

## EVALUATION OF THE OUTCOME OF SURGICAL NECK OF HUMERUS FRACTURE TREATMENT WITH METAIZEAU NAIL

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### SUMMARY

**Objectives:** To evaluate surgical outcomes in treatment for surgical neck of humerus fracture with Metaizeau nail. **Subjects and methods:** Prospective study on 55 patients treated surgical neck of humerus fracture with Metaizeau nail from April 2015 to December 2018 at Saint Paut Hospital. Patients were performed Metaizeau technique of elastic stable intramedullary nails according to the principle of 3-point contact under C-arm fluroscopy. Criteria for evaluation including clinical results, functional outcomes postoperation according to classification of Neer CS. **Results:** 55 patients underwent successful surgery: 86.7% excellent, 13.3% good, no cases had fair or bad results. Clinical results, post-operative X-ray showed good functional outcome of the glenohumeral joint, no failure was observed. **Conclusions:** Osteosynthesis for fractures of the surgical neck of the humerus with Metaizeau elastic nail is a closed minimally invasive surgery and less damage to soft tissue, no loss of blood, shorter post-operative period, quick recovery. This technique may be the best choice for surgeons.

\* Keywords: Metaizeau nail; Surgical neck of humerus fracture.

### INTRODUCTION

Previously, osteosynthesis for fractures of the surgical neck of the humerus was once known as two popular open reduction internal fixation (ORIF) namely using intradumellary nails and using plates. Both osteosynthesis techniques have some disadvantages: The fracture has to be exposed with an incision length of 6 - 15 cm, causing soft tissue damage, periosteal loss, blood loss, sometimes causing capillary nerve damage, susceptible

to bacterial infection, bone healing delay, pseudarthrose [3, 4], long scarring and long treatment. Therefore, the current trend of surgical neck of humerus fracture treatment is osteosynthesis with Metaizeau nails based on the principle of 3-point contact and balance force was formed by the 2, 3 nails which are threaded symmetrically to create a relatively stable and flexible system for fractures to facilitate bone healing. This osteosynthesis type showed several advantages: No exposure of fracture, cosmetic surgical incision,

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less blood loss, lower antibiotic use, shorter treatment day, earlier rehabilitation and faster bone healing, less soft tissue damages, but still entry the nails to the intramedullary and create a stable osteosynthesis by controlling under the fluroscopy.

Around the world, several authors reported the procedure, technique of closed reduction with Metaizeau nailing. The references showed that none of techniques and procedures were applied for all cases. Each procedure or technique has its own advantages and disadvantages; however, and there are still some unknown aspects in applying this process such as: entering nail over fracture and threading nail in the medullary canal, reduction technique at different fracture levels, nail technique, distal nail enchore technique in the metaphyse... [5, 6].

In Vietnam, there have been some facilities applying Metaizeau nail technique for surgical neck of humerus fracture treatment [1]. There have not been systematic studies yet, with controversial issues including: Entry point, reduction technique, fluoroscopy technique, the technique of using nails to avoid getting stuck in the medullary canal space and displacement of the angle. In Vietnam, depending on the facility of hospital, study on how to apply this technical process to treat Vietnamese people and solve some surgical technical difficulties is needed.

Thus, we conducted this study aiming: *To evaluate the treatment outcomes of*

*surgical neck of humerus fracture treatment with Metaizeau nails.*

## **SUBJECTS AND METHODS**

### **1. Subjects**

55 patients (26 men, 29 women) aged from 19 to 79 years (mean age 60.85) were diagnosed with closed displaced fracture of surgical neck of humerus and underwent closed reduction and internal fixation with elastic intramedullary nailing (Metaizeau technique) at Department of Orthopedics, Saint Paul Hospital, from April 2015 to December 2018.

*\* Selection criteria:*

- Patient aged 18 years and above.
- Surgical neck of humerus fracture according to Neer's classification grade II and III.

*\* Exclusion criteria:*

- Pathological fractures.
- Deformed bone marrow canal.
- Patients did not agree to participate in the study.

### **2. Methods**

*\* Study design:* Prospective, descriptive, cross-sectional longitudinal study.

*\* Research contents:*

- Clinical examination and radiological evaluation preoperation.
- Equipements: C-arm image intensifier; orthopedic table; surgical tools.
- Local or general anaesthesia.
- Operative technique:
  - + Patient and instrument preparation.

