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Original Article

Remove orthopedic fracture implant with minimal invasive surgery is good for the patient's early rehabilitation

Tiannan Zou[1*], Qiaohong Li[2*], Xiaoxiao Zhou[3], Zhao Yang[1], Ge Wang[1], Wei Liu[1], Chao Zhang[1]

[1]Department of Orthopedics, The First People's Hospital of Yunnan Province, China; [2]Department of Traumatology, The First People's Hospital of Yuannan Province, China; [3]Department of Orthopedics, Shanghai Pudong New District Zhoupu Hospital, China. [*]Co-first authors.

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Abstract: To explore the fact that minimal invasive osteosynthesis surgery could promote patient rehabilitate quickly. Patients needed to remove fracture fixation plates and screws in clavicle/femur/tibia and fibular bones were totally divided into two groups (conventional surgery group and minimal invasive surgery group). The operation time, intra-operative blood loose, post-operation 48 hours analgesic need, VAS score of 24-hours and 72-hours post-operation, post operation incision healing conditions, incision infection, patients' satisfaction about incision scar, and resting days were measured. Patients in the minimal invasive surgery group were satisfied with their scar condition than the conventional surgery group. There were no much difference between conventional surgery group and minimal invasive surgery group in operation time (46.3±10.2 minutes Vs 48.0±11.8 minutes) (P>0.05) and the blood lose in these two groups were 4 ml Vs 47.4±20.1 ml (P>0.05), respectively. There were no screws broken in both groups and all the implants were removed out successfully. Remove four limb fracture fixation implant with minimal invasive surgery is good for patients' early rehabilitation.

Keywords: Orthopedic fracture implant, Minimally invasive percutaneous plate osteosynthesis, rehabilitation

Introduction

Limb fractures are serious injuries and present a treatment challenge. Because they have the characteristic of high energy injuries and sometimes the damage is usually extensive and open fractures, compartment syndromes, and vessel injuries are commonly associated [1]. For patients with limb fracture, most of the patients received open reduction and internal fixation operation to treat the fractures [2]. After fracture healed with bone union, the patient usually required the orthopedic surgeon to take out the orthopedic implant. There are some possible reasons why the patients want to take out the implant: local skin irritation, local pain, local soft tissue infection, the surgeon require the patient to remove the implant, religion and culture reasons, and some other reasons [3].

Open reduction and internal fixation operative osteosynthesis were performed in the limb fracture needing operation osteosynthesis treatment since familiar to the operation techniques. To some experienced doctors, they also employ Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) techniques to treat limb fractures [4]. Surgeons with experienced surgical techniques and familiar with local anatomy were needed for the smooth process of MIPPO osteosynthesis [5]. Traditional open plating presents complications, such as, infection and delayed soft tissue breakdown, despite developments over past decades. Minimal invasive surgery does not need extensive skin and soft tissue dissection, the disturbance of local blood circulation in the fracture site is reduced and fracture heals quickly, and patient rehabilitates more quickly [6].

Since minimal invasive osteosynthesis surgery could promote patient rehabilitate quickly, and it could also promote patient's rehabilitation for patient who wants to remove the orthopedic

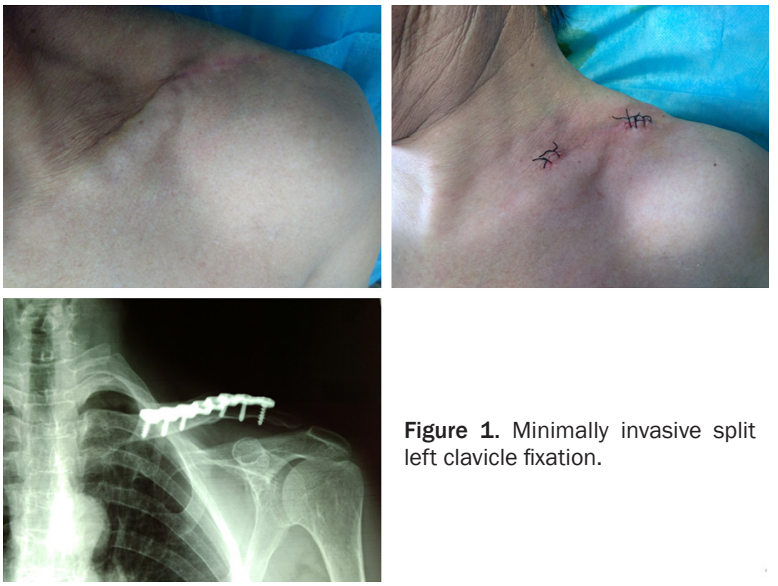

Figure 1. Minimally invasive split left clavicle fixation.

implant. However, there were seldom precise data reported in clinical. Here in this study, we performed the clinical research based on this consideration and reported our results.

Method

Patients needed to remove fracture fixation plates and screws in clavicle/femur/tibia and fibular bones were totally divided into two groups (conventional surgery group and minimal invasive surgery group) from July of 2013 to March of 2015. All the patients received fracture open reduction and internal fixation with osteo-synthesis plate and screws during their first operation. Patients in conventional surgery group received operations as such: original full length skin scar incision and soft tissue dissection, twist out the screws and take out the plate. However, operations as such: dissect only part of previous skin incision scar and soft tissue, twist out all screws and remove the plate through sub-skin tunnel for patients in minimal invasive surgery group.

