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Big Lateral Epicondyle Fracture of Humerus with Elbow Dislocation in Teenage and Adult

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Abstract

Background Fractures of the lateral epicondyle of the humerus are common in the pediatric population, but rare in adults. And the mechanism of big lateral epicondyle fracture of humerus is currently unclear. Therefore, the aim of this study was to report the treatment and outcomes of a series of big lateral epicondyle fractures of humerus with elbow dislocations, analyze the possible injury mechanisms, and provide clinical guidance for similar cases.

Methods In this case-series study, patients with big lateral epicondyle fracture of humerus combined with elbow dislocation from 2009 to 2019 were collected. Retrospective review was conducted to analyze the possible injury mechanisms and to evaluate the treatment and outcomes.

Results Four patients were included in this study. The mean age was 21 years (range, 13–32 y). Case1 and case2 were lateral epicondyle fractures with elbow medial dislocations, while case3 and case 4 were lateral epicondyle fractures with anteromedial coronoid facet (AMCF) fractures and elbow posterolateral/posteromedial subluxations respectively. The fractures of the first three cases were fixed with tension band. The lateral epicondyle nonunion fracture of case 4 was removed and the lateral collateral ligament (LCL) was reconstructed. The mean Mayo elbow performance score (MEPS) was 92.5 (range, 85-100).

Conclusions Big fracture of lateral epicondyle of humerus with elbow medial dislocation may be caused by varus stress. If an AMCF fracture also occurs, it may be for the varus posteromedial rotary instability (PMRI). For a big lateral epicondyle fracture of humerus, tension band can be used in the acute stage to get a good outcome.

Trial registration Reference number:202101024. Trial registration date: January 29th 2021, retrospectively registered.

Background

The lateral epicondyle of humerus is the common attachment point of the LCL and the extensor tendons of the forearm. Lateral epicondyle fractures of humerus are common in the pediatric population, but rare in adults.(1)

In 1966, Osborne and Cotterill first described an osteochondral fracture in the posterolateral margin of the capitellum with or without a defect in the radial head in patients with recurrent elbow joint dislocation and posterolateral rotatory instability (PLRI). In 2008, Jeon et al. suggested the term "Osborne-Cotterill lesion" for this condition.(2) In addition to PLRI, another mechanism of traumatic elbow fracture dislocation are PMRI. PMRI often creates a LCL injury and an AMCF fracture with resultant varus subluxation of the elbow.

We report four patients with big lateral epicondyle fracture of humerus combined with elbow dislocation. The injury mechanisms of these patients may be different from those previously have been reported. The purpose of this study was to present the treatment and outcomes of a series of big lateral epicondyle fractures of humerus with elbow dislocations, analyze the possible injury mechanisms, and provide clinical guidance for similar cases.

Methods

We collected patients who underwent surgical treatment of lateral epicondyle fracture of humerus in our Level 3 trauma center from 2009 to 2019. The patients without complete ossification of the elbow joint, elbow dislocation or computer tomography (CT) image, or with small avulsion fragment cannot be allowed to fix or repair with osteosynthesis were excluded. And four patients were included with a big fracture (This was defined as an avulsion fragment, which was big enough to be fixed or repaired with osteosynthesis(3)). All patients had imaging data showing lateral epicondyle fracture of humerus, accompanying with medial elbow dislocation in case 1 (Fig. 1) and case 2 (Fig. 2), with posterolateral elbow subluxation and AMCF fracture in case 3 (Fig. 3), with posteromedial elbow subluxation and AMCF fracture in case 4 (Fig. 4). All patients had pain and disfunction of the injured elbow, but no neurological symptoms. All patients underwent initial reduction, but case 1 failed for a large fracture. It should be noted that case 4 underwent elbow stiff for nonunion after four-month conservative treatment. The demographics of all patients were showed in Table 1.

