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รายงานผู้ป่วย **A Case Report**

Crush Hand Injury with External Fixation: A Case Report

การใช้ External Fixator ในการรักษาอาการบาดเจ็บทางมือ

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ABSTRACT

This report presents a case of crush right hand injury in a 35 years old Thai male who had an accident from machine in factory. There was opened wound and avulsion skin at the index and middle fingers. Proximal and middle phalanx of index and middle fingers was exposed with comminuted fracture. He underwent an operation by application of the instrument from needles no. 20 and K-wires as an external fixator. After operation about 6 weeks he had improved right hand movement and we could successfully keep both of his fingers.

Keywords: crush hand injury, external fixator

บทคัดย่อ

รายงานนี้จัดทำขึ้นเพื่อเป็นการนำเสนอรายงานการรักษาผู้ป่วยที่มีการบาดเจ็บที่มือ ของผู้ป่วยชายไทยอายุ 35 ปี ประสบอุบัติเหตุมือและข้อมือขวาพลาดเข้าไปในเครื่องจักร มีปัญหาเรื่องของกระดูกนิ้วชี้และนิ้วกลางแตก รวมทั้งมีการบาดเจ็บอย่างรุนแรงของเนื้อเยื่อบริเวณดังกล่าว ผู้ป่วยได้รับการรักษาโดยใช้โครงเหล็กยึดกระดูกจากภายนอก (external fixator) ซึ่งประดิษฐ์และประยุกต์การใช้งานขึ้นเองจากอุปกรณ์ที่หาได้ในโรงพยาบาล คือ เข็มฉีดยาเบอร์ 20 และ K-wire ในการยึดตรึงซึ่งมีราคาถูก และช่วยให้ผู้ป่วยไม่ต้องตัดนิ้วทั้งสองทิ้ง จากการติดตามหลังผ่าตัดประมาณ 6 สัปดาห์ ผู้ป่วยสามารถขยับนิ้วได้

คำสำคัญ: การบาดเจ็บทางมืออย่างรุนแรง, โครงเหล็กยึดกระดูกจากภายนอก

Introduction

The hand is very exposed to injuries in the daily man's work. The multiple functions of the hand are based on vitality, sensibility, motor function and stability. In severe hand injuries the functional results of the repair are often very poor. In a complex injury of the hand we are facing with the damage of the soft tissue and bone and the loss of vitality and function of the hand. The causes of hand injuries are mainly a crush trauma or the rotating saw. This is report of the crush hand injury which could be treated by mean of modified external fixator and we could save the injured site.

Case report

We described the case of 35 years old male who presented with accidental crush hand injury by his right hand being pulled inside the machine 1 hour ago. About his past history, there was no underlying disease. Other systemic review was negative.

On the physical examination he was conscious, full Glasgow coma score, pupil 3 millimeter in diameter both sides. The affected part was right hand; it was shown crush and injury. There was opened wound and avulsion skin at the index and middle fingers. Proximal and middle phalanges of index and middle fingers were exposed with comminuted fractures. The flexor digitorum profundus and superficialis of index and middle fingers were torn at fracture level. The neuro-vascular were also impaired.

The reongenogram in oblique and AP view of right hand was showncomminuted fracture of the proximal and middle phalanx of index and middle fingers (as figure 1 and 2)



Figure 1 reongenogram oblique view



Figure 2 reongenogram AP view

We brought the patient to the operation room for wound debridement and bone stabilization. During procedure the contaminated tissue was removed. The operating procedures were as follows:

1. Used sterile 4 needles no. 20 guide into metacarpal bone, proximal, middle and distal phalanges of index and middle fingers (right hand).

2. Then inserted K-wires no 1.6 through the 4 needles.

3. Fixed K-wire no. 2.0 on longitudinal line to maintain finger straight alignment (act as a bar of external fixator).

4. Fixed all K-wires and needle joints by dental cement after ligamentotaxis (figure 3).

5. Wound debridement and suture (figure 4).

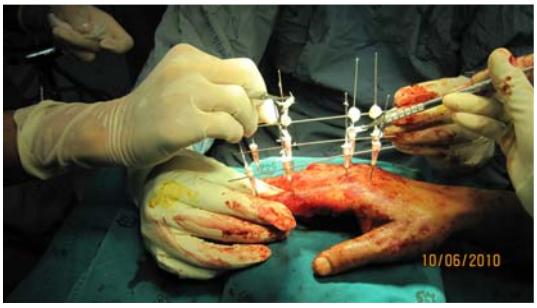


Figure 3 fixed all K-wires and needle joints by dental cement



Figure 4 wound debridement and suture after inserted modified external fixator.

