Section: Trauma & Orthopaedics

**Case report**

Hahn-Steinthal fracture fixed by Herbert Screws: report of two cases

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Abstract:

Introduction:

Fractures of the capitellum are rare and account for 1% of elbow fractures. They often lead to significant disability by limiting elbow motion. The aim of this study is to present two cases who sustained an isolated Hahn Steinthal type of fracture and they were treated operatively by open reduction and internal fixation using Herbert screw.

Case One:

A 24-year-old morrocan woman presented to our institution with left elbow pain, following a sports accident. Radiographic examination confirmed the diagnosis of Hahn-Steinthal type capitellum fracture. She underwent an open reduction and internal fixation using two Herbert screws. At the one year follow-up examination, the patient exhibited a normal range of motion without extension lag or pain.

Case Two:

A 47-year-old right-handed morrocan woman was admitted to our hospital after falling. Radiological examination showed a typical Hahn-Steinthal fracture associated with a radial head fracture which was classified according to Masson’s classification as type one. The condylar fragment was repositioned and fixed by two Herbert screws, and the radial head fracture was fixed by miniscrew. At the one-year follow-up the patient recovered full range of motion.

Conclusion:

Surgical treatment of Hahn-Steinthal fractures is absolutely indicated. The use of the Herbert screw gives a stable fixation, encouraging early rehabilitation in the five days following the surgery.
Keywords: Hahn Steinthal fracture, Herbert screw, Lateral approach, Surgical treatment

Introduction:
Fractures of the capitellum are rare and often lead to significant disability by limiting elbow motion. [1] Hahn first described this injury in a report in 1853. [2] Injuries to the capitellum are usually a result of axial loading of the capitellum by forces transmitted through the radial head, the lateral trochlear ridge and the lateral half of the trochlea. Type I, or the Hahn-Steinthal fracture, involves cartilage and the underlying osseous portion of the capitellum. [3, 4] The most commonly accepted mechanism of this fracture type is the transmission of an axial force through the radius that shears off the capitellum in the coronal plane [5]. As the complex nature of capitellar fractures has become better appreciated treatment options have evolved. A review of the literature reveals that treatment of capitellar fractures has progressed from excision to closed reduction to open reduction and internal fixation. The short-term risks of this type of fracture include joint stiffness and instability, while the long-term risk is represented by post-traumatic osteoarthritis.

The aim of this study is to present author’s experience with surgical treatment of the Hahn-Steinthal Fracture by Herbert screw fixation.

Case presentation One:
A 24-year-old girl presented to our institution with left elbow pain, following a sports accident (fall on the palmar face of her left hand with an overstretched elbow during a dance session). Elbow movements were limited in flexion, extension, pronation and supination. No neuro-vascular complications were observed. Radiographic examination confirmed the diagnosis of Hahn-Steinthal type capitellum fracture
(figure 1). Under regional anaesthesia, a postero-lateral approach to the elbow was used as described by Kocher [6]. The deep dissection used the interval between the triceps muscle posteriorly and the brachioradialis and extensor carpi radialis longus anteriorly. Capsulotomy showed a Hahn-Steinthal type I fracture without any other lesion of the radial head or of the medial facet of the trochlea. The fracture site was cleaned, the fragment was repositioned and the final fixation was obtained with two Hebert screws. Stable osteosynthesis and satisfactory joint congruity were obtained. The patient left the hospital 48 hours after surgery. She was immobilized in a splint postoperatively with active range of motion begun at one week. Two weeks from surgery, the patient was noted to have a range of motion from 30° to 100°, with full pronation and supination. Mobilization was guided by a physiotherapist. At the one year follow-up examination, the patient exhibited a normal range of motion without any extension lag. Radiographs showed no evidence of avascular necrosis or advanced degenerative changes.

Case presentation Two:

A 47-year-old right-handed woman was admitted to our hospital after falling (domestic accident) on the palmar face of her left hand with her elbow in extension. The patient reported immediate pain, swelling and functional disability of the right elbow. Elbow movements were limited. No signs of elbow instability and neuro-vascular abnormalities were observed. Radiological examination (Figure 3) showed a typical Hahn-Steinthal fracture associated with a radial head fracture which was classified according to Masson’s classification as type one. Twenty hours later the patient was operated using a Kocher’s postero-lateral approach to the elbow. After capsulotomy we observed a Hahn-Steinthal type I fracture, associated with radial
head fracture. The fracture site was accurately reduced and the fragment was. The condylar fragment was repositioned and fixed by two Herbert screws, and the radial head fracture was fixed by miniscrew (Figure 4). Intraoperative dynamic examination showed satisfactory stability of the osteosynthesis and anatomic articular congruity. The postoperative outcome was uncomplicated allowing the patient was discharged the hospital 24 hours after surgery with her elbow placed in a dynamic splint (ROM 30°-100°). Immediate active and passive rehabilitation was started. The splint was removed after 15 days, before beginning 2 months of a more intensive mobilization programme guided by a physiotherapist. Two months after surgery the fracture was radiographically considered healed. The elbow ROM returned normal after 3 months. At the one-year follow-up, radiographic examination showed no evidence of AVN, heterotopic ossifications or degenerative changes and the patient recovered full flexion, extension, pronation and supination(Figure 5).

