Open reduction, Radial-Ulnar Osteotomy combined Annular ligament reconstruction for Congenital Radial Head Dislocation in Children

Nguyen Ngoc Hung
National Hos pital Pediatric – Hanoi Medical University

INTRODUCTION

Congenital dislocation of the radial head (CDRH)is a rare condition, it is diagnosed after birth [1, 2].

Chronic radial head dislocation can be either congenital, developmental or post-traumatic

It can occur unilateral and bilateral

- ***Kelly DW.*** *Congenital dislocation of the radial head: spectrum and natural history. J. Pediat. Orthop 1981;* ***1****: 295-298. [PMID:7334108]*
- ***Tachdjian MO.*** *Pediatric Orthopaedic.s Ed. 2, pp. 184-187. Philadelphia. W. B. Saunders, 1990*

MATHERIALS and METHODS

A retrospective study evaluate the results of treatment whit operation or consevacation from 2009 and 2014

There were 5 patients of CRHD in Nation Hospital for Pediatrics.

All children presented had no history of trauma or had a history of previous elbow pathology or surgery.

Radiographic criteria

In the normal elbow, the central axis of the radius should pass through the center of the capitellum (Storen's line).

The status of the radial head reduction was evaluated. Radiographs (full length of the forearm)

Clinical criteria

The evaluation of the range of motion of both elbows and wrists.
Quantitative determination of pain.
Stability of the radio-ulnar joint.
Carrying angle of the elbow and stability to varus and valgus stress.
Flexion of the elbow & Flexion of the wrist

Range of motion (ROM) measurement

Pre-posterior treatment ROM, expressed as the sum of the flexion-extension arc and pronation-supination arc.

Defined a full flexion-extension arc as 140°,
full pronation arc as 75°,
full supination arc as 85° [8].

[8] Morrey BF*.The elbow and its disorders, 3d ed. Philadelphia: WB Sanders, 2000:262–81.*

Surgical Technique

The novel two incision/two-in-one technique described here involves one modification to the Sachar's method [9]

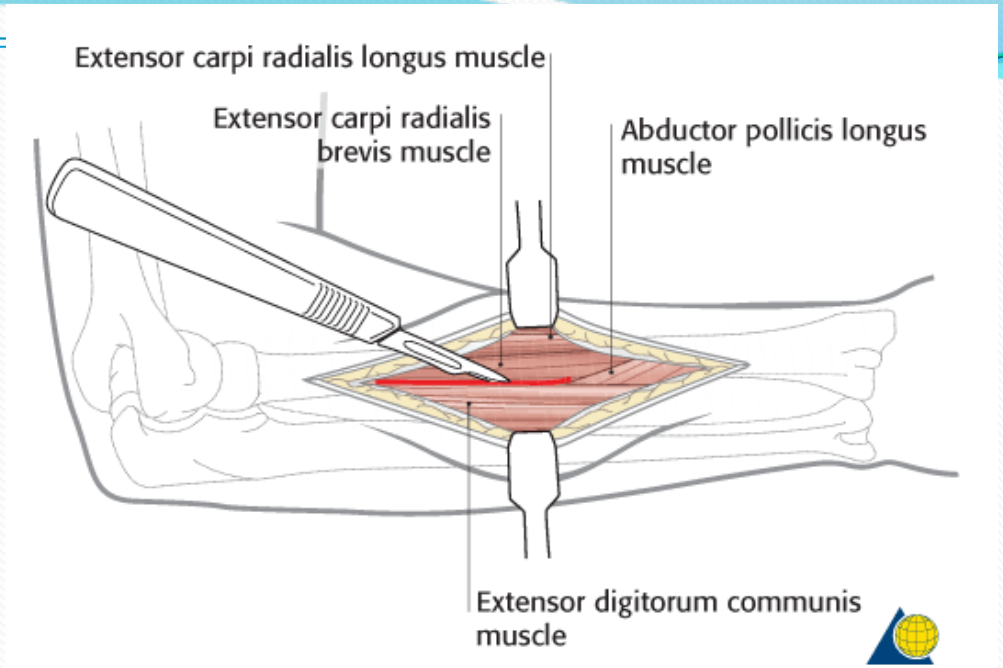
The first incision on the anterior aspect of the proximal forearm (Henry approach)

