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Current concepts in management of radial head fracture: An overview

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Abstract

The most frequent injury discovered so far is a radial skull fracture. The radial head fracture has become a crucial component of the elbow over the past ten years. According to a treatment plan that has evolved, the radial head fracture treatment aims to restore the wounded elbow's function and stability. A rising number of articles are available on radial head fracture. This article's goal is to give a summary of the most recent theories about the treatment of radial head fractures. Moreover, one of the most contentious elbow topics is the radial head fracture.

Keywords: Elbow injury, elbow fracture, radial head fracture

Introduction

The most frequent type of elbow fracture is a radial head fracture ^[1]. The "New England" Journal has published the first report of a radial head fracture despite it being more than 80 years old. Since then, the radial head has remained a contentious issue in both orthopedics ^[2] and trauma papers (Figure 1). The stability of the elbow has become more dependent on the radial head during the past ten years ^[2].

Epidemiology

Radial head fractures are predicted to occur 2.5 to 2.8 times more frequently than elbow fractures per 10,000 people annually. The age range of patients receiving treatment for radial head fractures ranged from 44 to 47.9 years old ^[3, 4]. The male-to-female ratio can range from 1:1 to 2:3 to 3:2 ^[5]. When compared to male patients between the ages of 48 and 54, female patients between the ages of 37 and 41 are more prominent ^[3, 4]. The incidence is highest in women between 50 and 60 and men between the ages of 30 and 40. Among patients older than 50, the number of female patients who have sustained a Radial head fracture is likely higher than that of male patients ^[6]. This general classification can be explained with correlation, and the occurrence of osteoporosis in a female patient aged 50 years old forward.

Biomechanics

The Radial head is the second important supplement in order to add the stability of the elbow. Several studies of biomechanics actualized to find the number of the stability of the elbow fracture model.

Also, several studies found that to cut the Radial head off, it will transform and caused to unstable of the elbow joint and tendon around the elbow. Moreover, they found that the stability will be better after the Radial head arthroplasty ^[7].

Significant reduction of the stable elbow was recorded that if the Radial head was cut off in the elbow joint and Lateral Collateral Ligament (LCL) was injured, it will affect to the instability of the elbow joint. Furthermore, it will affect to the loose of Varus instability of the elbow joint ^[8]. These findings caused to an advice to repair LCL which is the important thing to restore the stability of the elbow collaborate with surgery Open reduction internal fixation (ORIF) of the Radial head or the arthroplasty in the Radial head ^[9].

Pomianowski also reported that the instability of the elbow is increasing after the Radial head was cut and medial collateral ligament (MCL) was injured which will cause to valgus instability of the elbow ^[10].

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Classification

Mason ^[1] listed one hundred individuals with radial head fractures in 1954. He separated the Radial head fractures into three groups: Mason Type I fractures (73%) of the fracture without dislocation, Type II fractures (19%) of the head fracture with some dislocation, and Type III fractures (8%) ^[11] Of the Radial head fracture with shattering. Johnston ^[12] added the Radial head fracture in conjunction with elbow discrepancy as Type IV to the system in 1962. (Table 1). Bro

berg and Capo added additional information regarding fracture movement type II ^[13]. Rineer added that the connecting detail of the radial head could be used to determine the fracture's stability (Cortical contact) ^[14].

Using three-dimensional radiography (CT scan) can help make a more accurate diagnosis ^[15]. the possible potentiality of visualization CT is to determine the location of the Radial head fracture, which could be related to common injury and related to the elbow instability (Figure 2) ^[13, 16].

