

## Original Research

### Augmentation compression plating with bone grafting in aseptic non union shaft femur with nail in situ: a study of 20 cases

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#### ABSTRACT:

**Objective:** Nonunion of shaft femur is a common complication. Augmentation plating with retained nail is a novel method to treat these cases. **Method:** Twenty patients (18 male and two female) of mean age 37.5 years were treated by this method. **Results:** Union was achieved in all cases mean 7 months. **Conclusion:** Augmentation plating with retained nail is an ideal treatment option for aseptic non union shaft femur as this procedure requires less operative time and less blood loss as compared to exchange nailing. Patients are able to bear weight due to retained nail and plating helps to achieve compression at fracture site.

**Key words:** Nonunion, aseptic, augmentation plating, exchange nailing.

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#### INTRODUCTION

Femur fracture is common injury in orthopedics emergency and closed intramedullary nailing is now standard method of fixation in these cases<sup>1</sup>. Non union of shaft femur is also a common complication. Causes of nonunion may include insufficient stability due to short nail, lack of distal locking, misalignment in the upper or lower third fractures especially with comminution, and wide displacement of fracture fragments. Other causes of failure of union are devitalisation of tissues by trauma or open reduction, or the presence of distraction at the fracture site<sup>2</sup>.

There are numerous treatment methods in these cases such as exchange nailing, nailing converted to plate fixation, external fixator and bone grafting<sup>2</sup>. Exchange nailing was standard mode of management in such cases<sup>3</sup>. But due to high failure rate of exchange nailing treatment is shifting towards other procedure<sup>4</sup>.

Augmentation plating with retained nail is a novel method of treatment in these cases<sup>2,5</sup>. We reviewed result of augmentation compression plating with bone

grafting in twenty cases of aseptic non union femur with nail in situ. We used compression device to achieve compression at nonunion site. Use of compression device is not mentioned in English literature to best of our knowledge in these cases.

#### MATERIAL AND METHODS

Twenty patients (18 male and 2 female) of aseptic non union femur of mean age 37.4 years (range 18-52 year) were included in Study. 12 had atrophic and 8 had hypertrophic non union. 14 cases were done by open interlocking procedure identified by scar on lateral aspect of thigh. 7 cases already had exchange nailing with bone grafting. One case was operated twice earlier first for interlocking nail, which got failed. Then broken nail was removed and plating was done with bone grafting (figure 1). Unfortunately this procedure was also not successful. Finally augmentation plating with nailing and bone graft was done and union achieved (figure 2 and 3).

Our study was approved by institutional review board. Informed consent was taken from all patients. Neurovascular status of affected limb were assessed preoperatively. All cases were operated through lateral approach. After excising Fibrotic tissue, fracture site reduced and fixed with broad LCDCP on nail in situ (figure 4). Eccentric position of holes in broad LCDCP facilitates insertion of unicortical screw in front and behind nail (figure 5). Unnatural mobility and sclerotic avascular bony ends were common finding in every case. Compression was achieved through compression device. Bone grafting was done in all cases. Postoperatively physiotherapy was started next postoperative day for ROM knee. Partial weight bearing was started after six weeks. Full weight bearing was started after achieving union. Radiological union was reached when there was continuity of three cortices in antero-posterior and lateral view.



**X-Ray showing implant failure**

**Figure 1**



**Figure 2**



**Figure 3**



Figure 4



**Broad LCDCP with nail in Situ.**

Figure 5

## RESULTS

Union was achieved in all cases in mean 7(3-14) months. Radiological criteria of union was healing of 3 cortex out of 4.<sup>21</sup> There was no infection in any case. There was breaking of single screw in distal fragment while giving compression at fracture site in 6 cases. Mean follow up was 18 months (range 9 months to 3 years).

## DISCUSSION

The current definition of non-union of fracture is that will not consolidate without any further intervention independent from the treatment time<sup>6</sup>. According to Rosen non-union of fractures is defined as failure to achieve union in six to eight months. Clinical criteria are pain and tenderness at fracture site. Radiological criteria are absence of sign of union in x rays. The prevalence of nonunion in fracture of long bones is approximately 10 percent<sup>8</sup>. Smith and Morgan categorized aseptic nonunions as hypertrophic, normotrophic (oligotrophic), and atrophic. In hypertrophic nonunion, there is abundant callus and a persistent radiolucent line (the callus fracture sign<sup>18</sup>) at the fracture site. Atrophic or oligotrophic nonunion is characterized by the absence of callus and resorption of the bone ends which may be due to impaired vascularity. Non union is a difficult problem to treat. Fracture healing requires mechanical stability, vascularity, osteoinduction, osteoconduction and growth factors. These five factors are described as diamond concept of bone healing<sup>19</sup> and should be followed for treatment.

Currently, there are various strategies used to manage the nonunion of the femoral shaft. Exchange nailing with larger size nail is common mode of management in non union femur management. This method can result in high union rates of 78% to 96%, as reported by Forlong and colleagues<sup>9</sup> and Hak and coauthors<sup>10</sup>. There are many studies in literature to support exchange nailing but many studies have reported need of additional procedure after exchange nailing<sup>11</sup>. Niedzwiedzki and coauthors reported failure of exchange nailing in many patients of nonunion femur shaft. Therefore exchange nailing may be a good method of treatment but variable healing may occur especially in cases of atrophic non union. Reason may be the lack of compression or marked devascularization following trauma or open procedure. And only exchange nailing does not allow proper placement of bone graft<sup>20</sup> to act as scaffold (osteoinduction and conduction).

Chin -jung lin<sup>13</sup>, Choi and Kim<sup>14</sup>, Ueng and others<sup>15,16</sup> reported that plate augmentation with nail in situ is an effective method of treatment in non union femur. Nail in situ provide stability as a load sharing device, maintain alignment at fracture site and provide

rigid fixation so that patient can start full weight bearing early after procedure. Plating achieves direct compression at fracture site provides primary union and helps to place graft effectively. So this method offers extremely rigid fixation, mechanical stability, compression and autograft implantation, which promotes bone healing and increases union rate<sup>17</sup>. Ueng and colleagues<sup>16</sup> treated five patients with femoral nonunion and broken interlocking nail with the augmentative plating procedure, and bony union was achieved in an average time of 5.4 months after treatment..

Mean union time was 7 months in our study. There was no infection or joint stiffness in any case. Nail in situ helped to achieve early post operative weight bearing as well as maintaining reduction. During surgery plate application was easy as reduction was maintained. Screw were put obliquely in unicortical direction to side step nail . Therefore, plate augmentation leaving the nail in situ proved to be a simple procedure, with a short operation time and minimal blood loss. So our study indicates that this method is easy and more effective treatment option for management of all types of nonunion. Main reasons are compression at fracture site, effective graft placement and more stability due to presence of both plate and nail. One precaution is to see the level of nail near the articular area. If nail tip is near articular surface , compression device should be applied in proximal fragment to avoid intraarticular migration of nail. Partial weight bearing was started immediately and full weight bearing in two to three weeks. Review x rays done every six weeks till union achieved. Maximum follow up is 36 months.

We achieved union in all cases. So based on our experience of twenty cases, we strongly recommend this procedure. The combination of plate augmentation and bone grafting while leaving the nail *in situ* offers the benefits of triple attack on nonunion by extremely rigid fixation, the possibility of early-applied load-bearing force, and precise bone graft implantation. Compression at fracture site achieve primary union. So all these factors helps to achieve union. So weather the union is atrophic or hypertrophic plate augmentation is an effective method of treatment in all long bone fracture with nail in situ.

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