Table 1
The patient demographics

case	sex	age(y)	arm	injury mechanism	fracture pattern	dislocation pattern	initial reduction	nerve symptoms	others
1	F	13	right	traffic accident	LHE	medial dislocation	failure	no	-
2	M	20	left	fall off the horizontal bar	LHE	medial dislocation	success	no	-
3	M	32	left	skiing	LHE + AMCF	posterolateral subluxation	success	no	-
4	M	18	left	fall standing	LHE + AMCF	posteromedial subluxation	success	no	elbow stiff

LHE: lateral humeral epicondyle; AMCF: anteromedial coronoid face

All these four patients underwent surgical treatment (Table 2). The lateral epicondyle fractures were fixed with tension bands in case1 and case 2 through the posterior or lateral kocher approach respectively (Fig. 5). In case 3, the AMCF fracture was fixed with coronoid process plate (Acumed, Hillsboro, Oregon) through the medial split flexor carpi ulnaris (FCU) approach, the lateral epicondyle fracture was fixed through lateral kocher approach. Case 4 was a nonunion fracture. Firstly, the AMCF fracture was fixed with a cannulated screw through the anterior approach. Then, the lateral epicondyle fragment was removed under the periosteum through the lateral kocher approach. Lastly, the lateral collateral ligament was reattached and a hinge external fixator was added.

Three days after surgery, all patients began flexion and extension exercise under the protection of elbow orthosis or external fixator. All the protections were removed 6 weeks later. Patients were contacted and asked for follow-up routinely.

Results

During these surgeries, we found that all patients had a big lateral epicondyle avulsion fracture of humerus but the superficial fascias were intact. Case 1 and case 4 had a significantly big fracture block and involved the articular surface of the humeral capitellum. Case3 and Case4 both had an AMCF fracture. Besides, Case1 and Case2 both had complete medial elbow dislocations, while case3 had posterolateral and case4 had posteromedial elbow subluxations.

At postoperative review after 6 months, the flexion and extension range of case1's right elbow joint was 30°-70°, and both pronation and supination were 85°. X-ray showed that the fracture had healed but heterotopic ossification (HO) could be seen behind the elbow joint. An alkaline phosphatase (ALP) examination was normal. Therefore, we removed the tension band and performed HO removal and elbow arthrolysis. At final review (range, 11–30 months), the fractures of all patients had healed, the functions of the injured elbow joint were shown in Fig. 6 (case 2), and the mean MEPS was 92.5 (range, 85–100). The final review of all patients was showed in Table 2.

Table 2
Surgery and follow-up

case	surgical approach	surgery	follow-up (month)	HO	MEPS	extend/flex (°)	pronate/ supinate (°)	additional procedure
1	posterior	tension band	15	yes	90	20/135	85/80	HO removal + elbow arthrolysis
2	lateral kocher	tension band	30	no	100	10/135	80/85	-
3	medial split FCU + lateral kocher	tension band + acumed coronoid plate	11	no	95	10/130	75/80	-
4	anterior + lateral kocher	remove fragment + LCL repair + coronoid cannulated screw fixation + external fixator	25	no	85	10/120	75/75	-

HO: heterotopic ossification; MEPS: Mayo elbow performance score

Discussion

The LCL and the common forearm extensor muscles have a common attachment point on the lateral epicondyle of humerus. The lateral ulnar collateral ligament (LUCL) is a key component of the LCL. It is an elongated structure consisting of a thickened region of the posterolateral capsule that serves as the main stabilizer of the elbow joint(4). The reports of lateral epicondyle fractures combined with elbow dislocations in adults are rare. In 1966, Osborne and Cotterill reported a special type of elbow joint injury, manifested as habitual dislocation of the elbow joint, osteochondral avulsion fracture of the posterolateral edge of the capitellum with or without a crater or shovel shape fracture of the radial head(5, 6). However, they did not describe the associated ligamentous pathology of the LCL. The definition of "Osborne-Cotterill lesion" was suggested by Jeon et al. in 2008, when it was determined that there needs to be an accompanying injury of the LCL(2, 5). There have been some case reports related to similar injuries one after another (1, 2, 4, 7), all of these cases presented as PLRI.

McKee et al.(3) reported that 5 adult patients of 62 cases of complex unstable elbow joints had lateral epicondyle avulsion fractures. After the closed treatment failed, many of them were transferred to the hospital for final treatment of elbow instability, therefore, the severity of elbow instability in these patients may be higher than average. But the specific injury mechanism was not mentioned.

We report four patients with big lateral epicondyle avulsion fracture of humerus. The injury mechanisms are different from the Osborne-Cotterill lesion caused by PLRI reported in the literature. Case 2 and case3 were not complex instability after acute reduction, which was different from those reported by McKee et al.(3).