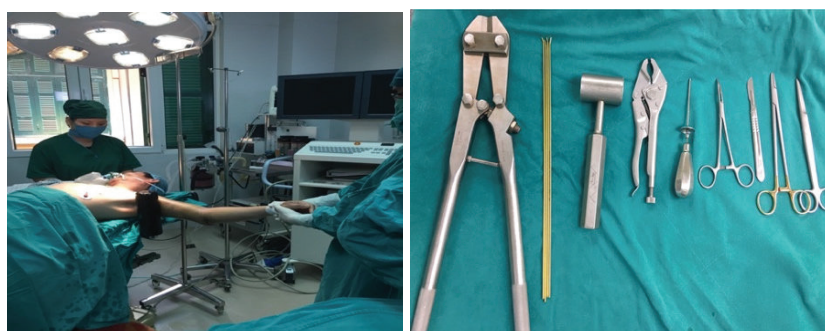


Figure 1: Patient position and surgical instrument.

- + The patient was placed supine on operating table, with a counter-pole placed in the armpit. Local or general anesthesia
- + Closed reduction under the fluoroscopy.



Figure 2: fracture Reduction under C-arm fluoroscopy.

- + Minimal invasive surgery from the distal humerus, lateral and medial epicondyle and posterior above the olecranon fossa.

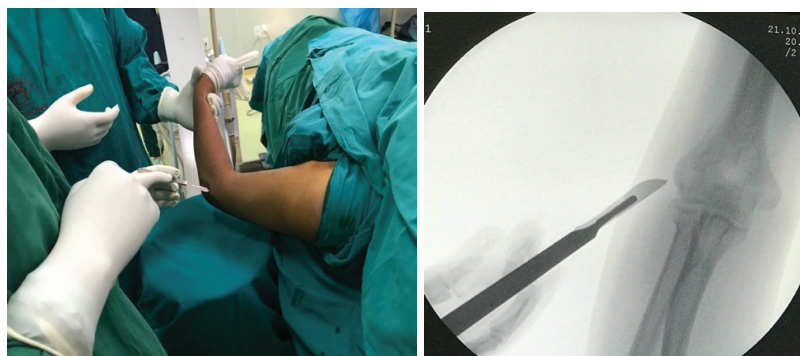


Figure 3: Incision position.

- + Fixation with Metaizeau nails under C-arm fluoroscopy.



Figure 4: Intenal fixation with 2 Metaizeau nails.

+ In the case of wide canal, we use the posterior skin incision to insert a third Metaizeau nail.

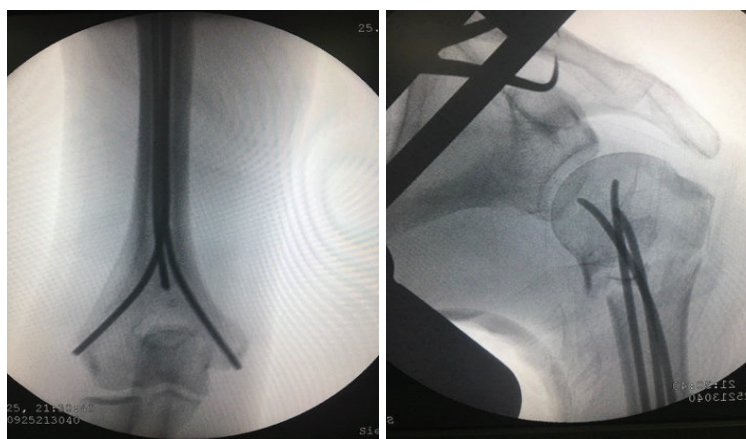


Figure 5: Fixation using with 3 Metaizeau nails.

+ Follow-up and evaluate the whole treatment process, treatment outcomes by clinical examinations and X-rays.

+ Rehabilitation according to the regimen.

\* *Result evaluation:*

- Short-term result: Wound healing, anatomical reduction and fixation results.

- Long-term result (at least 12 months): Scar, bone healing, anatomical reduction according to Neer's classification and rehabilitation standard.

## RESULTS

### 1. Statistical characteristics

From April 2015 to December 2018, there were 55 patients with a diagnosis of surgical neck of humerus fracture undergoing surgery at Saint Paul Hospital.