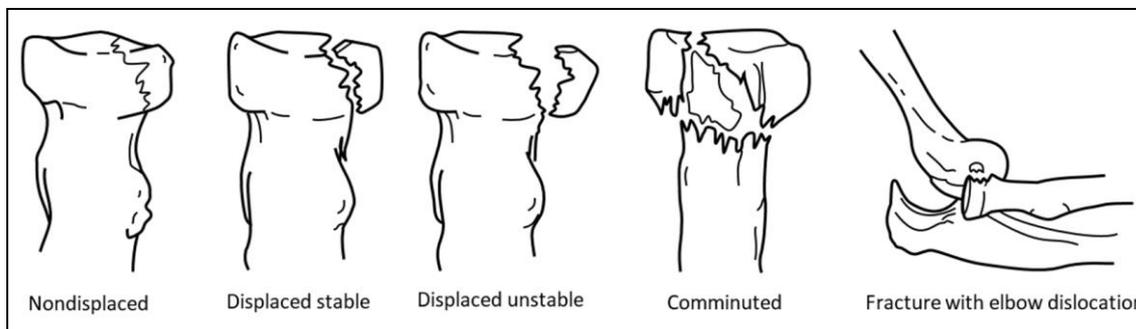


Fig 1: The different classification was summarized

Associated injury

To treat the patient with a Radial head fracture, we needed to pay extraordinary attention to the examination and the related injury treatment. Van Riet ^[4] discovered up to 39% of the occurrence and associated damage. The Radial head fracture, the loss of the outer tissue, the comminuted fracture of the Radial head, and the linked injury will be wounded in the tendon or bone, for example, the capitellum, in the back assessments of 333 individuals. This can be determined using magnetic resonance imaging (MRI), which is performed on 76% to 96% of patients with radial head fractures ^[17]. Also, Hausmann *et al.* ^[18]. Found that in 9 in 14 Mason type I patients that have got Radial head fracture, there are some parts of the Interosseous membrane (IOM) are torn.

Ligament injuries

Ligament injuries can be diagnosed with MRI, as 61% to 80% of patients with Radial head fractures suffer elbow injuries ^[19]. The Lateral Collateral Ligament (LCL) injury was found in up to 11% of the patient who has got a Radial head fracture, and Medial Collateral Ligament (MCL) was found in 1.5% of the patient who has got Radial head fracture, including MCL and LCL injury was found 6% ^[4] of the patient who has got the Radial head fracture.

Coronoid process (Elbow dislocation coronoid process fractures)

Elbow dislocation can be found 3% up to 14% along with the Radial head fracture. In the injury mechanisms that have mentioned, coronoid joint that was crushed against with trochlea of humerus can cause to coronoid fracture. The elbow dislocation, the Radial head fracture ^[3], and the coronoid fracture are called "the terrible triad of the elbow". It caused the severe instability of the elbow and often found the complication after injuries that related to terrible triad ^[20] such as the instability of the elbow and may have a subsequent post-traumatic OA elbow.

Ulnar fracture

Radial head fracture patients can have an ulnar fracture in 1.2% to 12% of cases ^[3, 4] that often found in Monteggia fracture which is the dislocation of the Radial head

collaborated with a one-third distal fracture of ulna ^[21] and the mechanism of injury is a fall in the outstretched arm with a hand hitting the ground.

Capitellum injury

Osteochondral injury of capitellum can be found with the Radial head fracture and from MRI we found that capitellum injury can be found up to 39% ^[13, 16].

Injury related to other conditions

The radial head fracture can also be associated with other injuries, such as injury to the interosseous membrane (IOM). It is the joint separating the radius and ulna. The Essex-Lopresti injury is a triangle fibrocartilage complex injury ^[22]. Nerve damage is a possibility. 20% of patients with elbow injuries experience nerve damage, with the median nerve being the most severely impacted ^[23]. Radial and posterior interosseous nerve damage can also result from radial head fractures ^[24] and artery injury. These can occur in the patient who has got the elbow injury 0.3% up to 1.7% ^[25].

Management of Non-displaced fracture

Mason type I fractures are generally treated with a pressure bandage and arm sling for 1-2 weeks, followed by active mobilization physical therapy of the elbow as soon as possible ^[26]. The aspirated hemorrhage in the joint will reduce the pressure and the pain in joint ^[27]. Furthermore, there is no different pain between the patients groups that only put on arm sling compared with the patients groups that have got with a bupivacaine injection in the elbow ^[28]. Mason type I fractures were studied by Shulman ^[29] who concluded that orthopedic surgeons are likely to treat patients with Mason type I fractures in the Radial head by non-surgical treatment and to follow up on X-ray results without changing treatments.

