External Fixator As a Primary and Definitive Treatment for Open Fractures in Disasters and Conflicts

Abduljabbar Alhammoud, MD[1]*; Mason Al Nouri, Dr.*[1]*; Mahmood Ali Arbash, Dr.*[1]*; Bakry Mazz, MD*[2]
[1]*Hamad General Hospital, Doha, QATAR;*
[2]*Alzarzor Hospital, Aleppo, SYRIA*

Background/Purpose: War injuries usually occur as a result of high-energy trauma and may be caused by heavy weaponry, explosions, or collapsed structures. During these circumstances, the highest number of injuries occur in the musculoskeletal system. Furthermore, the femur, the tibia, and the humerus are very commonly involved in many cases and can present with varying levels of soft-tissue injury.

The first line of treatment in cases of long bone shaft fracture (open or closed) is intramedullary nailing, but external fixation is also indicated in some situations such as for damage control and massive soft-tissue injuries. In situations of conflict, poor countries with low budget health-care systems can be forced to use the external fixator as a primary and definitive treatment for open fractures. We aim to summarize the experience of one field hospital using external fixation as a primary and definitive treatment for the open femur, tibia, and humerus fractures.

Methods: This was a retrospective review of all war injuries that presented to one field hospital with very limited human and logistic resources. Between 2011 and 2015, 955 orthopaedic war injuries with open femur (334 cases), tibia (462 cases), and humerus (159 cases) fractures were managed with one orthopaedic team. Different types of external fixators were used according to availability with one new type locally invented.

Results: *Open femur fractures:* 334 presented with an open femur fracture; average age was 28.8 years (SD 11); 90.4% were male and 9.6% female. There were according, to Gustilo/Anderson classification, 24.9% type 1, 47% type 2, 28.1% type 3, and 14.7% with vascular injury. Most of the cases (247 [74%]) were managed by AO external fixator, 74 (22.2%) Orthofix, 10 (3%) locally invented, and 3 (0.9%) Hoffman. The external fixator was the primary and definitive method of treatment in 96 cases (28.7%), with an average 4.6 months to achieve full union. Using external fixator as the only treatment method in open femur fracture was statistically not significant in the classification of the fracture (*P* value 0.26) and the type of external fixator (*P* value 0.48). *Open tibia fractures:* 462 presented with open tibia fracture; average age was 27.9 years, with 91.3% male and 8.7% female. There were, according to Gustilo/Anderson classification 133 (29.8%) type 1,158 (35.5%) type 2 ,155 (34.7%) type 3, and 143 (31%) with vascular injury. Most of the cases (273 [59.1%]) were managed by AO external fixator, 115 (24.9%) Orthofix, 49 (10.6%) locally invented, and 24 (5.1%) Hoffman. The external fixator was the primary and definitive method of treatment in 143 (31%), with an average 2.5 months to achieve full union. Using external fixator as the only treatment method in open tibia fracture was statistically not significant regarding the classification of the fracture (*P* value 0.061) or type of external fixator (*P* value 0.235). *Open humerus fractures:* 159 presented with open humerus fracture; average age was 28.36 years, with 89.9% male

and 10.1% female. There were, according to Gustilo/Anderson classification 66 (41.5%) type 1, 41 (25.8%) type 2, 51 (32.1%) type 3, and 19 (11.9%) with vascular injury. Most of the cases (66 [41.5%]) were managed by AO external fixator, 30 (20.8%) Orthofix, 51 (32.1%) locally invented, and 10 (7.1%) Hoffman. The external fixator was the primary and definitive method of treatment in 52 (32.9%), with average 2.1 months to achieve full union. The main complication was the pin tract infection with 165 deep infection, 53 cases in femur (15.9%), 93 (20.1%) in tibia ,and 19 (11.9%) in humerus.

Conclusion: Satisfactory results can be obtained using definitive external fixation of open long bone shaft fractures (femur, tibia, humerus) if a stable fixation is achieved. Pin tract infections, although a common occurrence, are not a major problem and can be treated with local wound care and antibiotic therapy. The most common problem arising from the external fixation remains the decrease in the range of motion of the near joints, especially for fractures around the joint and when the external fixator is applied across the joint.

See pages 49 - 106 for financial disclosure information.