inserted directly inside like the screws, after positioning the acetabular cup. The iliac fixation they provide is less invasive; they can also be positioned to obtain complementary fixations in the pubic and/or ischial region. The pegs are implanted simply by “abutting” after the housing is prepared by perforation. In this case too, angular stabilization of the “peg” follows by means of a screw for locking to the cup. The acetabular implant completed with screws and/or pegs provides the system with radiographic aspects comparable to those of a primary implant in terms of space occupied.
3. *Stems (iliac stems)*: are the “greater” fixtures of the systems, used in more complicated cases. They are 15 mm at the base and are joined to the outer surface of the acetabular cup by means of a screwed intermediate element and a special locking cap. They are conical shaped, and like the pegs, have anti-rotational fins distributed radially along their surface.

The main peculiarity as compared to other iliac fixation systems lies in the possibility of adjusting the cup positioning parameters independently (acetabular inclination and version) after implantation of the iliac stem.



Results and discussion The preliminary results refer to the first 130 implant cases in the last 2 years. The possibility of transformation of the implant from a simple “press-fit” hemispherical cup to a system with multiple fixation aids has made it possible to handle all types of acetabular prosthesis with a single system. The possibility of sequential adjustment of the cup implant parameters has actually helped simplify the technique and prevent acetabular orientation defects. Thanks to the numerous options available, application of the OMNIA system may also be extended to cover various “difficult”

cases of primary prosthetization (dysplastic outcomes, traumatic outcomes, severe bone stock deficiency).

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SESSION 12

Microbiological aspects of prosthetic aseptic loosening

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The loosening of prosthetic joints in the absence of infection (aseptic loosening) is the most common reason for revision surgery. A significant part in this process is undoubtedly played by the generation of wear debris, mainly from the bearing surfaces of the joint, and the cellular reaction to this in the implant bed (the so called “effective joint space” [1]). Phagocytic cells (macrophages and multinucleated giant cells) are the ones that remove foreign material from the tissues, and these cells function in the interface between implant and bone lead up to the local production of many mediators including numerous cytokines (TGF- α , M-CSF, GM-CSF, IL-1, IL-6, TNF- α), enzymes and integrins. There is also evidence for interactions between macrophages and locally recruited lymphocytes, which may or may not give rise to an immunologically mediated process and a consequent bone loss and progressive prosthetic loosening. All the process is so started by the presence of wear particles [2].

Numerous studies suggest that the cellular reactions detected in the tissues in cases of aseptic loosening are indeed those of contact sensitization. There is good evidence to show that a type IV cell-mediated immune reaction is taking place, with TH1 cell involvement (T helper lymphocyte) and active antigen presentation [3]. The extent to which sensitization is present in individual cases of aseptic loosening remains a subject for further work and this needs all the sophisticated molecular methods now available to modern biology to be applied in appropriate prospective clinical studies coupled with experimental models *in vitro* and *in vivo*. Immunological processes play a very important part in joint loosening than previously considered.

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Mini-invasive surgery and infection: advantage or risk?

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Potential disadvantages of minimally invasive surgery (MIS) applied to joint replacement include malaligned components, poor cement technique, retained cement fragments, skin damage and infection. While in fact MIS had been originally proposed to reduce direct trauma and exposure, decreasing in this way bacterial contamination, increased indirect trauma to soft tissues has been claimed to increase the risk of wound healing problems and infections.

Objective data in support of a different risk of septic complications of MIS compared to standard approach are few. This may be due to different factors:

1. Definition of MIS may vary in different authors. Focusing on knee surgery, the definition of MIS is controversial: some standards include the length of the incision, which typically is under 14 cm, but various authors report lengths down to 6 cm; the amount of soft-tissue disruption, specifically damage to the quadriceps muscle; trying to not dislocate the patella; minimizing the amount of knee joint dislocation (tibial-femoral dislocation)...
2. Infection rate after joint prosthesis is relatively low. This finding, connected to the low number of MIS procedures, leads to difficult statistical analysis.
3. There are no specifically designed studies on the matter.

