



Editorial

Interprosthetic femoral fracture: Crime or punishment?



Crime or punishment? Given the risk of femoral fracture around an implant, should we hesitate to perform total hip or knee replacement (THR, TKR) when there is already an implant at the other end of the femur? Probably not—but subject to certain precautions! Arthroplasty shows major proven benefit for the patient in terms of pain, function, cardiorespiratory capacity and well-being. Even so, caution is needed to avoid femoral periprosthetic fracture (PPF), and especially its major form: interprosthetic fracture (IPF).

In absolute numbers, PPF is becoming ever more frequent, although the percentage rate is not rising: it is gerontologic traumatology that is increasing [1]. The absolute increase can be explained by several factors: firstly, increasing numbers of THR and TKR in developed countries, and more particularly an increase in the number of implant revision procedures, especially for TKR with femoral shaft extension [2]; and secondly, rising numbers in the 3rd and 4th age groups, with dual impact: increased risk of fracture (of the femoral neck, and PPF), and increasing problems of lower-limb joint degeneration.

PPF mainly affects elderly patients with multiple morbidity, who are, therefore, especially fragile [3–5]: in this population, mortality is comparable to that seen following proximal femoral fracture [1,5]. Furthermore, PPF increasingly occurs in complex clinical situations. The French Society of Orthopedic Surgery and Traumatology (SoFCOT) fully recognized this in the conclusions of its 2005 symposium [6], scheduling a symposium on periprosthetic fracture around TKR for 2020.

One particular form of PPF to be distinguished is IPF. Local anatomic features often make IPF surgery complex, sometimes even necessitating total femur replacement [3–5], with only moderate clinical results and high rates of septic complication (11–44%) and dislocation (7–43%) [7]. Bone stock is diminished, and osteoporotic cortical bone is jeopardized by implant loosening of greater or lesser severity. In case of very low bone stock, some authors advocate replacing the fracture by a sleeve cemented onto the adjacent implants [8,9]. The mechanical stability of these assemblies seems promising [8] and clinical results have been satisfactory, although with only 4 cases [9]. There was no classification of IPF highlighting this potential complexity until Soenen et al. (2011) [4] added a type D to the Vancouver classification, making a link between PPF classifications for the hip and for the knee. Type D well represents the surgical problem, corresponding to an implant-free length of at least one-third of the femoral shaft. Such cases of IPF are relatively rare according to the literature [3–5,10], although series have not been large: to the best of our knowledge, the largest was the French GETRAUM series, with 51 cases [5]. IPF shows

wide anatomic diversity: fracture localized in the part of the shaft between the two implants, fracture around one implant loosened, by trauma or not, or extreme forms with loosening of both implants. There is further the possibility of mechanical deterioration in one or other implant, and of simple change of bearing being jeopardized in an old or obsolete design.

Some risk factors for IPF have been identified: (1) low bone stock, with widened medullary canal and/or thin cortical bone [11], especially just below the stem of a THR [12]; (2) poor bone quality; and (3) loosened implant [13]. The relevance of inter-implant distance is discussed: according to some authors, short distance was a risk factor in static experimental conditions [14], whereas others found no association [15], although, paradoxically, loading was maximal with zero inter-implant distance [15]. Experience shows that IPF most often occurs when the distance between the two shaft implants is small [4], suggesting that it would be wise to implement a distance of two shaft widths between the two stem tips, requiring preventive fixation below this distance [14].

Morbidity and mortality is high, and greater in IPF than PPF; IPF patients are more often elderly and fragile and the obvious technical difficulties incur a risk of infection (24%), local mechanical issues, with a 24% rate of major revision surgery, and high mortality (31%) [5]. Multidisciplinary teamwork with geriatricians may be necessary for medical management of the peri- and postoperative periods.

According to the clinical situation, there is no room for error in treatment. The surgical option chosen needs to be the right one, performed with the utmost rigor. The whole femur must be fixed and stabilized. The literature is in favor of locking plates in PPF and even more in IPF [3–5,9], although polyaxial screws have not demonstrated any superiority [16]. Whether the plate is used via a conventional or a minimally invasive approach (with less morbidity), fixation should begin at the femoral condyles and continue up along the shaft. Some authors recommend a minimum overlap of at least 2 cortical diameters between plate and stem [17], while others advocate at least 6 cm [18]. In a mechanical study, Auston et al. (2015) [19] found that adding an anterior locking plate to the lateral plate increased assembly resistance. Radiologically, a review of the literature reported higher rates of non-union and re-fracture after conventional surgery and a higher rate of non-union with non-locking plates [20].

In our opinion, management also involves prevention. Falls should be avoided, with geriatric follow-up (biological, ocular, muscular and neurologic). Regular radiologic and clinical implant follow-up is needed to enable early treatment of loosening, thereby

avoiding the very complex situation of major osteolysis and PPF. This is fundamental but unfortunately too often overlooked, although highlighted by the 2005 SoFCOT symposium [6]. Careful thought should be given in the case of an implant-bearer requiring arthroplasty at the other end of the femur. If the indication is well-founded and a standard implant is considered, there is no reason to hesitate. If, on the other hand, a constrained implant with long keel/stem is indicated, and even more in case of implant revision, preventive femoral fixation should be considered. Some teams take into account of postoperative IPF risk by associating femoral fixation to implant revision or implantation of a long keel/stem. However, an interprosthetic space located low on the femoral shaft seems to reduce the risk of IPF [12].

Crime, then or punishment? It's hard to say. . . Given the risk of femoral fracture around the implant, should one hesitate before implementing THR or TKR when the other end of the femur already has an implant? Certainly not! Ongoing progress in orthopedics and traumatology is revealing new situations and particularly, anatomic entities. The epidemiology of traumatology is changing: IPF is an excellent example, requiring technical innovations combining skills in traumatology and in prosthetic reconstruction, and an attitude of prevention which is not yet part of our habits. We need to be aware of the role we have to play in preventing these fractures, which jeopardize function and may be life-threatening in this older and more fragile population. Implant monitoring should be regular and rigorous, and complementary femoral fixation should be considered in case of revision surgery or implantation of a long keel/stem.

Disclosure of interest

The authors declare that they have no competing interest.

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Received 26 February 2019

Accepted 2 March 2019