- Mean age was 60.85 years (ranged from 19 - 79). The most common age was over 61. Patients under 40 years old accounted for the lowest rate (4/55 patients, accounting for 20%). 34 patients (61.8%) had injuries by traffic accidents and daily-life accidents.

- Male/female ratio: 1/1.12. There were 31 left hands (56.40%), and 24 right hands (43.60%) with injuries.

*Table 1: Classification of fracture according to Neer's classification.*

Grade	Number of patients	Percentage (%)	Injured hand		Age		
			Right	Left	18 - 40	41- 60	> 61
II	19	34.5	6	13	2	5	12
III	36	66.5	18	18	2	12	22
Total	55	100.0	24	31	4	17	34

Surgical neck of humerus fracture grade III accounted for the highest proportion (66.5%). Most of them were in the age group over 61 years.

19/55 patients (34.5%) with grade II fracture, of which group of age over 61 made up the highest rate.

*\* Procedure result:*

- Technique and procedure in fixation with Metaizeau nails: 2 nails: 44 patients (80%), 3 nails: 11 patients (20%).

- Surgical technique according to Neer's classification:

*Table 2: Osteopathic technique.*

Grade	Number of Metaizeau nails		Total (n, %)
	2	3	
Neer II	17	2	19 (34.5)
Neer III	27	9	36 (65.5)
Total (n, %)	44 (80.0)	11 (20.0)	55 (100.0)

- Reduction procedure:

*Table 3: Reduction procedure and incision position.*

Technique		Number of patients
Reduction	Closed reduction	55
	Mini open < 1 cm	0
Incision	Epicondyle lateral 1 cm	55
	Epicondyle medial 1 cm	55
	Posterior incision 1.5 cm above olecranon fossa	11

55 patients were fully closed reduced under C-arm without open surgery.

11 patients used the third nail because of large canal diameter



*\* Treatment result:*

- Short-term results:

+ Primary wound healing 100%, no cases of surgical site infection occurred.

+ Intra- and post-operative complications:

In surgery, there was an unexpected accident that was a piercing of the opposite side bone due to uncontrolled piercing. No cases required surgery conversion due to unusual progress.

*Table 4: Reduction results.*

Displacement	Grade		Total
	II	III	
None	17	32	49 (89.0)
Low	2	4	6 (5.5)
High	0	0	0 (0.0)
Total	19	36	55 (100.0)

- Long-term results (after 12 month): 45/55 patients (81.8%) were followed-up.

*Table 5: Results of fracture union (n = 45).*

	Number of patients	Percentage (%)
Undisplaced union	40	88.9
Minimal displaced union	5	11.1
Displaced union	0	0.0
Total	45	100.0

*Table 6: Rehabilitation outcomes for shouder joint (n = 45).*

Results	Number of patients	Percentage (%)
Excellent (90 - 100 points)	35	77.8
Good (80 - 89 points)	10	22.2
Fair (70 - 79 points)	0	0.0
Bad (< 70 points)	0	0.0
Total	45	100.0

*\* Final results:*

*Table 7: General results (n = 45).*

Results	Number of patients	Percentage (%)
Excellent	39	86.7
Good	6	13.3
Fair	0	0.0
Bad	0	0.0

## **DISCUSSION**

### **1. Patients' age**

Our results showed that patients who were indicated for treatment and underwent surgery aged from 19 - 79 years. Why is there no limit of age indication for surgical neck of humerus fracture. According to JP Metaizeau and Pierres Lascombes [8, 9], it could be explained: The closed fixation surgery is a minimally invasive surgery requiring less intervention, less influence to the function of the patient's body in general and each organ systems in the human body in particular. For example: In the past, elderly people with chronic diseases such as COPD, diabetes, and hypertension were often the subjects of absolute contraindications to surgery.

Therefore, previous surgical indications often became contraindicated. However, the reduction and fixation of conservative treatment still had to be considered. It means patients still need minimal reduction and conservative treatment regardless of the old age. Instead of the external fixation, internal fixation was performed. This surgery is considered as non-surgical technique because of less skin incision, less soft tissue damage, shorter operation time, shorter treatment. Most surgeries can be performed by anesthesia combined with sedation or short anesthesia, so it has little effect on the respiratory organs. That is why the closed-piercing procedure can be used for all ages.