Scientifically available data show:

1. C-reactive protein levels do not differ among MIS and standard procedures.
2. A meta-analysis of the available data from the literature reveals a ten fold increase of delayed wound healing in patients that underwent minimally invasive prosthesis of the knee, compared to standard approach (0.3 vs. 3%).
3. The same analysis failed to show any difference as to regard deep infection.

From year 2001 to 2006 56 patients underwent surgical procedures for deep infection following knee arthroplasty in our Department. Of these patients only 4 (7.1%) had been previously operated through a minimally invasive approach. Treatment of infection after MIS did not differ significantly compared to patient previously operated through a standard approach.

In conclusion:

1. MIS for knee replacement is associated with an increased, but not statistically significant, risk of delayed wound healing, compared to standard procedures.
2. There are no documented late sequelae of delayed wound healing.
3. There is no documented different risk of deep infection compared to standard approach.
4. Treatment of infection after a MIS is similar to that of infection after standard procedure, in our experience.

SESSION 13

Achilles tendon ruptures: percutaneous repair with Tenolig

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Introduction From June 1998 to January 2008 we treated 125 patients affected by subcutaneous ruptures of Achilles tendon with the percutaneous tenorrhaphy technique by Tenolig [1, 2, 3]. This approach is a mini-invasive surgical technique which consider two parallel Dacron threads with a distal harpoon and a proximal malleable needle.

Material and methods Most of the patients are males (75%) and the mean age was 36.6 years. A sportive accident was involved in 2/3 of the cases. The surgery was performed in local anesthesia and the mean duration time was of 10 min.

Results Patients were discharged from the hospital the day after the surgery. Patients wore an elastic bandage until the removal of the two threads (35 days after the surgery without any anesthesia). Results, valued by the Trillat and Mounier-Kuhn score, were good or excellent in 92% of cases. The mean AOFAS score was 96 points. No re-rupture occurred to our patients. We noticed three cases of rupture following the surgery but in a tendon zone not interested by the previous lesion.

Conclusions We think that this surgical technique is safe, easy and quick and offers a great advantage in comparison with the other traditional methods. This technique allows a clinic healing by an immediate mobilization and a quick load. Moreover, by using the mini-invasive approach we can preserve vascular support of paratenonion and avoid the well-know complications following the open surgery or the close therapy.

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External fixation, non-invasive technique in fracture's treatment

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Introduction We consider external fixation a non invasive technique to be taken into consideration for limb traumatic pathology treatments. In fracture treatments we have to consider a method concerning: (1) immobilizing to relieve pain; (2) assuring a good

alignment; (3) unchanging consolidation process; (4) avoiding the risk of complications; (5) restoring the function quickly.

Through the positioning of two or three pins for clamp, with least incisions of 1 cm approximately we succeed in treating different types of fractures, without opening the focus. To understand the philosophy of dynamic external fixators, understanding the physiology of the biological process of fracture consolidation is required firstly.

Phases of bone reparation

1. Reparation with granulation tissue
2. Formation of the primary callus
3. Formation of the definitive callus

Dynamic axial fixators respect the biological process of fracture consolidations. In the initial stage of the process, rigidity and axial movement graduality is respected, while in the advanced ones, controlled and progressive movements in the area of the fracture is achieved.

Material and methods Out of 360 external fixators used to treat different orthopaedic and trauma pathologies, 228 were used for diaphyseal fractures treatment and 31 for articular fractures. We employed in all cases different models of Orthofix external fixator created and developed by Prof. G. De Bastiani and col. (University of Verona).

Discussion The advantages of Dynamic Axial Fixators are: (1) least perturbation of the fracture area; (2) non invasive technique; (3) non synthesis material in fracture focus; (4) stimulated bone callus; (5) respect of bone biology; (6) smaller loosening of pins and infections. We can (1) do corrections of bony defects, without altering bone long, with callotasis and bony transport, (2) treat multifragmentary, diaphyseal, metaphyseal and articular fractures, (3) perform free access to treatment of soft parts and (4) achieve precocious mobilization of the patient.

Conclusions We consider dynamic axial fixators an excellent method in the treatment of complex limbs fractures. In fact, biological concepts of fracture's consolidation are respected, with the containment of reduction and solid initial immobilization. Being a non invasive technique, the best control of possible infections and greater facility in the treatment of soft parts is achieved, together with lesions and correction of bony defects, leaving the near articulations free to avoid rigidity.