Fractures with stable partial articular displacement and their management

There is currently no consensus on the treatment of the Radial head fracture patients that have a partial articular displaced fracture. The Radial head fracture surgical is popular. After found a new surgical technique ^[30] there is a good treatment report in Mason type II fractures ^[31] group. In another way,

conservative treatment article of Mason type II fractures also reported a good result [32]. Lindenhovius [33] reported a long-term result of ORIF for the partial articular displaced fracture of Radial head that have an average for 22 years of follow-up. Although the result was good, but 44% of patients have the complication. Additionally, they compared their results with those of Akesson *et al.* who performed the same fracture follow-up [32], which is the 19 years of getting the conservative treatment. A long-term comparison of ORIF and ORIF was not found to be superior. These results are the same as the study a retrospective by Yoon [34]. Getting a non-operative treatment compared with ORIF, they found that there is no significant differences in clinical in ROM elbow and a muscle strength during the treatment groups [34]. However, there might be the additional complication; for example, Hardware loosening and heterotopic ossification (HO) after treated ORIF.

Management of comminuted fractures

Mason [1] advised that we carry out the operation and ORIF for the comminuted radial head fracture. Over the past ten years, the differences between various surgical procedures have been explained. Following that, ORIF has gained popularity, and patients who received it for a fractured radial head have reported positive outcomes. Compared to shattered bones with only two or three parts, Mason type III fractures with more than three pieces are more likely to generate favorable results, according to Ring [35]. Moro [36] discovered that unstable fractures are challenging to repair and are more

likely to result in hardware loosening or nonunion than stable fractures, such as a severe radial head fracture. Therefore, if there is unable to fix by ORIF method, there is an advice to use Radial head prosthesis (RHP) for getting the stable Radial head. Chen [37] compared ORIF with the Radial head prostheses (RHP) for the unstable Radius head fracture. After two years of follow-up the patient, in the Radial head prosthesis (RHP) group significantly had a better symptom, but there is additional complications; for example (stiffness joint, nonunion, malunion, or infection) with the ORIF group (11 in 23 cases was found) compared to the Radial head prostheses (3 in 23 cases was found) [37] Concluded that Radial head prostheses (RHP) is more effective than the ORIF. However, they have observed fairly that Radial head prosthesis (RHP) have a problem about a lifespan and wear which did not find in short-term follow-up of the study that have mentioned. Nowadays, Radial head prosthesis (RHP) effected only short-term but for the results of a middle-term, there still have no information.

Management of associated injuries

Two ideas serve as the foundation for treating complex elbow injuries [38]. Osteosynthesis (ORIF) involves repairing the ulnohumeral joint, coronoid fractures, olecranon, or distal humerus to maintain elbow functionality. The stable elbow needs to be shielded for the subsequent one. As previously stated, the radial head is a crucial elbow component. Since radial head fractures frequently accompany ligament injuries, the LCL and MCL should also be treated simultaneously.