The mechanisms and injury patterns of traumatic elbow fracture dislocation are incompletely understood. The elbow can dislocate through either a PLRI or a varus PMRI(8). PMRI creates a LCL injury and an AMCF fracture with resultant varus subluxation of the elbow joint. If the force of the injury persists, the medial collateral ligament may rupture and the elbow joint may be completely dislocated. The radial head is usually not injured. PLRI and PMRI seem unable to explain the injury mechanisms of our case1 and case2.

Simple elbow dislocations typically occur in the posterior or posterolateral direction caused by valgus external rotation or valgus hyperextension(9). Rhyou et al.(10, 11)reported that varus and external rotation of the forearm seem to be the main injury mechanisms in simple posteromedial dislocation that is different from PMRI. Jockel et al.(12) reported four cases of simple medial elbow dislocations with complete tear of the extensor tendon origin and LCL from the humerus without big avulsion fragments in all cases, the LCL and extensor tendon origin was repaired by suture anchors. The injury mechanism of our case1 and case2 was similar to this, however, the authors did not mention it.

Although it is impossible to determine whether different cases have different mechanisms of injury. We speculate that the injury mechanism of case1 and case2 is simple varus distractive force which cause the avulsion fracture of humeral epicondyle and disengagement of the coronoid process from the trochlear notch, subsequently leading to the complete medial dislocation without coronoid fracture. Case 1 was a teenager, the ossification strength was not strong enough although the epiphyseal plate was closed, so the avulsed lateral humeral epicondyle manifested as a large dorsal fracture involving the articular surface of capitellum. Case3 and case4 had avulsion fractures of the lateral epicondyle of the humerus and coronoid fractures, which should belong to PMRI. In association with AMCF fractures, the injuries pattern of LCL were nearly always as complete avulsions from their attachment at the lateral epicondyle, just like degloving(13, 14). Park et al.(15) reported 19 patients with AMCF fractures, all patients had LCL injuries, 4 of them were repaired with Bio-SutureTak anchor sutures for small avulsion fragments at the humerus.

To the best of our knowledge, a big lateral epicondyle avulsion fracture with simple medial dislocation or AMCF fracture have not been described previously.

As this is a rare clinical scenario, the injury mechanisms and optimal treatment for big lateral epicondyle fracture with elbow simple medial dislocation or AMCF fracture remain unknown. For the first three fresh patients, the big lateral fracture may lead to elbow instability and stuff in the humeroradial joint. The fracture piece is a thin slice, there is the attachment of LCL and the common extensor tendon. If screw fixation is used, early functional exercise may cause the thin bone slice fracture. If anchor is used, the anchor must be placed in the center of rotation and below the fragment, then the fracture fragment is drilled some holes to suture the ligament and the common extensor tendon. The operation is more cumbersome, and drilling the fragment may break it. As a result, we chose tension band to fix the lateral epicondyle of the humerus. Based on the prognosis of existing patients, we feel that tension band is a good choice. The coronoid process of case 3 was fixed with Acumed coronoid process plate. Case 4 was an old fracture with a sclerotic bone fragment. Because it was impossible to anatomically restore the fragments and fixation of the fracture may cause nonunion, we resected the bone fragments under the periosteum, reconnected the point of isometry with a trans osseous suture through bone tunnels, fixed the coronoid process with a screw, and added an external fixator finally.

Conclusions

Lateral epicondyle fractures of humerus are rare in adults. Big fragment with adequate size to be allowed to fix or repair with osteosynthesis, medial dislocation or AMCF fracture, evidence of instability, and fracture extension into the joint may be the most predisposing factors for surgery. For acute fractures of lateral epicondyle of the humerus, fixation with tension band may lead to an excellent functional outcome.

Abbreviations

AMCF: Anteromedial coronoid facet

LCL: Lateral collateral ligament

MEPS: Mayo elbow performance score

PMRI: Posteromedial rotary instability

PLRI: Posterolateral rotatory instability

CT: Computer tomography

LHE: Lateral humeral epicondyle

FCU: Flexor carpi ulnaris

HO: Heterotopic ossification

ALP: Alkaline phosphatase

LUCL: Lateral ulnar collateral ligament

Declarations

Ethics approval and consent to participate

Ethics approval and consent approved by the Ethical Committee of the Xiangya Hospital of Central South University (reference number: 202101024). Written informed consent was obtained from individual or guardian participants.

