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PROCEDURES OF CONVERSION FROM PRIMARY EXTERNAL FIXATION TO SECONDARY INTRAMEDULLARY NAILING IN THE TREATMENT OF OPEN TIBIAL FRACTURES

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ABSTRACT

Background: *There are a lot of methods of treatment for open tibial fractures, such as casts, traction, internal fixation. Each method has its own advantages and disadvantages. Secondary nailing after external fixation is applied in treatment for open tibial fractures by surgeons around the world.* ***Objectives:*** *Establishing procedures of conversion from primary external fixation to secondary intramedullary nailing in the treatment of open tibial fractures and assessing treatment outcomes.* ***Method:*** *63 open tibial fractures (including type II, type IIIA, type IIIB) were done secondary nailing after external fixation at CanTho Central General Hospital from 11/2006 to 12/2011.* ***Results:*** *The overall final results were excellent in 52 (82.54%) cases, gGood in 11(17.46%) cases.* ***Conclusion:*** *The primary results showed that this is a potential method for treatment of the complicated open fractures of the tibial shaft.*

Keywords: *open tibial fracture, primary external fixation, secondary intramedullary nailing.*

I. INTRODUCTION

The management of open tibial fractures remains controversial. The rates of infection and nonunion are higher in Gustilo type IIIB than in types I, II, and IIIA open fractures. There are a lot of methods of treatment for open tibial fractures, such as casts, traction, internal fixation. Each method has its own advantages and disadvantages. Collaborating, promoting the advantages of each method to have an optimal treatment has always been studied. Secondary nailing after external fixation is applied in treatment for open tibial fractures by surgeons around the world. In Vietnam, it is still new method. This is the main reason for this study. This study plans to solve two objectives:

1. Establishhing procedures of conversion from primary external fixation to secondary intramedullry nailing in the treatment of open tibial fractures.

2. Assessing treatment outcomes.

II. MATERIALS AND METHODS

2.1. Materials

63 open tibial fractures (including type II, type IIIA, type IIIB) were done secondary nailing with SIGN nails after external fixation at CanTho Central General Hospital from 11/2006 to 12/2011.

2.2. Methods

A cross-sectional descriptive study

This study was carried out in the following steps:

Step 1: Selecting the candidates who are patients with open tibial fracture fixated with external frame.

Step 2: Removing the external fixation frame, temporary fixation with patellar-bearing plaster cast; bacterial culture from the specimen at the pin sites.

Step 3: Taking care the pin sites

Step 4: Secondary nailing with SIGN nails

Step 5: Postoperative caring and discharge.

2.3. Assessing treatment outcomes:

Evaluation of primary results: according to the Larson-Boston standard.

Evaluation of long – term results: according to the Ter-Schiphort standard.

III. RESULTS

3.1. Details of patients

Age and gender

The youngest patient was 18 years old, the oldest one was 70 years old. The mean age was 34.51 years old.

Fracture details

Fracture details (Gustilo classification)	Combined injuries		Patients (n=63)	Ratio (%)
	Yes	No		
Grade II	6	0	6	9.52
Grade IIIA	19	25	44	69.84
Grade IIIB	9	4	13	20.64
Total	34	29	63	100%

Inital soft tissue treatment (n=63*)*

Method of Inital soft tissue treatment	Gustilo classification			Total (%)
	Grade II	Grade IIIA	Grade IIIB	
Closed suture	6	25	0	31(49.21)
Apart suture	0	10	0	10 (15.87)
Opened wound	0	9	0	9(14.28)
Local flaps	0	0	13	13(20.64)
Tổng (%)	6 (9.52)	44 (69.84)	13 (20.64)	63(100)

The reduction result (n=63)

Reduction result	Patients (n=63)	Ratio (%)
No displacement	9	14,29
Small displacement	20	31,75
Lage displacement	34	53,96
Total	63	100%

The X-ray after external fixation showed that 53.96% of the large displacement, 31.75% of the small displacement and 14.29% no displacement.

3.2. Interval stage treatment

Soft tissue treatment after removing the external fixation frame (n=63)

Method	Patients (n=63)	Ratio (%)
Secondary suture	9	14.28
Thin skin graft	13	20.64
Nothing	41	65.08
Total (%)	63	100

Duration of external fixation (days)

The average duration of external fixation was 11.19 days (from 7 days to 16 days). The average duration of external fixation of grade II, IIIA and IIIB was 12 days, 10.57 days and 12.92 days. The difference is statistically significant ($p<0.05$)

Interval time (n=63)

The time interval between external fixation to tibial interlocking conversion ranges from 5 days to 9 days with average duration of 6 days in our cases. Any further soft tissue procedures if required carried out after tibial interlocking in same sitting. During this waiting period, general nutrition of the cases were also maintained with high protein diet.

The interval time of grade II, IIIA and IIIB was 5.33 days, 6 days and 6.31 days. The difference is not statistically significant.

3.3. Secondary nailing

Stage of secondary nailing

The time between external fixation to interlocking conversion ranges from 12 days to 24 days with average duration of 17.17 days

Average per operative duration taken for external fixation procedure was 45 minutes and range from 30 to 60 minutes. Per operative duration taken for tibial interlocking was range from 50 to 70 minute with average of 65 minutes.