Fig 2: The radiographic pre-operative

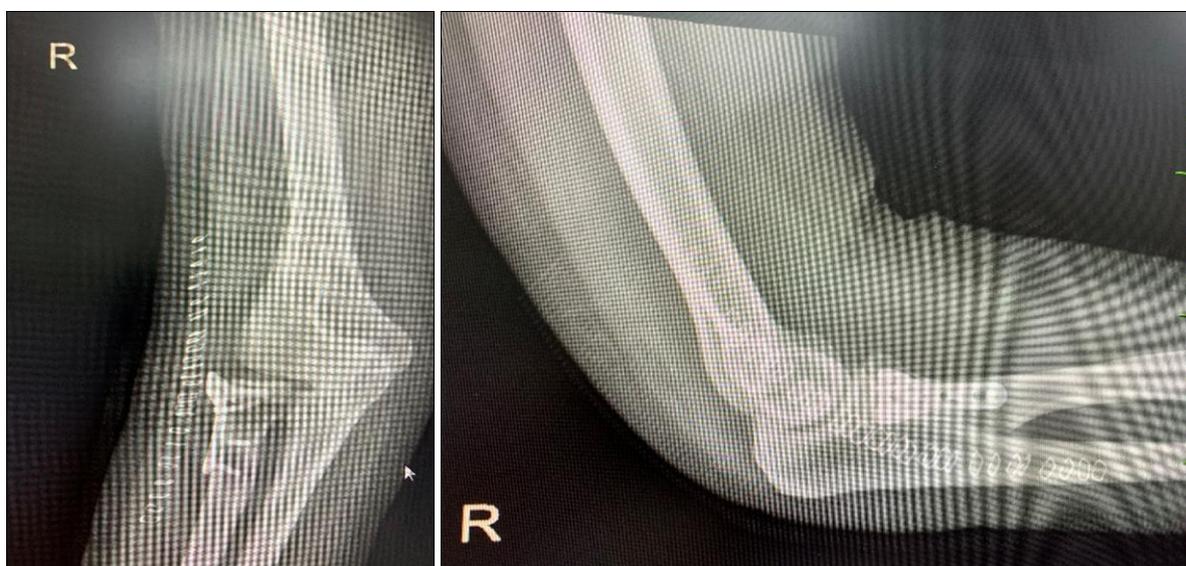


Fig 3: The radiographic post-operative

Table 1: The different classification was summarized

Description of classification according to various authors					
Type	Mason	Johnston	Hotchkiss	Broberg and Morrey	Rineer
I	Without displacement	Without displacement	< 2 mm dislocation	< 2 mm dislocation	
II	With displacement	With displacement	> 2 mm dislocation	< 2-3 mm dislocation and involves > 30% of radial head	Cortical contact between fragments > stable No cortical contact between fragments > unstable
III	Comminuted	Comminuted	Comminuted	Comminuted	
IV	-	Fracture associated with dislocation of the elbow		Fracture associated with dislocation of the elbow	

Table 2: Summary of treatment of Radial head fracture

Mason type	Indication	Treatment option's
I	All	Conservative with early motion
II	Stable	Conservative with early motion or ORIF
	Unstable	Conservative with early motion or ORIF
	Block with rotation	ORIF
III	2-3 simple fragments	ORIF
	> 3 unstable fragments	Arthroplasty

Conclusion

The Radial head is one of important part that could help the elbow joint be stable. Also, the Radial head fracture and the associated injuries may cause the pain, osteoarthritis after injury, and defective elbow functions. Therefore, there should be the Radial head fracture management to obtain the stable and functional elbow (Table 2).

Non-displacement fracture (Mason type I) should be treated by moving elbow joint as soon as possible. The best treatment of partial articular displaced fracture that is stable (Mason type II) is unclear and can be treated by conservative treatment by fast moving or ORIF. The unstable fracture (Mason type III) which consist of 2 or 3 pieces can manage by the ORIF but the ORIF is unstable, or the Radial head fracture are more than.

Three pieces, the Radial head prosthesis (RHP) gives a better result in short-term. There is still no information about the long-term results of radial head prostheses (RHPs). The coronoid, olecranon, and ligament injuries associated with radial head fractures must be assessed and treated adequately.

The summary case study report

Summary of case history, the patient aged 36 years old having pain and swelling right elbow, and the right elbow hit the ground.

- Diagnosed in this patient: (Closed fracture right Radial head) Mason type III.
- Guidelines for treatment in this patient.

The method employed to achieve the best results is influenced by the nature of the radial head fracture. The type and extent

of the therapy are determined by Mason's categorization, which is used in medicine and depends on how severe the radial head and neck fractures are. Mason classified three types of radial head fractures: a non-moving fracture, a dislocation fracture, and a fracture that broke into two or more pieces. The fourth kind is then introduced, which includes any radial head fractures associated with humero-ulnar joint dislocations.

In the patient that have got the third type fracture, there should be treat by the ORIF with locking plate and screw fracture to hold the Radial head in place.

In the operating room, the elbow stability should be checked whether it has Varus or Valgus instability characteristics. In this patient, he does not have one (Figure 3).

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Author's contribution

SM performed study design, data collection and analyses, and manuscript writing.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declarations**Ethics approval and consent to participate**

Not applicable.

Consent for publication

Not applicable.

Competing interests

The author declares no competing interests.

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