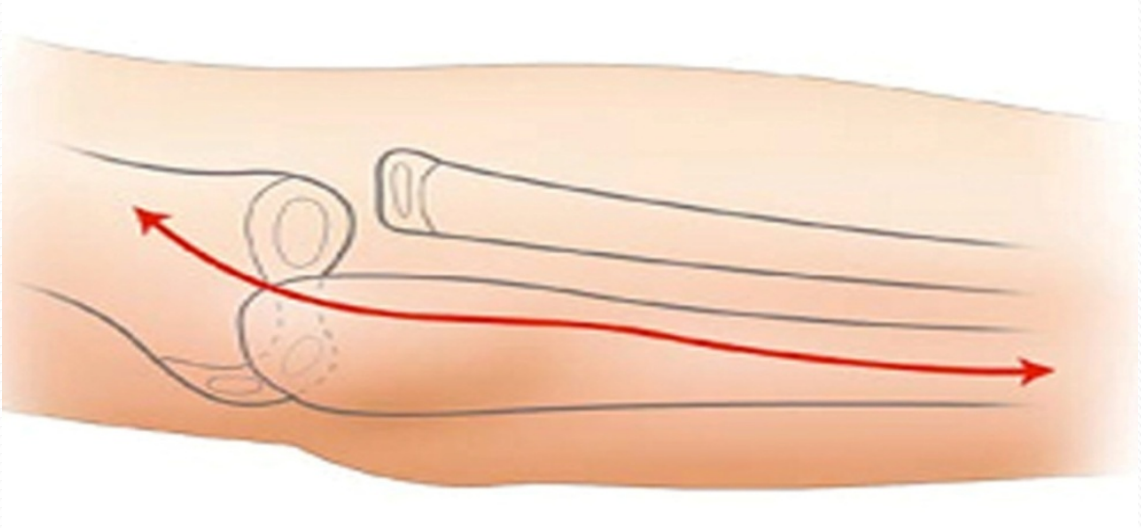
The second incision on the Posterio-lateral (Speed and Boy's approach).

The radial shaft was stabilized by Kirschner wire with a 1.7 mm **(Fig 2).**

Sachar K, Mih AD. *Congenital Radial Head Dislocations. Hand Clin.1998;* ***14(1):*** *39–47.*

Speed and Boyd. *Fractures and dislocations in children: Campbell's operative orthopaedics. 2013*