Consent for publication

Informed consents were obtained from all patients (legal guardians) included in the study.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

LC, HL and HBL conceptualized and designed the study. LC, HL, HBL, YZ, HTL and ZL performed data collection and analysis. LC, HL and HBL analyzed and interpreted the data, prepared the original draft, reviewed and edited final draft. LC obtained the funding and made a supervision during the study. All authors read and approved the final manuscript.

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Figures

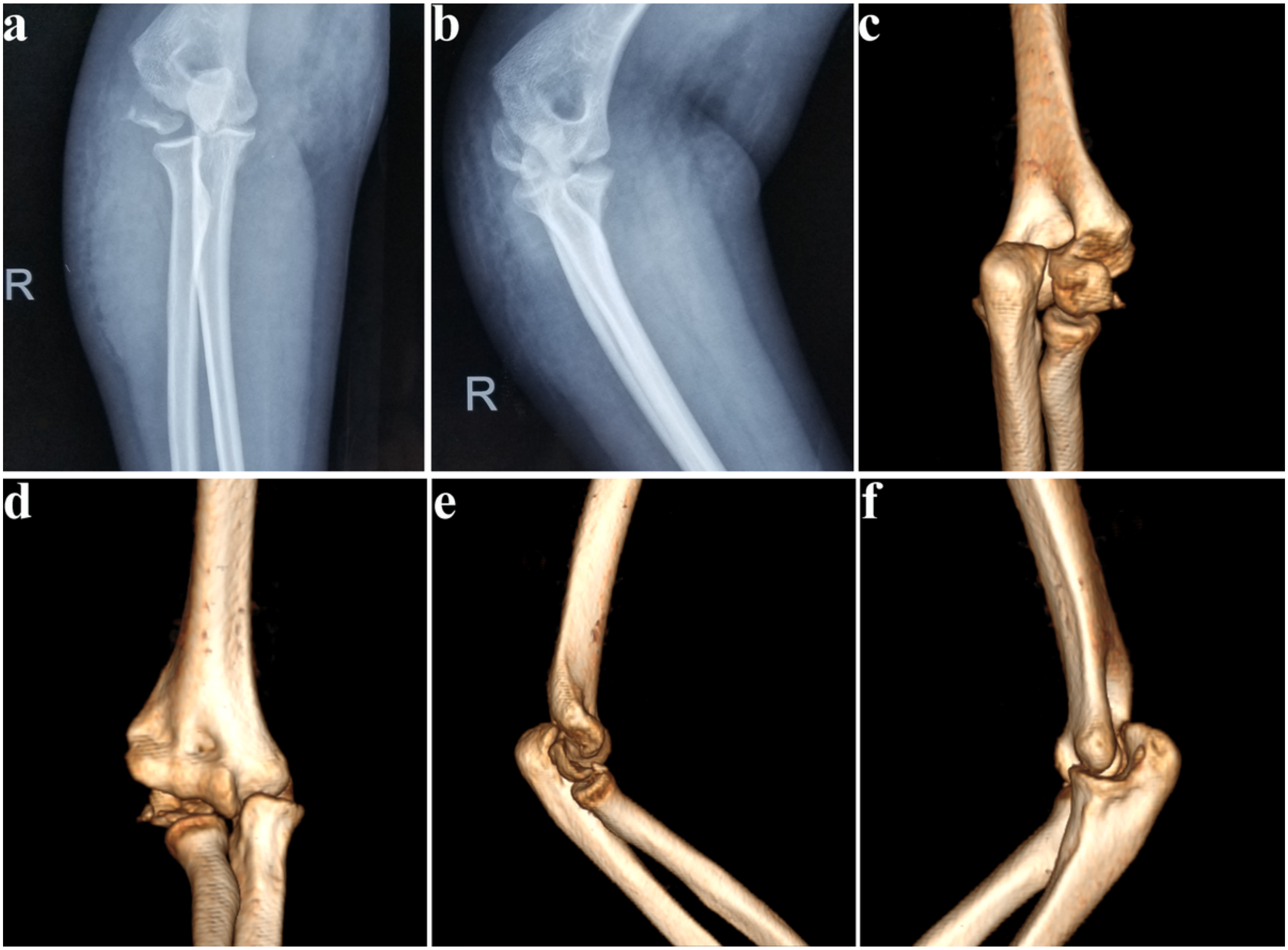

Figure 1

Preoperative radiographs（a, b）and 3D-CT images (c, d, e, f) of the right elbow in case 1 showing lateral epicondyle fracture of humerus with medial elbow dislocation