### **2. Procedures and indication**

According to Fulan D, JP Meataizeau and Pierres Lascombes [7, 8, 9] closed fixation for small long bones such as

forearm, humerus bone... is not limited. It means that the indications can be applied for not only closed but also open fractures. It was even more effective than the vis brace or the spinal nails because the cross section and mass of the nail in the body was lower than the above materials, the risk of infection was limited. Therefore, nail piercing was indicated for not only closed fractures but also distal tibia open fractures, even with Gustilo's classification IIIA. In addition to traumatic fractures, some authors also applied the technique for bone follicles. Therefore, the indication for nail piercing in the treatment for surgical neck of humerus fracture is very common: For fractures of bone follicles, the treatment indication by nail piercing is not limited by the position of fracture and the type of fracture as in the AO's classification, and elastic nails are all applicable. This is really an advantage of this method. However, in this study we only apply for surgical neck of humerus fracture.

According to JP Metaizeau [8], the flexibility of the nail is the biggest advantage of the method. The fracture is fixed relatively firmly and stimulates strong bone formation due to small movements at the fracture site.

### **3. Results of surgery and rehabilitation**

Through 55 patients undergoing surgical treatment, we found that all patients had bone healing. The healing process was quite normal according to the healing process for transverse, cross, and uncomplicated fractures. Surgical neck of humerus fracture is a fracture that is quite easy to heal due to a spongy bone. However, in some cases with grade

III according to Neer's classification, there was a third piece of bone that healed more slowly.

The healing rate was 100%. In the study by Muller CA, Henle P [10] on 70 patients treated for surgical neck of humerus fracture with elastic nails, this rate was 92%. SW Wachtl, CB Marti [4] in a study including 82 patients used beam-piercing to treat a proximal fracture of the brachial bone. The healing rate was 95%.

Functional results: According to Neer's score: Excellent: 35 patients (77.8%) with over 89 points; good: 10 patients (22.2%). No patients had moderate or bad results. In 10 patients with good results: The reasons were limited reach of the hand or inability to reach the opposite armpit or take the clothes off or the hand could not touch and had moderate, tolerable pain, reduced when using pain relief. These were elderly patients with osteoporosis, degeneration and being afraid to exercise.

#### **4. Advantages and disadvantages of the technique**

- A minimally invasive treatment which does not damage other components around the fracture such as: membranes, blood vessels and nerves...
- Minimize the risk of infection due to not having to open the fracture.
- Simple operation, easy to perform with high precision.
- Applicable to many types of fractures, including complicated fractures, fractures in the elderly.
- Small incision is small, ensuring aesthetics.

- Low cost of treatment due to short hospital stay, fast recovery after surgery.

#### **5. The technical applications in orthopedic trauma facilities**

The applicability of this technique in the PMU facilities depends on some factors:

- Firstly, it depends on the qualifications of the surgeon. We believe that it is not difficult for the surgeon to reach this level and master this technique. The main thing is whether the surgeons know the benefits of this technique. When they see the benefits of technology especially for the patient, they will find a solution to do it.
- Nextly, it is the equipment issue. The Orthopedic Department must have an orthopedic table to manipulate the fractured bone and C-arm fluoroscopy to check the procedure performed during manipulating the fracture and inserting nails. These are the two main requirements.

As for hospitals in Hanoi, many major hospitals had Orthopedic Department. However, the department that has both the orthopedic table and the C-arm is still few. At present, these facilities are only found in Saint Paul, Duc Giang, Dong Anh Hospital. All three of these places have implemented this technique. In the future, if the equipment is more fully equipped, the ability to deploy this technique is very large.

#### **CONCLUSION**

Metaizeau technique of elastic stable intramedullary nails achieved good efficacy in terms of bone healing, early restoration of function and movement... because closed surgery is less invasive



and less risk of infection. This method reduces the amount of blood loss, shortens the hospital stay, helps patients with early mobility, so they can avoid the complications of muscle atrophy, completely restore the shoulder joint movement amplitude and achieve high aesthetics. Results of 100% union healing (alignment union healing was 89.0% and less displacement was 5.5%). Excellent rehabilitation accounted for 77.8%, good 22.2%.

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