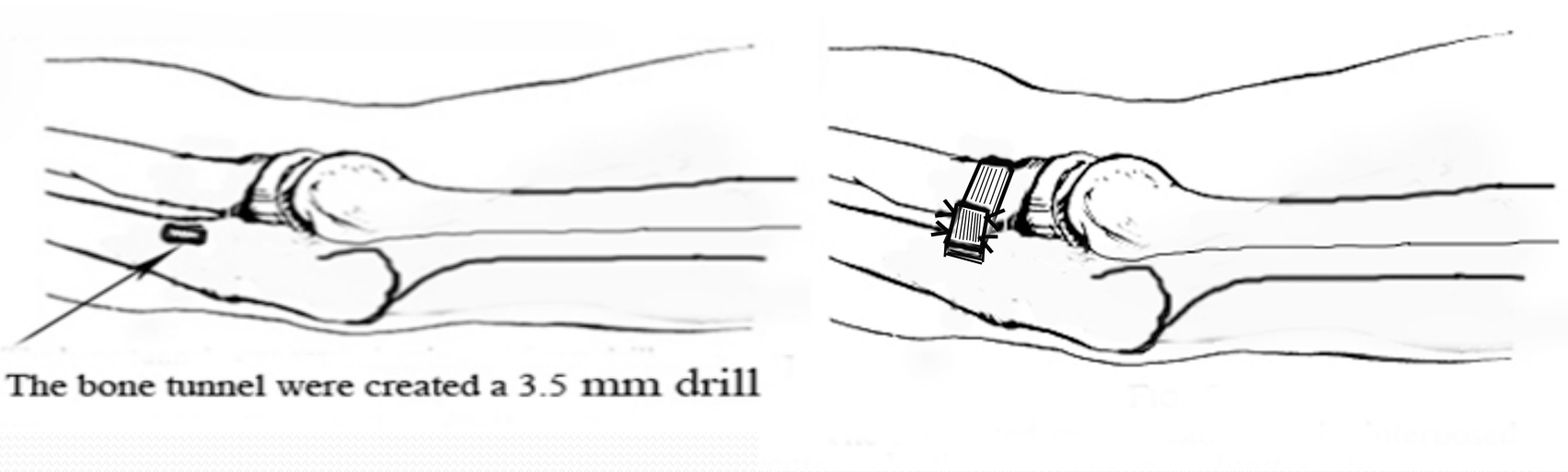

Extensor carpi radialis longus muscle
Extensor carpi radialis brevis muscle
Abductor pollicis longus muscle
Extensor digitorum communis muscle



Annular ligament Recontruction

The bone tunnels were created using a 3.5-mm drill at the level of annular ligament.

A strip of fascia lata with width of 1 cm and length of 6-8 cm was obtained from distal one third thigh.



The bone tunnel were created a 3.5 mm drill

Post-operatively, the elbow is immobilized in 90° flexion and full supination for a period of six weeks followed by gradual mobilization

Evaluate Surgical Result

A new scoring system was subsequently based on the four parameters: deformity, pain, ROM, and function.

The four parameters were weighted equally, 25 points each, for a perfect score of 100 points:

1) Deformity: 25, no concern; 15, minor concern; 0, major concern;
2) Pain: 25, no pain; 15, intermittent mild pain but not limiting activities; 0, pain, limiting activities;
3) Range of motion (sum of the flexion-extension and pronation-supination arcs): 25, >250°; 15, 250°– 200°; 0, <200°;
4) Function: five activities of daily living (comb hair, feed self, open doorknob, hold on to subway overhead rail, put on shoes with hands)

Total elbow performance score was graded as excellent (90 or more points), good (89–75 points); fair (74–60 points); or poor (<60 points) [20]

20. Kim HT, Park BG, Suh JT, Yoo CI*. hronic radial head dislocation in children, Part 2: results of open treatment and factors affecting final outcome. Journal Pediatric mOrthopaedic 2002; 22(5):591-7*

Table 1. Clinical data of the Patients

Case	Gender	Side	Deform. type	Other Deformities		Patient's age and Approach		Follow-up
				Patient	Family	Operation (Years)	Conservation (Years)	
1	Female	Left	Anterior	No	No	15.0		34
2	Male	Right	Anterior	No	No	13.0		42
3	Female	Left	Anterior	CDH	No	12.0		46
4	Male	Lef	Anterior	No	No		10.0	72
5	Female	Left	Posterior	DLF	No		6	39

There were 3 cases have been operated and 2 cases have been conservactioned. Mean age at treatmen : 11.2 years; Follow-up time: 46.6 months. Combinated Congenital deformity with Congenital Dislocation of the Hip in 1 case; Congenital deviceint long Femur in 1 case.

Table 2. Range of motion measurements (in degree)

Case	Preoperative				At follow - up			
	Flex-Ext arc (°)	Pronation arc (°)	Supination arc (°)	Total arc (°)	Flex-Ext arc (°)	Pronation arc (°)	Supination arc (°)	Total arc (°)
1	120	65	75	260	125	70	80	275
2	110	60	70	240	130	70	70	270
3	125	65	70	260	130	65	75	270
4	130	70	70	270	135	70	75	280
5	125	70	75	270	120	70	80	270