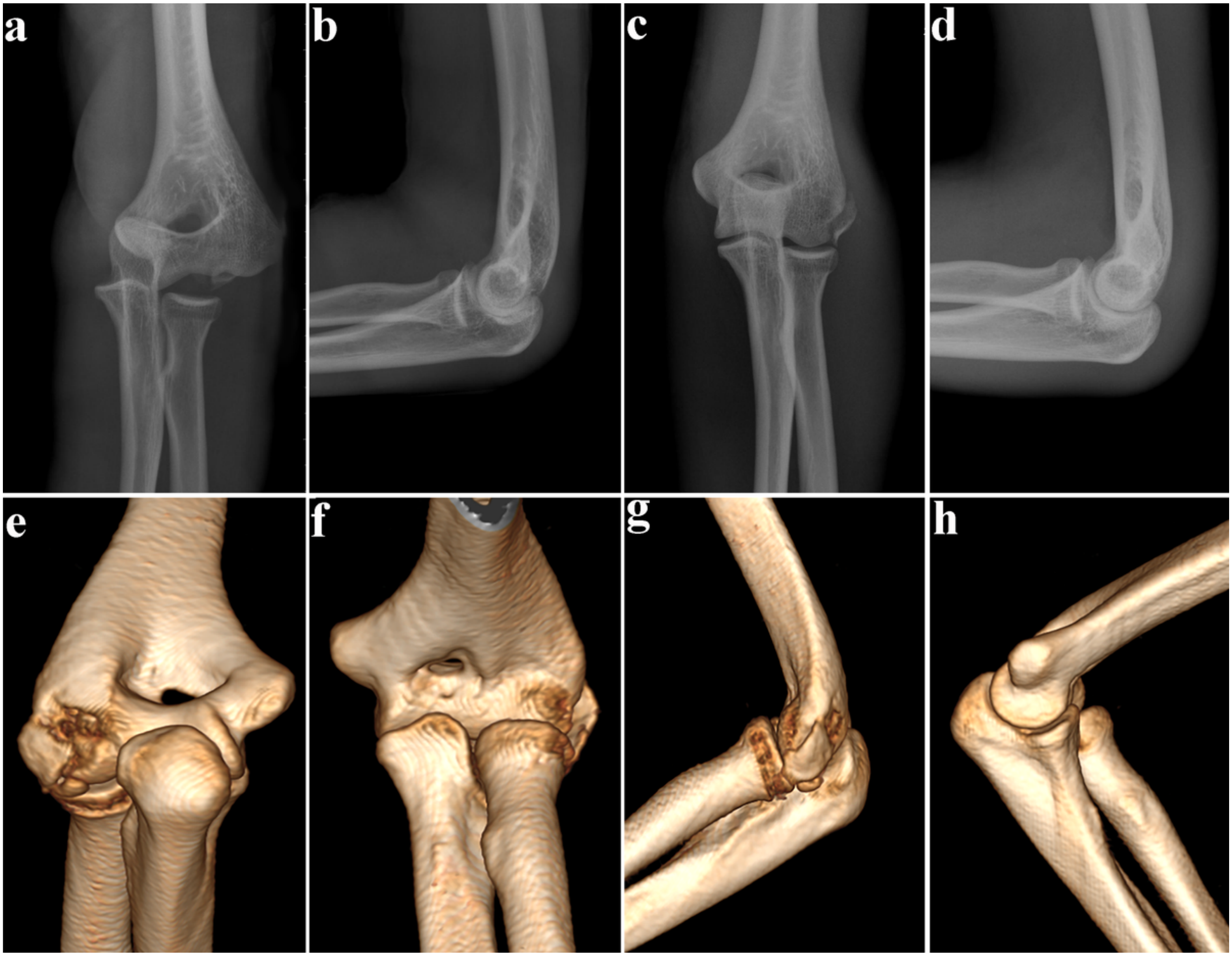

Figure 2

Preoperative radiographs（a, b）of the left elbow in case 2 showing lateral epicondyle fracture of humerus with medial elbow dislocation. Preoperative radiographs（c, d）and 3D-CT images (e, f, g, h) after initial reduction

