

ABSTRACT

Periprosthetic distal femoral fractures (PDFF) constitute an unpleasant complication in patients with a total knee replacement (TKR). The incidence reported in literature is 0,3–2,5 %. The number of periprosthetic knee fractures has been increasing due to the ageing of population, a growing number of implants, a longer life expectancy of patients, a more intensive physical activity of patients, and osteoporosis. Most of these fractures are treated surgically, non-surgical treatment is reserved solely for patients unable to undergo a surgery for general health conditions.

Our retrospective study evaluated the group of patients with PDFF who were treated at our department in the period 2007–2020 and 4035 primary TKR were performed. The total number of patients with PDFF was 88. The mean age of patients with PDFF was 77 years (56–94 years) and at the time of fracture the mean age was 71 years in men and 78 years in women. The average time from the TKR to periprosthetic fracture was 8.2 years (0–20 years). The fractures were assessed using the Su classification modified by Krbec.

A primary TKR was performed in 75 cases for gonarthrosis, in 7 cases for rheumatoid arthritis and in 6 cases for secondary, post-traumatic gonarthrosis. The average incidence of periprosthetic distal femoral fractures was 6 cases per year. Women represented 86 %, men 14 %. Su Type I fracture was diagnosed in 23 % of cases, Su Type II fractures in 67 %, and Su Type III fractures in 10 %. 70 patients with PDFF were treated surgically, in 18 cases conservative treatment was opted for. The average treatment time of PDFF to healing by callus formation was 6.6 months (3–12 months). Mortality during the first 3 months after osteosynthesis of PDFF was 9 %. A failure of osteosynthesis of PDFF was reported in 4 cases.

We dealt with biomechanical studies of the transfer of forces in the area of periprosthetic fracture of the distal femur in individual types of osteosynthesis with applications in practice in the experimental part. The aim of the study was to determine the biomechanical properties of different types of osteosynthesis of a periprosthetic fracture of the distal femur - we monitored the tension in the implant and the dislocation in 3 planes during axial and torsional loading. The behaviour of osteoporotic bones and implants was analysed using a computer finite-element model. The study was carried out in cooperation with the NTIS – New Technologies for the Information Society Research Centre of the Faculty of Applied Sciences of University of West Bohemia. Five types of osteosynthesis were chosen: angled blade plate, DCS plate, NCB plate, LISS plate and DFN. Of the three monitored targets, we managed to achieve only the first target - the DFN nail had the greatest rigidity under axial loading. The other two objectives were not confirmed.

Multiple classification systems were developed to assess these fractures. The most appropriate we consider the classification of Su et al. classifying the PDFF into 3 groups, namely based on the height of the fracture line relative to the femoral component. Osteosynthesis by retrograde femoral nail is indicated for periprosthetic fractures, with

sufficient bone mass in distal femur, which allows stable distal fixation. The new generation of anatomically shaped angular stable implants gives us yet another option for osteosynthesis of PDFF. Many studies point at the advantages of these implants in osteoporotic bone as against the conventional plates.

The number of PDFF has been increasing. The main methods of internal osteosynthesis continue to be the angular stable plates and the retrograde femoral nail. Preoperative planning is important to determine the type and dimensions of the existing femoral component and to distinguish whether or not it has come loose. The choice of the implant may depend on the bone mass available for distal fixation. The retrograde femoral nail is usually the most suitable method of treatment for proximal PDFF (Su Type I). The angular stable plates can be used for PDFF originating at the femoral component (Su Type II and Type III). Very distal fractures classified as Su Type III with a loose femoral component require a revision surgery with a TKR with stems. The surgeon should be prepared for a revision surgery if the intraoperative finding is more complicated than anticipated based on the preoperative radiograph.