Terrible triad of the elbow: A case report of a new variant

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ABSTRACT
The usual terrible triad of the elbow consists of posterior dislocation of the elbow, radial head fracture, and coronoid fracture. We describe a new variant of the terrible triad of the elbow consisting of fracture of the capitellum involving the full length of the trochlea and posterolateral dislocation of the elbow associated with coronoid fracture (type 1 Regan-Morrey). A 25-year-old girl was brought to the emergency ward with the history of having jumped from the third floor with an intention of committing suicide. She sustained multiple fractures, i.e., fracture ribs, bilateral intra-articular fracture of the lower end of the radius, left-side elbow injury, left subtrochanteric fracture femur, and left zygomatic fracture with head injury. The elbow was stable after stabilization of the capitellum fracture through a collateral approach. Coronoid fragment was left alone, as it was a very small fragment.

KEY WORDS: Capitellum, terrible triad variant, trochlea

Hotchkiss described “terrible triad of elbow” in 1996. It consisted of injury to the coronoid process, radial head, and collateral ligaments with posterior dislocation of the elbow. This term was used in recognition of high rate of complications such as instability, malunion, nonunion, and proximal radioulnar synostosis that this osteoligamentous injury was prone to. The case described in this communication had the triad involving coronoid fracture, posterior dislocation of the elbow without any ligamentous injury, and capitellum fracture (coronal shear fracture), which extended into the trochlea. The management of the terrible triad variant and challenges involved are also described.

Classically, capitellar fractures are described into three types, type 1 (Hahn–Steinthal), type 2 (Kochers), and type 3 (comminuted). Types 1 and 2 are isolated capitellar fractures and, in fact, are very rare.[1] Ring et al.,[2] in their series of 21 patients, described a new classification involving five types of fracture patterns of the capitellum. We describe a type of capitellum fracture in which the full thickness of the trochlea was involved contributing to elbow instability. This represented the type IV of Ring-Jupiter classification. We are presenting this case for its unique presentation and for its management, which appeared seemingly simple.

Case History
A 25-year-old female sustained multiple fractures, i.e., head injury, left zygomatic fracture, fracture ribs with pneumothorax, left subtrochanteric fracture, and bilateral lower end intra-articular fracture radius with left elbow injury (Figure 1), while attempting to commit suicide. A trauma team attended to her and provided initial management of head injury and pneumothorax. The fracture management was carried out in three stages: The subtrochanteric fracture was fixed at a first stage with biological plating, bilateral lower end radius with capitellum fracture was fixed at the second stage, and at the third stage zygomatic fracture was fixed.

The capitellum fracture fixed through an open reduction procedure through a lateral approach. The fracture line extended well into the entire length of the trochlea and split the trochlea in the coronal plane, hinging on the lateral collateral ligament (Figure 2). The chip fracture of the coronoid process also contributed to instability of the elbow. Additional medial
incision was taken to visualize the medial portion of the coro-
nal fracture plane. Distraction of the joint was necessary to
reduce the capitellar fragment. Radial head captured on the
capitellar fragment to push it more proximally when we tried
to reduce the elbow before aligning and stabilizing the frag-
ment. After reduction, definitive fixation was done with two
3.5 mm cortical screws used as lag screws and one 4 mm can-
cellous screw passed from medial to lateral (Figure 1). The
medial collateral ligament was intact and coronoid fracture
was left alone, as it was too small to be fixed. The lateral unlar
collateral ligament was attached to the large coronal capitellar
fragment. It appeared structurally intact. The capitellum re-
presented the lateral column injury, which replaced the radial
head in the usual terrible triad. The anterior and middle col-
umns are represented by the coronoid process and the cap-
seule. The posterior capsule represented the posterior column.
Injury thus completed the entire circle without compromising
the major ligamentous complex. At the completion of proce-
dure, the range and the stability of the elbow was checked.
Elbow was stable up to 40º of flexion to full flexion.

Postoperatively, the elbow was immobilized in an above-elbow
slab in 90º flexion and pronation. Gentle elbow range of mo-
tion exercises with extension block splint was initiated at 2
weeks. The patient was given indomethacin for 1 month to
minimize the risk of formation of myositis ossificans. Radi-
ological evaluation showed backing out of the screws at 3 months,
which were taken off percutaneously to facilitate the range of
motion exercises. The capitellum fragment tilted and shifted
proximally medially though the elbow continued to remain
stable. Postoperative radiograph did not show any heterotopic
ossification. At the follow-up visit 6 months later, the patient
had an useful range of 20º–100º range of movement at the elbow.
Her supination, though, was restricted. She had full pronation
from neutral position. The Mayo elbow performance score[6]
was 60/100; which indicated a fair degree of success.

Discussion
The elbow joint is visualized as made up of four columns:
Anterior formed by coronoid process, brachialis, and anterior
capsule.
Medial formed by medial collateral ligament, coronoid proc-
ess, and medial condyle.
Lateral formed by radial head, capitellum, and lateral collat-
eral ligament.
Posterior formed by olecranon process, triceps, and posterior
capsule.
Bony articulation of the elbow joint is such that stability is
greatest when flexion is less than 20º and more than 120º owing
to deep engagement of articular surfaces. The radial head
also provides 30º of the valgus stability and acts as a primary
stabilizer when anteromedial collateral ligament is incompe-
tent.

Shawn W. O’Driscoll[5,6] described the stages of soft tissue dis-
ruption in elbow dislocation. The first stage is posterolateral
rotational instability. The second stage is where the coronoid
is perched against the bony articulation of the distal humerus.
For elbow dislocation to occur, the circle of soft tissue disrup-
tion has to be completed. Soft tissue disruption starts on the
lateral ulnar collateral ligament and completes on the medial
ulnar collateral ligament.

The usual terrible triad of elbow consists of posterior disloca-
tion of elbow, radial head fracture, and coronoid process frac-
ture in which the bony as well as capsuloligamentous struc-
tures are disrupted, giving rise to instability. The new variant
involved capitellar fracture instead of radial head fracture. It
was large enough to jeopardize the stability of the elbow joint
along with posterolateral dislocation of the elbow. This dif-
fered from the usual triad in that there was no major involve-
ment of ligament complex along with it.

This variant does not need any ligament repair/reconstruction,
whereas the usual terrible triad may need so if stability cannot
be obtained between 60º and full flexion. Though the elbow
was painless and stable, our case emphasizes the difficulty in
obtaining the purchase of the capitellar fragment, and shared
the complications of a terrible triad such as malunion and stiff-
ness of the elbow as well as proximal radioulnar joint. We con-
cur with recommendations made by McKee et al., MD, regard-
ing the need of extensile exposure in these particular patterns
capitellar fractures. [7]

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