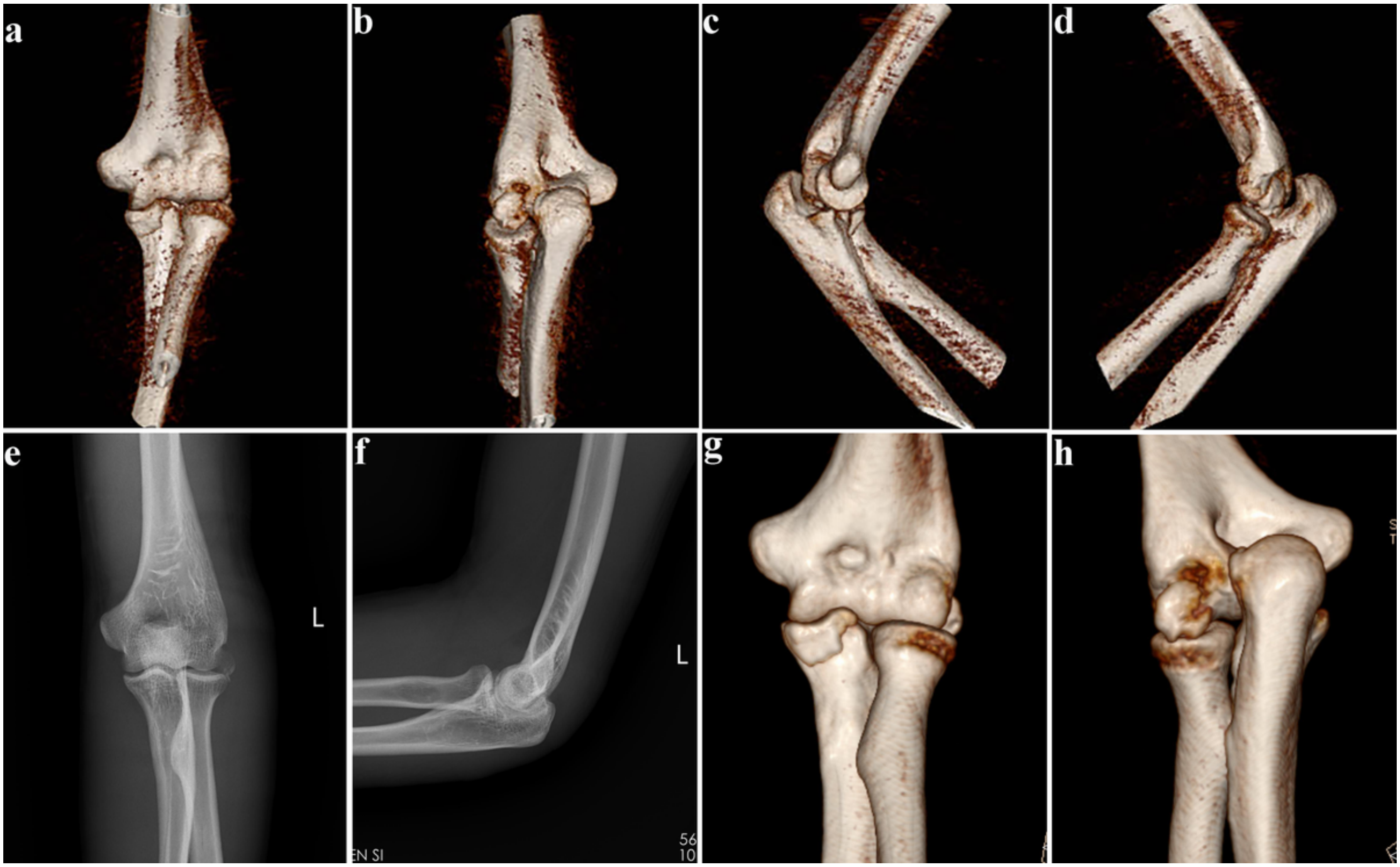

Figure 3

Preoperative 3D-CT images（a, b, c, d）of the left elbow in case 3 showing lateral epicondyle fracture of humerus and AMCF fracture with posterolateral elbow subluxation. Preoperative radiographs (e, f) and 3D-CT images (g, h) after initial reduction

