

Case Report

Prosthetic extension stem with locking plate for periprosthetic supra-condylar femur fracture above a total knee arthroplasty: a case report

Youqiang Sun¹, Min Shao², Zelai Yu², Qinsheng Wang², Ting He², Qiushi Wei³, Wei He³, Leilei Chen³

¹Guangzhou University of Chinese Medicine, No. 12 Jichang Road, Baiyun Distract, Guangzhou 510405, China;

²Third Affiliated Hospital of Guangzhou University of Chinese Medicine, No. 22 Qingzhu Street, Jiangnanxi Road, Guangzhou 510240, China; ³First Affiliated Hospital of Guangzhou University of Chinese Medicine, No. 16 Jichang Road, Baiyun Distract, Guangzhou 510405, China

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Abstract: In order to revise a complex periprosthetic femur fracture which was classified as Rorabeck III pattern of a total knee arthroplasty of an old female, we designed a new fixation method which was implanting a suitable extension stem matched with the femoral prosthesis, and also along with osteotomizing the femur, fixating an lateral locking plate, grafting the contralateral iliac bone and blinding a steel wire to the fracture line. Though extremely complexity of the revision procedure, the operation was successful eventually and the patient got a good result without any complication. At the time of follow up in the second year, the knee had reached up to the bony healing without any painful, heating and swelling. Her ROM function could reach up to 0-105 degree, the VAS score had been reduced from 6 to 0, the KSS score had improved from 50 to 89 and the SF36 score also had increased from 69 to 105. She could be independently living by herself and took part in different kinds of social activities. However, the good result she got was just at the recent time, for she had been followed up only for just 2 years, and the long-term durability still needed a continue follow up.

Keywords: Total knee arthroplasty, periprosthetic supra-condylar femur fracture, treatment

Background

Periprosthetic femur fractures above a total knee arthroplasty is an uncommon but highly challenging injury and it tends to occur more frequently in the supra-condylar region above the total knee arthroplasty components [1]. The probability incidence of periprosthetic femur fractures can be 0.6% in 5 years, this rate can reach up to 1.7% after a revision, and the incidence of the distal femoral fracture after total knee arthroplasty can range from 0.3% to 2.5% [2]. However, the treatment of this kind of fractures would be full of complexity and difficulty. It affected by many factors such as complete equipments, peri-operative supports and surgical skills of both trauma and revision arthroplasty services [3, 4]. The predisposing factors are female gender, poor bone stock, rotational constrained implants, stress risers such as screw holes around the knee, mal-

alignment of the prosthesis, endosteal ischemia, anterior femoral notching, arthrofibrosis, chronic steroid hormone use, rheumatoid arthritis, revision total knee arthroplasty poliomyelitis and neurological diseases such as epilepsy, parkinson's, cerebellar ataxia, myasthenia gravis, polio and cerebral palsy.

Several options can be chosen to provide a secure internal fixation of supra-condylar fracture of the distal femur [5-11], such as condylar plate, less invasive stabilization system, retrograde intramedullary nail, dual plate fixation. Many elements should be considered into our mind in choosing an appropriate management method for the fracture which including the patients' general health, the fracture pattern, the fracture location, the displacement and the type of implantation [12]. Periprosthetic fractures above total knee arthroplasty have particular risks for failure, including wide metaphy-

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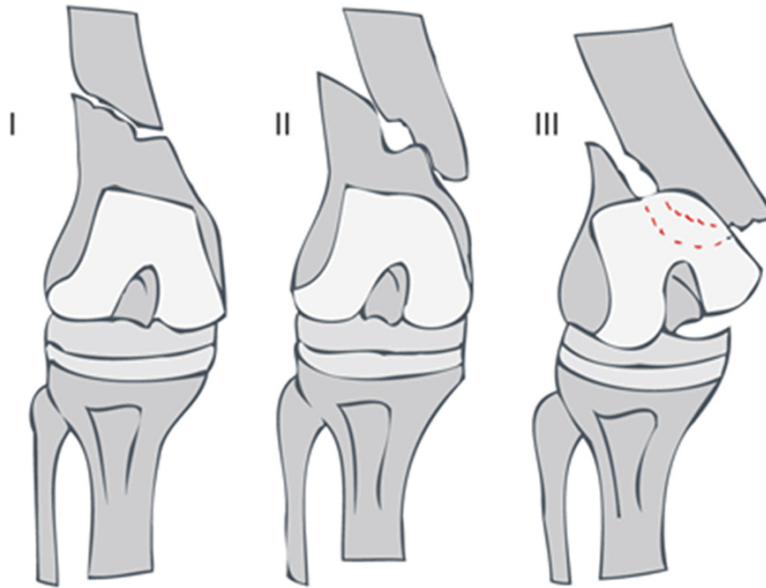