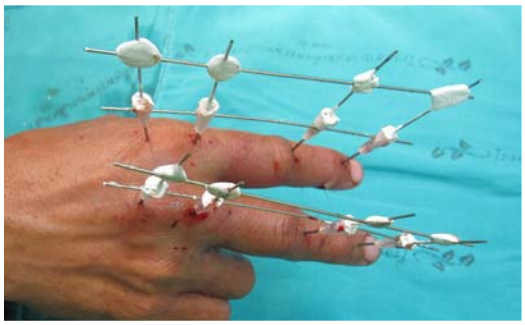


Figure 5 post-operative fixation



Figure 6 reongenogram of post-operative fixation.

The patient was fixed by the modified external fixator about 6 weeks and then we removed it and started rehabilitation process. (figure 5, 6)

Post-operation, after removal external fixator for 2 months, patient could move their both fingers well as shown by range of motion (table 1 and figure 7, 8).



Figure 7 Range of motion of extension movement



Figure 8 Range of motion of extension movement

Table 1 Range of motion of right index and middle fingers after remove external fixator

Motion	Index finger			Middle finger		
	PIP joint	**DIP joint**	**MCP joint**	**PIP joint**	**DIP joint**	**MCP joint**
Flexion	30^0	30^0	90^0	20^0	20^0	70^0
Extension	-10^0	-10^0	-10^0	-10^0	-10^0	-10^0

Discussion

The pathophysiology of soft tissue injuries of the hand is diverse. The most common mechanisms of injury are blunt trauma (crush injury, contusions, and abrasions), laceration, avulsion, ring avulsion, and burns. Besides skin and superficial tissues, the many muscles, ligaments, and tendons of the hand are vulnerable to injury, as are the nerves and blood vessels that supply these structures. Damage to these structures may create permanent functional and/or sensory deficits specific to the site of injury.

The prevalence and acute nature of soft tissue injuries to the hand require that the emergency physician understanding the principles of evaluation and treatment. The key is to get a good history and do a thorough exam. You should have a high index of suspicion so that you do not miss a potentially devastating underlying injury.

History and physical examination

It is important to know the nature of the injury as well as background information about the patient to guide your physical exam and treatment options. Information that you should obtain include extent of injury (e.g., fingers, hands, forearms), mechanism of injury and force of crush (some pieces of equipment have known compression forces).

The injured extremity must be thoroughly examined. Particular attention should be paid to the following factors. An asterisk indicates that positive findings may indicate a compartment syndrome.

- Appearance of skin (look for blisters, open wounds, elevated areas, foreign material and other abnormalities)
- Circulation to the hand (palpable pulses in the radial and ulnar arteries, capillary refill in the fingers)
- Neurologic exam (e.g., complaints of tingling or numbness, ability to differentiate between sharp and dull objects, ability to move fingers)
- Deformity indicating possible bone or joint injury
- Radiographic studies to document a fracture

We described the case of 35 years old male who has presented with accidental crush right hand injury. The physical appearance of wound and crush injury was shown avulsion skin and degloving tissue

at the 2nd web space. Bone fracture on the first evaluation was shown comminuted of proximal and middle phalanges of index and middle fingers. The neurovascular still attached with proximal part of wound, capillary refill was impaired. We supposed that we still had a chance to keep both of fingers. The reongenogram oblique and AP view of right hand revealed the comminuted fracture of proximal and middle phalanges of right index and middle fingers.

How could we keep both fingers and bone alignment? From this case we found that the most important problem was the instrument to keep length and alignment of fingers. At present we still do not have an external fixator for small finger. That the reason why we had to modify our own instrument from resource in our hospital. We modified our instrument from needle no. 20, K-wire and dental cement which were cheaper and equally effective as the expensive external fixator. This instrument could keep length, bone alignment, ligamentotaxis, and decreased damage of tissue as well as the size was more proper for small finger.

Conclusion

A severe crush injury of the hand provides the surgeon and therapist with a significant reconstructive challenge. The injury is extensive, involving a whole variety of tissues in the hand, and even with optimal treatment disability can occur. By applying modified external fixator could improve the functional outcome in this problem case.

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