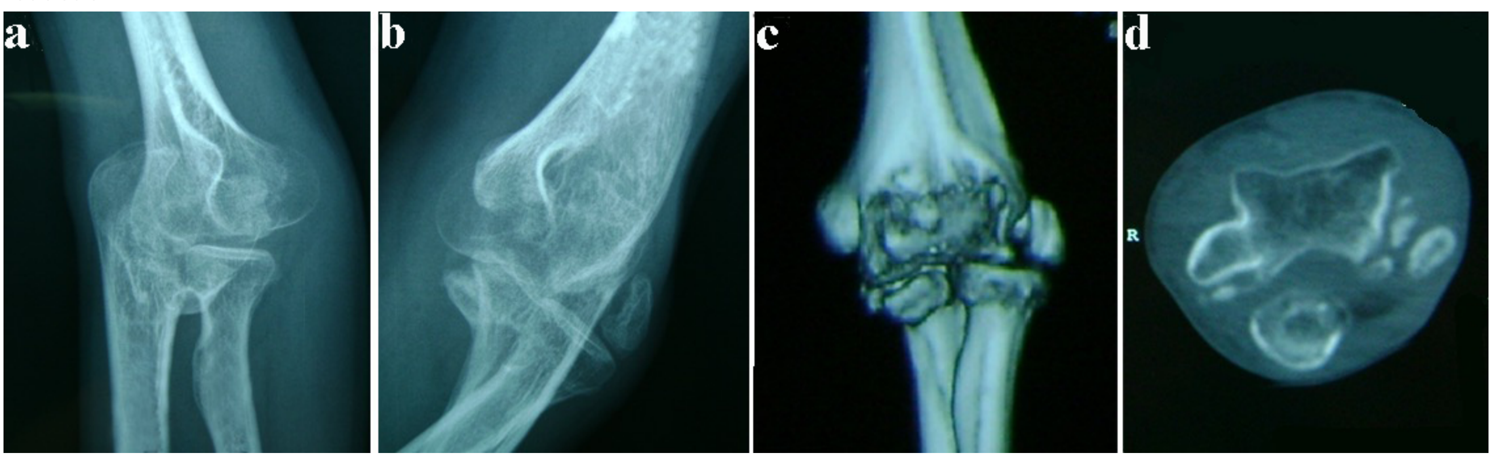

Figure 4

Preoperative radiographs (a, b), 3D-CT image (c) and CT image (d) of the left elbow in case 4 showing lateral epicondyle fracture of humerus and AMCF fracture with posteromedial elbow subluxation

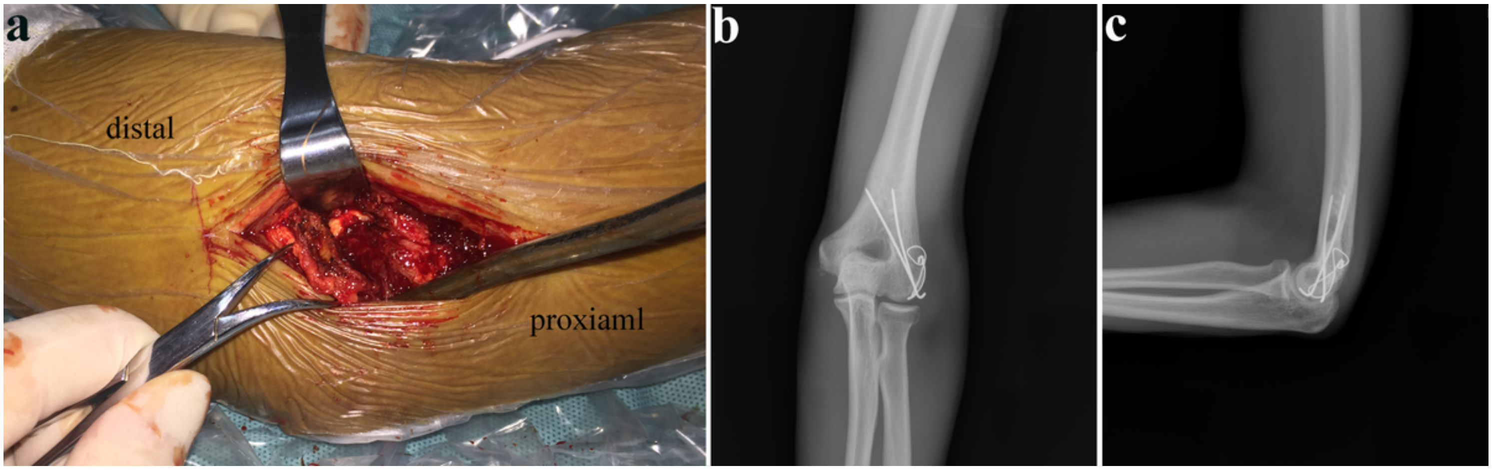

Figure 5

Intraoperative photographs (a) of the left elbow in case 2. Postoperative radiographs (b, c) at 30 months showing healing without elbow deformity