Range of motion measurements (in degree) mean Pre/Post treatment:
Flex-Ext: 122°(AD=7.6) /128°(SD=5.7) **P***valuate* 0.003156 ;
Pronation arc: 66°(AD=4.2) /69° (SD=2.2) **P***valuate* 0.02115 ;
Supination arc: 72° (SD=2.7) /76° (SD=4.2) **P***valuate* 0.005221 ;

Total arc: 260°(SD=12.2) /273°(SD=4.5) **P***valuate* 0.000012

Table 3. Elbow performance score

Case	Preoperative						At follw - up					
	Defor.	Pain		Motio	Funct	Total	Defor	Pain		Motio	Funct	Total
		Ebow	Wrist					Ebow	Wrist			
1	15	15	25	25	20	75	25	25	25	25	25	100
2	15	0	25	25	15	55	15	25	25	25	15	80
3	15	15	25	25	10	65	15	15	25	25	15	70
4	25	25	25	25	25	100	25	25	25	25	25	100
5	0	25	25	25	15	65	15	25	25	25	15	80

% Improvement + [(B-A)/A] X 100 (A: Preoperative mean ROM in each arc; B: at follow – up in each arc) Total elbow score: Excellent. ≥ 90; Good, 89-75; Fair, 74-60; Poor ≤ 60. Total points for Elbow performance score without wrist point.

Elbow Performance score with mean Pre/Post treatment:
Deformy: 14 (SD=8.9)/19 (SD=5.5) **P***valuate* 0.012228 ;
Elbow Pain: 16 (SD=10.2)/23 (SD=4.5) **P***valuate* 0.001557 ;
Motion: 25 (SD=0)/25 (SD=0)
Function: 17 (SD=5.7)/19 (SD=5.5) **P***valuate 0.206236* ; Total: 72 (SD=17.2)/86 (SD=13.4) **P***valuate* 0.000106

Surgical result: Excellent in 1 case, Good in 1 case, Fair in 1 case

Cases report

Case 1

Post-operative thirty - four months, had painless elbow but with the same range of pre-operative movements (full flexion-extension arc as 125°, a full pronation arc as 70°, and a full supination arc as 80°).

Case 2

Fig 3. X-rays showed anterior dislocation of an underdeveloped radial head

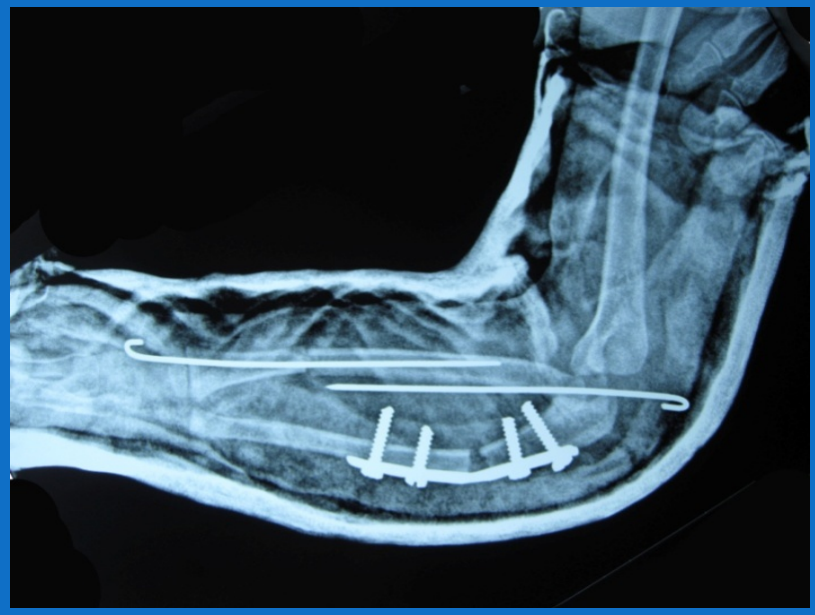


Fig 4. Patient was performed A-U Osteotomy combined ALR

Post-operative fourty- two months, had painless elbow but with the full flexion-extension arc as 130°, a full pronation arc as 76.9°, and a full supination arc as 81.2°)