Figure 1. The Classification of supra-condylar femoral fractures above total knee arthroplasty created by (Rorabeck & Young, 1999).

seal and diaphyseal spaces, osteoporosis, small distal femoral fragments, and prosthetic anchorage pegs reducing the sites for fixation [7]. The surgical options including intramedullary devices, condylar buttress plates and, more recently, locking plates [13].

In the following case report, we described a surgical treatment and a follow up of two years clinical results of the patient with this challenging combination of problems. The patient was managed with implanting a suitable extension stem matched with the femoral prosthesis. In the procedure, we osteotomied the femur, fixated it with an lateral locking plate, grafted the contralateral iliac bone and blinded a steel wire of the fracture line. During follow up, the patient was informed that the data concerning this case would be submitted for publication, and she consented.

Case presentation

A sixty-six-year-old woman presented to us with Swelling, serve pain, limitation of movement above the right knee after a primary total knee arthroplasty. Attributing to a severe osteoarthritis, she received total knee arthroplasty. But this time, she fell down from the lift to the ground at home. Before this accident, her flexion function of the right knee could be up to

100 degree without painful and swelling. According to the classification system of supra-condylar femoral fractures (**Figure 1**) [14], she could be classified to be the Rorabeck III pattern. She had no previous history of other diseases and in hospital experience excepting the last time when she received the TKA surgery in our hospital and neither did she had any drug and food allergies history. She married in an appropriate age with a calm personality, and she had no any other bad habits. The KSS function score of the knee was 49 points at the time of her presentation. After a comprehensive examination of

her, we found there were no contraindications for her to have a revision surgery. This case was discussed in detail and the woman decided to receive a revision surgery two days later. The preliminary plan of this surgery was to implanting a suitable extension stem which was matching with the femoral prosthesis, along with osteotomied the femur, fixating an lateral locking plate, grafting the contralateral iliac bone and blinding a steel wire of the fracture line.

The figures of the intro-operative procedures are affiliated below (**Figure 2**). We conventionally opened the knee, exposed the prosthesis and fracture line, then gradually hollowed out some bone in order to form a hole for implanting the extension stem from the entrance of the inlet spot of the femoral prosthesis. We retained the bone stock of both 0.5 cm height both from the anterior and posterior sides and about 1 cm height from the left and right sides so as to form a suitable diameter tunnel for the slotting and fixating of the extension stem. At the same time, setting a 6 degrees valgus angle of the extension stem with the prosthesis when implanting to the marrow cavity, then we tightened up the nut to the femoral prosthesis at the entrance of the inlet spot. As it was difficult to insert the extension stem to the proximal femoral, we truncated the femur at a place of 10 cm distance to the button of the femoral prosthesis,