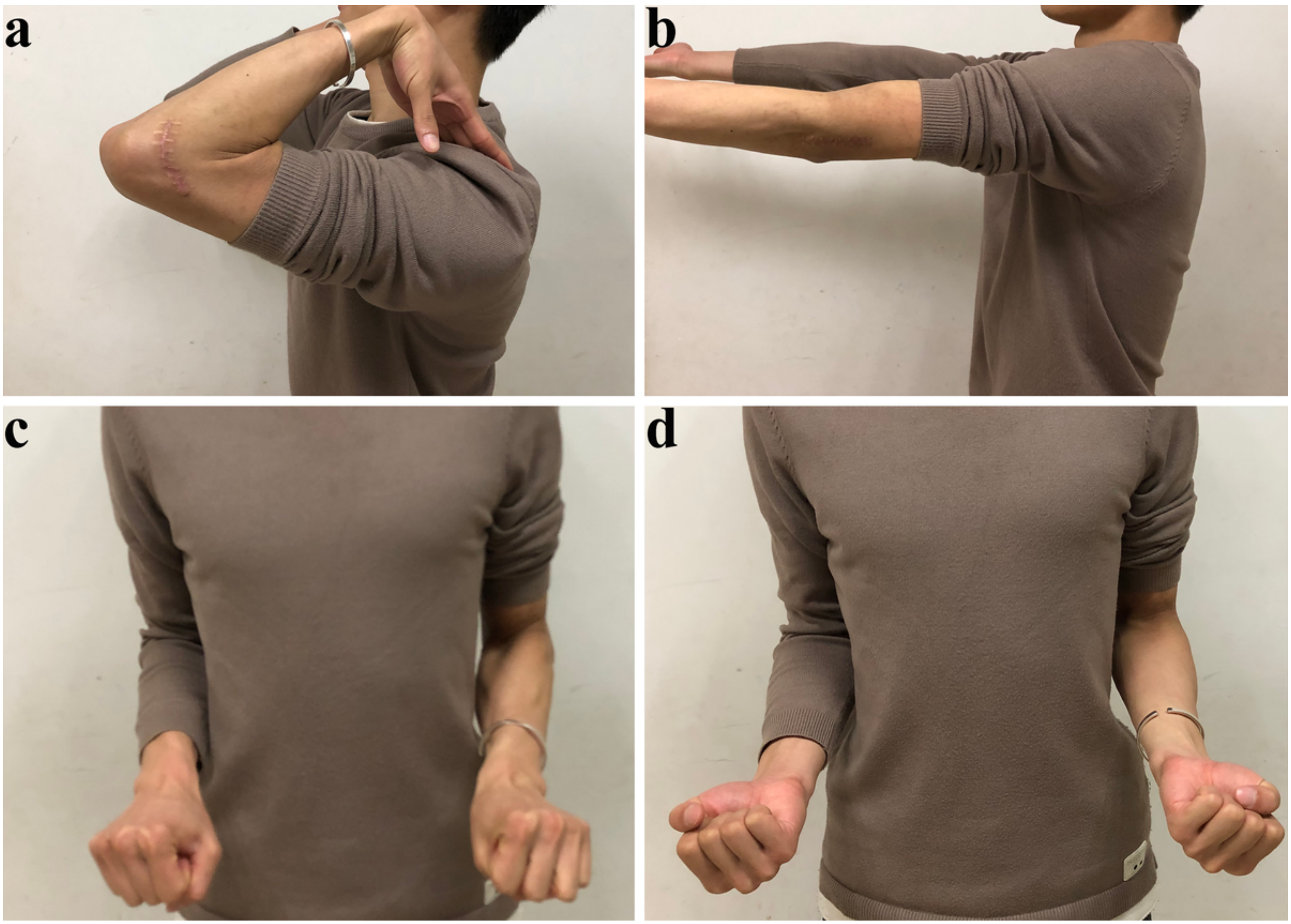

Figure 6

Macroscopic pictures of bilateral elbows in case 2 at the last follow-up in flexion (a), extension (b), pronation (c), and supination (d)