Treatment of non-unions with (Orthofix) dynamic axial fixator

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Objective The experience acquired in the treatment of non-unions of the long bones, with external fixators is presented. Orthofix dynamic axial fixator proved to be, with respect to rigid fixators causing bone healing problems and still pseudoarthrosis, an excellent method for pseudoarthrosis treatment.

First evaluation must include: (1) physical and mental condition of the patient; (2) quality of the soft tissues; (3) range of movements in joints.

Aims of the treatment are: (1) improvement of bone and soft tissue quality; (2) correction of length and angulations; (3) mobility of adjacent joints

We classified them accordingly to their treatment in: hypertrophic non-unions, atrophic and infected.

Material and methods From 360 external fixators placed in order to treat different kind of orthopedic and traumatic pathologies, 74 corresponded to the treatment of upper and lower limbs non-unions. Evolution before surgery was, from 7 months to 20 years. Types: 18 hypertrophic; 22 atrophic and 34 infected. Patients consisted in 23 females and 51 males, ranging from 12 to 82-year-old. We used in all cases different models of Orthofix external fixator created and developed by Prof. G. De Bastiani and col. (University of Verona). The treatment should follow three principles: (1) realignment; (2) stabilization; (3) stimulation. In hypertrophic non-unions, the method included two steps: first 4–6 week compression, then dinamization progressively. In atrophic non-unions, bone graft from iliac crest was routinely employed, followed by dinamization after the appearance of the early radiological evidences of bone callus formation. In infected non-unions, primary toilettes were achieved, followed by external fixator placement in order to give strong and sustained compression.

Discussion The evaluation of the results was carried out using the following parameters: (1) bone healing; (2) correct alignment of the fragments; (3) range of motion similar to the preoperative; (4) shortening; (5) non-unions or amputation.

Conclusions Advantages D. A. F.: (1) minimum surgical traumatism; (2) no implants in the focus; (3) easy placement; (4) initial rigid fixation; (5) free access to repair soft coverings. The bone healing was obtained in 94.6% of the cases, with satisfactory results in 81.5% considering the dynamic external fixation an excellent choice for the treatment of non-union.

SESSION 14

Mechanical problems in femoral rear-nailing after periprosthetic fractures of the knee

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Retrograde intramedullary (IM) stabilization of unstable supracondylar femur fractures has become the treatment of choice for many fractures based on biologic and mechanical considerations. This resulted in early recovery, lesser hospital stay, and early rehabilitation of patient with good results.

The presence of the intramedullary nail, however, introduces the potential for high concentration of stress at its proximal end. Moreover, finite element analysis showed an increased stress concentration around the proximal locking screws with an higher risk for fatigue fracture when an unused screw hole of the diaphyseal region occurs. To prevent undesired stress concentration at the proximal end of the nail, the careful selection of the proper nail length is recommended. Use of the longest possible intramedullary nail for supracondylar femur fractures improves fracture stability and reduces the risk of hardware fatigue failure.

Anatomical positioning of the nail in the middle of the medullary canal avoids impingement of the tip of the nail with the cortices of the femur preventing further risks of a fatigue fracture after cyclic physiological loading.

Fibula for tibia: traditional method still actual?

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The “fibula for tibia” constitutes an historical intervention of orthopaedic surgery, that was employed for solving connected important problems in the infectious and in some neoplastic lesions of the tibia. The reconstitution of the skeletal continuity, when it is not possible to

use osteosynthetic metallic tools and/or homoplastic transplants, can be obtained with this technique that, in our opinion is able, still today, to give, the correct indication when the basic pathology occurs in conjunction with other systemic diseases. We present our experience obtained on a series of 10 observations, of which 7 related to chronic osteomyelitis of tibia and 3 on adamantinomas, one of which had a recurrence. Diabetes was the systemic disease found most frequently in our experience and was also the cause of failures in interventions performed before the technique in examination. In one case the “fibula for tibia” was performed in conjunction with a following intervention of plastic coverage through a sural flap. The follow-up of this technique goes from a minimum of 4 years to a maximum of 16 years.