A total number of 22 patients including 11 males and 11 females were involved in the conventional surgery group. The mean age was 42.5±13.9 years. There were 6 healed femur fractures, 9 healed tibia-fibular fractures and 7 healed clavicle fractures. A total number of 23 patients including 10 males and 13 females were involved in the minimal invasive surgery group. And the mean age was 42.5±12.9 years. There were 7 healed femur fractures, 10 healed tibia-fibular fractures and 6 healed clavicle fractures.

Statistical analysis

Statistics analysis was performed using SPSS software, version 11.0 (SPSS, Inc., Chicago, IL, USA) to analysis data in this study which included operation time, intra-operative blood loose, post-operation 48 hours analgesic need, VAS score of 24-hours and 72-hours post-operation, post operation incision healing conditions, incision infection, patients' satisfaction about incision scar, and resting days before return to pre-operation working conditions. Nonparametric categorical variables were performed by the Pearson's chi-square test and Fisher's exact test. Independent sample t test was used to compare the operation blood lose, operation time, post operation 24 h and 72 h pain VAS,. The level of significance was set at $P<0.05$.

Results

There were no much difference between conventional surgery group and minimal invasive surgery group in operation time (46.3±10.2 minutes Vs 48.0±11.8 minutes) ($P>0.05$) and the blood lose in these two groups were 4 ml Vs 47.4±20.1 ml ($P>0.05$), respectively. All patients' wound healed well and no surgical wound infection. There were no screws broken in both groups and all the implants were removed out successfully. Patients in the minimal invasive surgery group were satisfied with their scar condition than the conventional surgery group.

More oral analgesics were needed for patients in conventional surgery group to cope with post-operative wound pain compared with patients in minimal invasive surgery group (16/22 cases VS 9/23 cases). **Figure 1** showed that Vas in conventional surgery group were significantly higher than minimal invasive surgery group 24 hours after the operation (5.8±0.7 Vs 4.6±0.8) ($P<0.05$) and 72 hours after the operation (3.3±0.7 Vs 1.3±0.6) ($P<0.05$). After implant removal, patients in minimal invasive

Figure 2. Minimally invasive internal fixation of tibia and fibula demolition.

Figure 3. Minimally invasive internal fixation of femoral demolition.

surgery group needed to rest 24.3±5.6 days before they returned to previous work, which was significantly shorter than patients in conventional surgery group 29.0±9.1 days ($P< 0.05$). As concerning surgical wound length, minimal invasive surgery need less wound length to expose and remove out the implant compared with conventional surgery (**Figures 2**, **3**).

Discussion

With the development of operative techniques and orthopedic implant design and manufacture, orthopedic surgeon can now perform operative osteosynthesis of a lot trauma fractures that could not be treated well previously and got good results [7, 8]. Prompting operation after the trauma is good for patient's rehabilitation and preventing relevant complications for four limb long bone fracture. Plate and screws fixation is important method for treating four limb fractures. For some patients with indications fractures could be treated with Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) method, and got good therapy efficacy [9]. MIPPO has been widely applied to treat long bone shaft fractures in recent years because of its technical advantages and satisfactory clinical outcomes. The plate is inserted by a percutaneous approach with separate proximal and distal incisions. This method causes less soft tissue disruption and preserves the fracture haematoma and blood supply to the bone fragments. MIPPO operation requires that the attending surgeon master relevant operative techniques and relevant operation equipments are available. But in some underdeveloped area, conventional open reduction and inter fixation with plate and screws is very important fracture treatment method.

After four limb fracture healed, patients may require doctors to remove implant for such rea-

sons as: religion reason, local skin irritation, local pain and uncomfortable, local infection, local soft tissue allergy reaction to implant, and other reasons. General full length original incision had to be employed and a lot soft tissue has to be dissected to remove the implant for conventional surgery to remove the orthopedic osteosynthesis implant. Soft tissue injury is obvious after extensive surgical exposure, and which may delay the patient's recovery in this conditions.

In hospital with adequate equipment and optimal orthopedic implant, four limb fracture osteosynthesis could be carried out by MIPPO method, therefore, minimal invasive surgery method was taken into consideration in the orthopedic implant removed surgery. Minimal invasive surgery is widely carried out in surgery related department such as orthopedic surgery, general surgery and hepatic-bile surgery, thoracic surgery, cardiovascular surgery, urology and gynecology, it is safe and effective.

Compared with conventional surgery method, we found that after removing orthopedic implant with minimal invasive surgery, patients recovered more quickly. They returned to preoperation work much earlier, post operative incision pain degree reduced, patients need less oral analgesics to reduce incision pain. Reduced analgesics application could reduce analgesics related complications such as gastric bleeding and ulcer, analgesics allergy [10, 11]. The aim of minimal invasive surgery was to protect soft tissue instead of making as shorter incision as possible. Therefore, attention should be paid to protect major vascular, nerve and tendon. In surgical wound with inadequate exposure, major vascular, nerve and tendon might be injured [12-14].

The fact that patients in minimal invasive surgery group returned back to job earlier, which illustrated that removal orthopedic implant through minimal invasive surgery was good for the patient's early rehabilitation. And it could reduce patient's economic lose due to rest after operation.

In our present study, we find that remove four limb fracture fixation implant with minimal invasive surgery is good for patients' early rehabilitation. The patients experienced less pain and returned to work early. This kind of surgery is safe for the patients.

Disclosure of conflict of interest

None.

Address correspondence to: Chao Zhang, Department of Orthopedics, The First People's Hospital of Yunnan Province, No. 157 of Jinbi Road, Kunming City of Yunnan Province, People's Republic of China. Tel: +86-871-63638549; Fax: +86-871-63638549; E-mail: chaozhang2015@sina.com

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