23.81 % of our cases were done secondary nailing in the second week, 61.90 % at the third week and 14.29% at the fourth week after external fixation.

3.4. Results

*** At the wound**

62 patients achieved healing of the wounds, one patient was superficial infected in the skin graft area and got healing.

*** Long term result.**

Follow up duration in this study ranges from 12 months to 73 months with average duration of 42.98 months. All cases were followed up to end of the study. No cases were lost during the follow up in our study. The overall final results were excellent in 52 (82.54%) cases, good in 11(17.46%) cases.

IV. DISCUSSION

Management of open tibial fracture had evolved greatly. Previously open fractures of the leg were managed by casting with a window for wound care. The introduction of external fixator revolutionized the management of open fracture as it provided fracture stability with advantage of wound management. External fixator and intramedullary nail is currently the method of choice in the treatment of open tibial fractures. The combined use of these two methods in the treatment of open tibial fractures was advocated by many surgeons. Advantages of external fixation for the management of soft tissue problems with the advantages of intramedullary nailing in avoidance of malunion, reduced incidence of delayed union and early rehabilitation were added up. The use of external fixation for the initial management of Gustilo type-II and type-III open tibial fractures has proved successful in providing adequate initial stability and easy access to the wound. The best course of management after the wound has healed is less clear. There are many reports of the use of secondary nailing as a reconstructive procedure in malunion, delayed union and infected nonunion.

We have used the external fixator for temporary stabilisation while the soft tissues were reconstructed. Our aim was to return the patient to full function as

quickly as possible. Immobilisation in a plaster cast for a long time is often needed. Healing may then be in acceptable alignment, but there may be significant morbidity. We found a high incidence of nonunion, angular malunion and recurvatum; these patients required more radiographs and visited to the outpatient clinic. A high incidence of infection has been noted secondary to delayed intramedullary nailing.

We had one superficial infection among 63 patients (1.59%). Pin-site infection due to prolonged external fixation has been noted by many authors, and to reduce this risk many have decreased the time of external fixation with a planned interval between the removal of the frame and the placement of the intramedullary nail. We waited for granulation at the pin sites before secondary nailing, after a delay averaging 6 days, and gave antibiotics before operation. We were impressed by the overall efficiency of secondary intramedullary nailing, with significantly less time to union and fewer complications.

Many authors have published on the cause of infection in conversion from external fixation to secondary intramedullary nailing and trials of methods to prevent infection. Several authors have noted pin site infection due to prolonged external fixation. In contrast to the studies described above, Blachut et al and Wu and Shih found that a

shortened external fixation period (average 17—22 days), and longer interval before secondary intramedullary nailing (average 9—14 days) were key points in preventing deep infections [1]. Wheelwright and Court-Brown also showed that when secondary nailing was delayed until after granulation of the pin sites, secondary intramedullary nailing after external fixation was associated with a lower infection rate [10]. In addition, Respet et al proved in a canine model that pin site infection in the medullary canal correlated directly with the duration of pin insertion. Cultures of the medullary contents were positive for 3 weeks after removal of the pin, but when the pin sites were allowed to heal for more than 3 weeks, all of the cultures were negative. However, Tournqvist reported that four deep infections occurred in four patients with non-union stabilised by secondary intramedullary nailing after external fixation with a safety interval of an average of 218 days. Based on that report, a longer waiting interval does not always prevent deep infections.

From the results of the study, we found that the reasons for conversion from external fixation to intramedullary nailing are: (1) the fracture site is reducted and fixed better, (2) early weightbearing enhances healing and functional rehabilitation after fractures of the tibial, (3) avoiding the complication such as pin site infection, secondary displacement, delay union, nonunion.

According to Kazuhiko Yokoyama et al, important key factors preventing deep infection in this conversion method are summarised as follows: (1) early flap coverage by well-vascularised tissue within 1 week after trauma, (2) short duration of external fixation, (3) early unreamed intramedullary nailing, (4) debridement of the screw hole at the pin site and (5) slightly prolonged interval between removal of the external fixator and intramedullary nailing until complete healing of the pin site [4].

In our study, we did not indicate to convert from external fixation to intramedullary nailing for all cases. The indication is based on (1)local wound, (2) the characterictics and location of fracture, (3) fixation results after external fixation, (4) duration of external fixation, (5) general condition and the needs from the patients.

From the above, we have selected and indicated to convert from external fixation to intramedullary nailing for 63 cases in the following groups: (1) Unstable open tibial fractures with high risk of secondary displacement; (2) Open tibial fractures with large displacement after external fixation; (3) Patients who do not want to carry external fixator.

V. CONCLUSIONS

Now a day increasing treads were going towards early primary interlocking of compound grade I/II diaphyseal fractures of the tibia and also well established method of management of diaphyseal fractures without bone loss. Primary interlocking in Comp grade IIIA/B fractures are still controversial as study had shown high infection rate and high failure rate.

From the results of the study, we found that the success of the method is due to the following factors: (1) strict sampling: do not select the patients with clinical signs of

infection at the wound and/ or pin sites, (2) actively conversion in the early stage to limit the risk of pin sites, (3) early closure before conversion, (4) preparing for good general conditions and combined injuries (5) waiting for the granulation of the pin sites, (6) the bacterial culture of the pin sites and to guide the use of antibiotics when the bacterial culture is positive, (7) using antibiotics before and after surgery.

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