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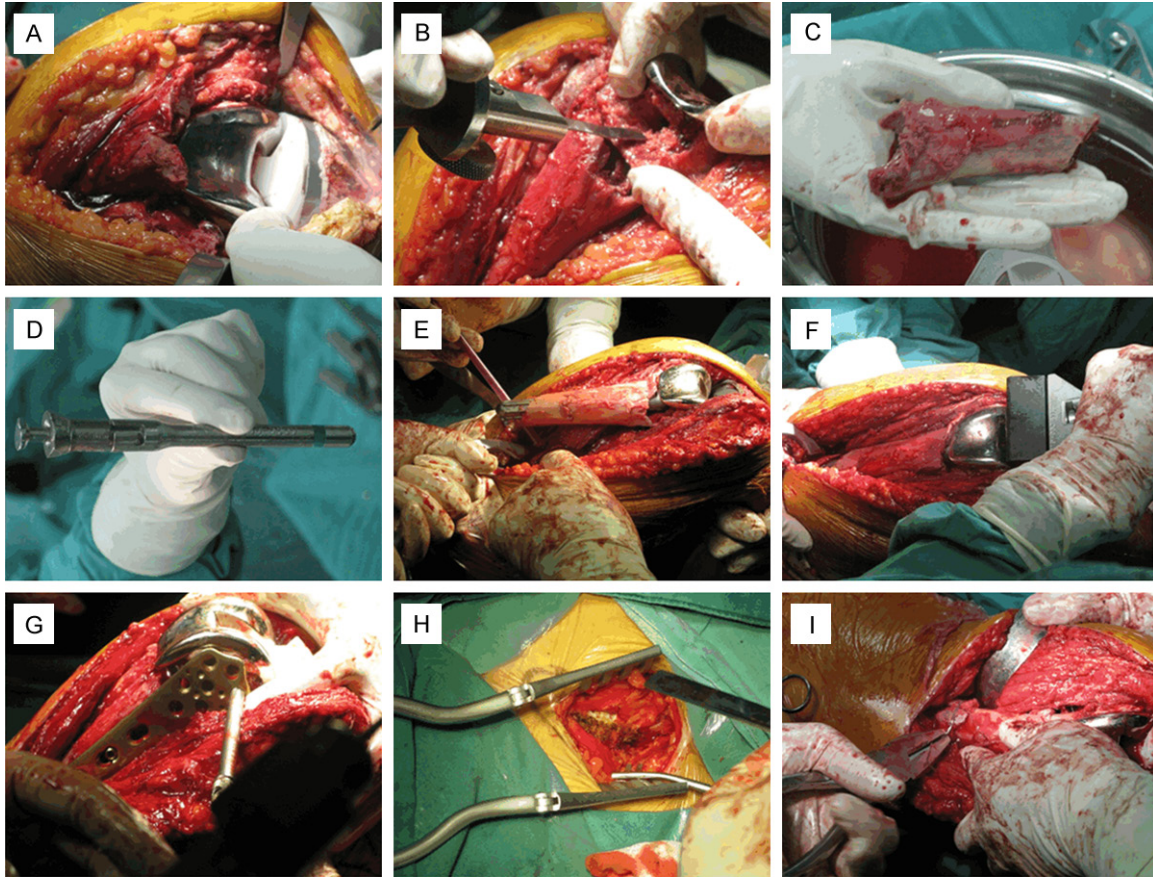


Figure 2. The procedures of the surgery. A. The fracture in and above the prosthesis. B. The tibia slotting. C. The truncated proximal femoral bone. D. The free prosthetic extension stem. E. The prosthetic extension stem installing. F. The prosthesis fixating. G. The locking plate installing. H. The iliac bone taking for grafting. I. The wire binding.

after the extension stem was inserted to the truncated femur, there was about 1.5 cm of the stem exposed outside of the top, we stretched the low limb and then successfully inserted it upward to the proximal femur, after finishing that procedure, we tested the stability of the bone at the fracture and truncated line, to our satisfaction, we found it a heavy stability and the fracture was already in good anatomical position on the fracture line. The PFC prosthesis of the Company of Depuy provided us such a chance that we can insert a extension stem from the entrance of the inlet spot of the femoral prosthesis, which is the only one kind of prosthesis designed for a second matching that we experienced in our career.