Discussion:

Fractures of the humeral capitellum are rare and account for 1% of elbow fractures. [9, 10] Patients with capitellar fractures usually present with pain and swelling of the elbow after injury. A fall on the outstretched hand or directly on the elbow produces a shear force fracturing the capitellum in the coronal plane. As the center of rotation of the capitellum is 12–15 mm anterior to the humeral shaft, it is vulnerable to the shear forces. [11] These fractures are frequently missed on first examination; they are not obvious on anteroposterior radiographs because the fracture line may not be recognized against the background of the distal humerus. They are best seen on a true lateral view, it shows the characteristic appearance of the “half-moon” of fragment which is ascended and attached in front of the epiphysis. [12] Radiographs must be carefully assessed for the presence of medial trochlear extension,
metaphyseal comminution, and associated radial head and/or neck pathology. Exact morphology of the capitellar fracture is often difficult to ascertain from preoperative plain radiographs alone [4, 5, 8, 9]. CT scan with sagittal and coronal plane reconstructions is recommended to define the medial extent of the fracture, articular impaction, and metaphyseal and condylar comminution. [13] These fractures can be classified according to the McKee modification of the Bryan and Morrey classification. [4] Type I (Hahn-Steinthal) is a coronal shear fracture with a large osseous capitellar fragment [2, 14] Type II involves a shell of the articular cartilage with a thin layer of bone and are known by the eponym Kocher-Lorenz [15, 16]. Type III fractures include all comminuted fractures of the capitellum. There is no universal agreement on the treatment of this fracture. Closed reduction of type I has been advocated. [17] Hahn [2] firstly reported the unsatisfactory outcome after conservative management of a coronal shear fracture of the capitellum humeri. During the autopsy he found that the capitellum had been superiorly displaced and consequently united to the anterior side of the humerus, causing the restriction of elbow flexion. However, authors have shown that excellent results are achievable if closed anatomical reduction is attained and subsequently maintained up to the consolidation of the fracture. [18] The conservative treatment consisting in an immediate mobilization may determine a limitation of elbow motion caused by remaining displaced articular fragments and also post-traumatic osteoarthritis due to articular incongruity and lateral instability. Some good results are described particularly in older patients [19]. Surgical treatment of capitellum humeri fractures is absolutely indicated because the fragment may block flexion in all four types of capitellum humeral fractures. Perfect reduction by closed manipulation is impossible. [20] Excision of the fragment or fragments is the best treatment for cases in which the
fragment is small, or when comminution of small fragments has occurred. For old unreduced fractures when the displaced fragment is blocking flexion, excision also is the treatment of choice. Dushuttle showed that after excision of the fragment, valgus instability occurred if the fracture was associated with medial joint instability. [21, 22] Hardy [23] and Pogliacomi [5] believe that the isolated removal of the articular fragment as a primary treatment in Hahn-Steinthal lesions should be avoided because it may induce radio-humeral osteoarthritis and instability especially in cases of voluminous fragments. Open reduction and internal fixation is in most cases a suitable method of maintaining a stable osteosynthesis and joint congruity while allowing an early mobilization. Available instrumentation including Kirschner wire fixation or AO compression screws have been used with varying degrees of success. Kirschner wires do not offer a strong compression and a stable fixation at the fracture site and require subsequent removal. This method needs a longer postoperative period of immobilization interfering with early mobilization and rapid functional recovery. [5] The reabsorbable pins have the advantage of not requiring subsequent removal. Fixation using compression screws is a very exacting technique, with freehand manipulation of instruments lending to frequent disruption of reduction and risk to articular cartilage penetration. [3] Herbert and Fisher introduced their new bone screw for the treatment of fractures and nonunion of the scaphoid in 1984. Since then, its applications have grown to encompass fixation of numerous other small bone fractures. This development is an attractive alternative for fixation of articular fractures such as the capitellum. [3] Since Simpson and Richards [25] reported using Herbert screws for a capitellar fracture in 1986, several authors report good results using these screws and recommended their use, except in slice fracture cases. Herbert screws allow for rigid fixation at the fracture site, do not have to be
removed, and its major advantage of the Herbert screw system, lies in the fact that the screw is placed within the bone without any outside prominence, thereby avoiding unnecessary soft-tissues irritation. A minimum of two screws should be placed to ensure rotational stability; when possible, the screws should be placed in a divergent pattern directed at the posterior nonarticular aspect of the lateral column. [26] There is rarely the necessity for screw removal, the rehabilitation program starts earlier, is uninterrupted and the functional recovery is faster. Problems related to headless screws might arise if avascular necrosis or chondrolysis occurs, exposing the metal implants to the adjacent radial head and possibly leading to erosion or arthritis within the joint. Fortunately, reports on the development of AVN are rare. [5]

In our two cases, we opted for both patients for open reduction and internal fixation using Herbert screws by lateral approach. This approach allowed accurate anatomical reduction of the fracture. The use of the Herbert screw gives a stable fixation, encouraging early rehabilitation in the five days following the surgery. At 13-month follow-up we believe that the anatomical and functional results are very encouraging.

We can conclude that open reduction and internal fixation is the actual preferred method of treatment for Hahn-Steinthal type I capitellum humeri fractures. Modern fixation methods, in particular cannulated and headless screws, have given satisfactory results. We recommend open reduction and internal fixation with Herbert screws for the treatment of capitellar fractures, because this procedure leads to minimal articular damage and rigid fixation, as well as early mobilization.

Consent:
Written informed consent was obtained from the patients for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

**Competing Interests:**
The authors declare that they have no competing interests.

**Authors’ contributions:**
EM made the diagnosis, and operated both of two patients, and wrote the case report. MA made the diagnosis. EM participates in the treatment of the patient. SM, EA, and EA supervised the writing of this paper. All authors read and approved the final manuscript.

**Legends of figures:**

Figure 1: Preoperative Radiographic examination showed a left type I Hahn Steinthal fracture

Figure 2: Postoperative control showed an anatomic reduction

Figure 3: Type I Hahn Steinthal fracture associated with a radial head fracture

Figure 4: Fixation of the condylar fracture with a Herbert screw, and the radial head with a miniscrew

Figure 5: Postoperative functional results

**References:**