Considering the complexity and difficulty in the surgery skills as well as the high complications in the perioperative period, the revision procedures of the case is full of heavy trauma and huge risk. It was reported the prosthesis might

be affected by some uneven or excessive force [15], we then used a lateral locking plate (Synthes company) to help strength the fixation, because we hope it more stable [8]. Why didn't we using the intramedullary nail [9]? For in this case, there was no room for implanting an intramedullary nail, and we also could not setting the valgus angle if we using the intramedullary nail at the situation but not remove the primary prosthesis; Why didn't we use the locking plate? On the one hand, it could not obtain a stable fixating for just applying only one locking plate, and there was also a high complication rate for locking plate fixation of periprosthetic distal femur fractures in patients with total knee arthroplasty [16]; On the other hand, if we took out the femoral prosthesis, we could not insert such a stable femoral prosthesis anymore. As the bone and prosthesis fit so well, there was no need to take an adventure to clear the cement and choose a suitable femoral prothe-

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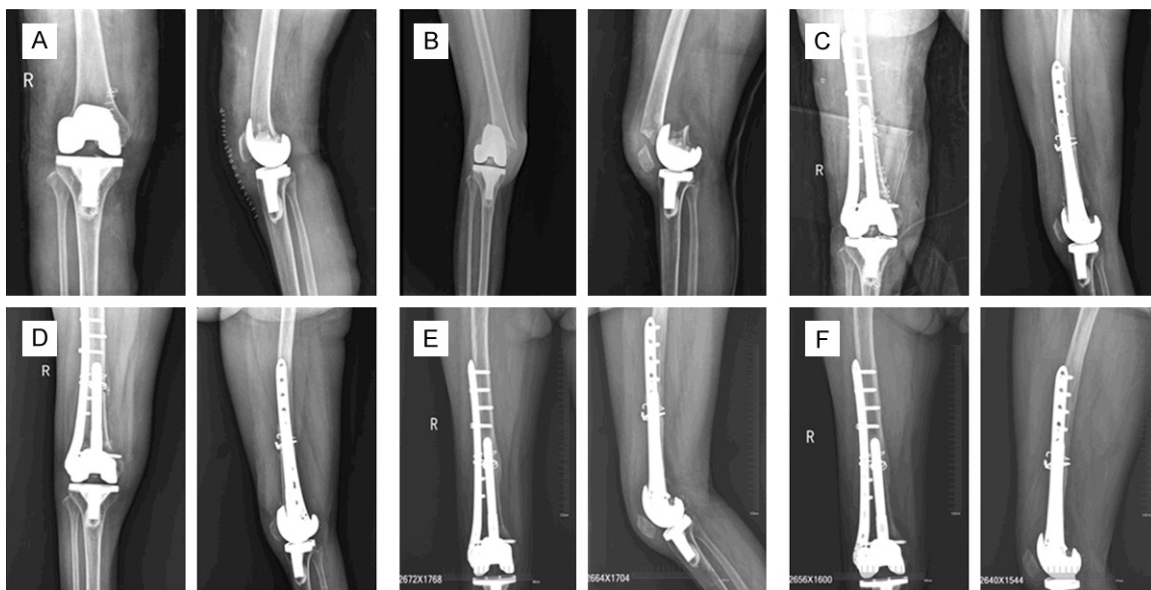


Figure 3. A. The patient's TKA X-ray (4 months before the revision). B. Periprosthetic supra-condylar femur fracture after falling down. C. 1 day after the revision operation, we see a good anatomical position on the fracture line. D. 3 months after the revision operation, we can see the bone was growing. E. 1 year after the revision operation, we can see the fracture lines have already disappeared. F. 2 years after the revision operation, the bone has already strengthened and the fixation was also stable.

sis which cost much. After the surgery, we conventionally did a pain relief, heat clearing, blood clots preventing, anti-inflammatory treatment as well as the functional training guiding. We also did a follow up in a regular three months (the X-ray outcomes are shared below **Figure 3**), and this time when she came up for the subsequent visit, we found a good function of her knee, the knee had reached up to the the bony healing, without any painful, heating and swelling. Her flexion function of the revision knee could reach up to 105 degree, the extension function could reach to 0 degree, the KSS function score of the knee was 89 and what the most important thing was she could be independently living by herself and took part in different kinds of social activities.

Discussion

Within the near future, our orthopedist are supposed to facing with an increasing number of periprosthetic fractures above a preoperative total knee arthroplasty [17, 18]. In many situations, the management of these fractures involving with challenging problems for the treating surgeons and also for the patients [9, 19], they are really exhausting problems that we should carefully deal with. When our sur-

geons facing with these injuries, they must be aware of the complexity of the technical demands, and should require an adequate analysis of the etiology, the prognosis and a corresponding transfer into an individual treatment concept [17, 20]. As we all known that the intramedullary nail, locking plate, LISS fixation system, revision procedures all have their indications, contraindications and complications, merits and demerits [10, 11, 20]. So we should strictly understand the advantages and disadvantages so as to make a good choice.

Previous literature reported that the only use of intramedullary nail, locking plate, revision procedures would not always promise a good result and always saw with high complications in different kinds of fixating means [10, 11, 20]. In dealing with this case, we did a systematic preoperative discussion, and the decision of mating of a prosthetic extension stem with an locking plate for treatment was based on our fully considering of both the specific characteristics of the implant, the patient-specific factors and some economic issues of the patient herself. The woman was a laid-off worker with a severe osteoporosis and belongs to a RorabeckIII pattern fracture. Although there was rare report of this kind of surgery practice, we did it in our

own plan. Undeniably, we experienced some difficulties such as the implanting the extension stem and the femur osteotomizing during the surgery. Luckily, the procedure turned out safety and during our follow up period, the patient thoroughly got a good function compared with the reported outcomes of intramedullary devices, condylar buttress plates and bilateral locking plates. In the study, we did not need to use the statistical analysis method as it was just one case. At last, her knee had reached up to the bony healing, without any painful, heating and swelling, the ROM function could reach up to 0-105 degree, the VAS score had been reduced from 6 to 0, the KSS score had improved from 50 to 89 and the SF36 score had also increased from 69 to 105. Obviously, the patient obtained a good result after the revision surgery. However, the good result she got was just at the recent time, for she has been followed up only for just 2 years, and the long-term durability of this construct is still unknown.

We suggest Rorabeck III pattern as the indication of the prosthetic extension stem with locking plate for periprosthetic supra-condylar femur fracture after the total knee arthroplasty. According to the Rorabeck classification system, the Rorabeck III pattern is of much complexity which means easy for failure. When the condylar is involved in the fracture, it is hard to fixate only with an plate for internal fixation because there is also a high complication rate. Besides, it is also difficult in using double steel plates fixating at both sides of the fracture, as there is no room for the fixation in the condylar place and the fracture line. In addition, we also could not setting the valgus angle if we using the intramedullary nail but not remove the primary prosthesis. The single intramedullary nail cannot permit stable fixation and there is also no suitable intramedullary nail for this kind of fracture in the market. The prosthetic extension stem is the only one kind of prosthesis designed for a second matching for the primary prosthesis of TKA. It is really a new try and a new method in this case. This surgery seemed like a kind of a combination of both intramedullary nail and internal fixation in some degree.

Conclusion

Therefore, we do not advocate this surgical technique for all patients with a similar situa-

tion, but we present this approach as one option to be considered. We believe that for this kind of periprosthetic supra-condylar femur fracture, the surgical decision-making process must be individualized and the surgeon must consider both the specific characteristics of the implant failure and the patient-specific factors. Only after the individualized treatment plan been put forward, can we successfully promote the fracture healing, reconstruction of bone around implant and maintain joint function. For this case, the patient had received a comprehensive preoperative consideration and had already got a good function after 2 years of the surgery, but we will continue the follow up in order to get more evidence.

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Disclosure of conflict of interest

None.

Address correspondence to: Min Shao, Third Affiliated Hospital of Guangzhou University of Chinese Medicine, No. 22 Qingzhu Road, Guangzhou 510240, China. Tel: 020-84237774; E-mail: shaomin98@aliyun.com; Leilei Chen, First Affiliated Hospital of Guangzhou University of Chinese Medicine, No. 16 Jichang Road, Guangzhou 510405, China. Tel: 020-39351211; E-mail: yutian_1010@sina.com

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