Case 3

Fig 5. X-rays showed anterior dislocation of an underdeveloped radial head

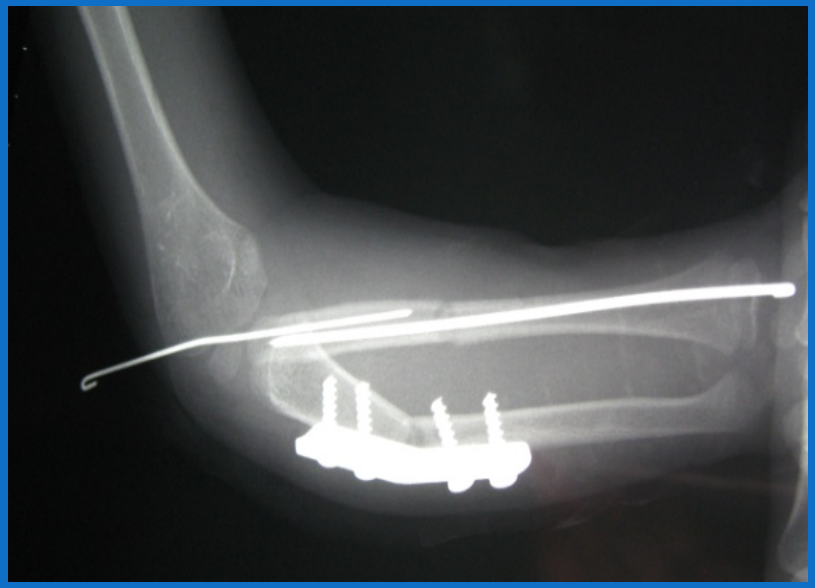


Fig 6. Patient was performed R-U Osteotomy combined ALR

Post-operative fourty- six months, had mild pain elbow but with the full flexion-extension arc as 130°, a full pronation arc as 65°, and a full supination arc as 75°)

Case 4

Fig 7. X-rays showed anterior dislocation of an underdeveloped radial head

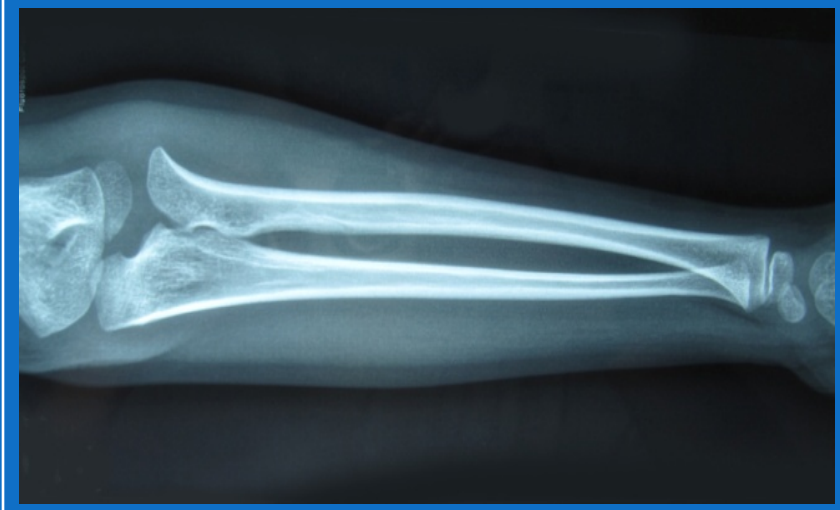


Fig 8. X-rays showed Deformity of a radial head and underdeveloped radial head

On examination, there were flexion-extension arc as 130°, a full pronation arc as 70°, and a full supination arc as 70°.

Practicing sports without pain or functional impairment

Case 5

Fig 9. X-rays showed posterior radial head dislocation at 12 months old.

Fig 10. X-rays showed an underdeveloped radial head and posterior dislocation at 12 months old.

She had been diagnosed with a unilateral congenital radial head dislocation of the left elbow and congenital deficient long femur at the age of 12 months

Case 5

Fig 11. X-rays showed posterior dislocation at 6 years old.

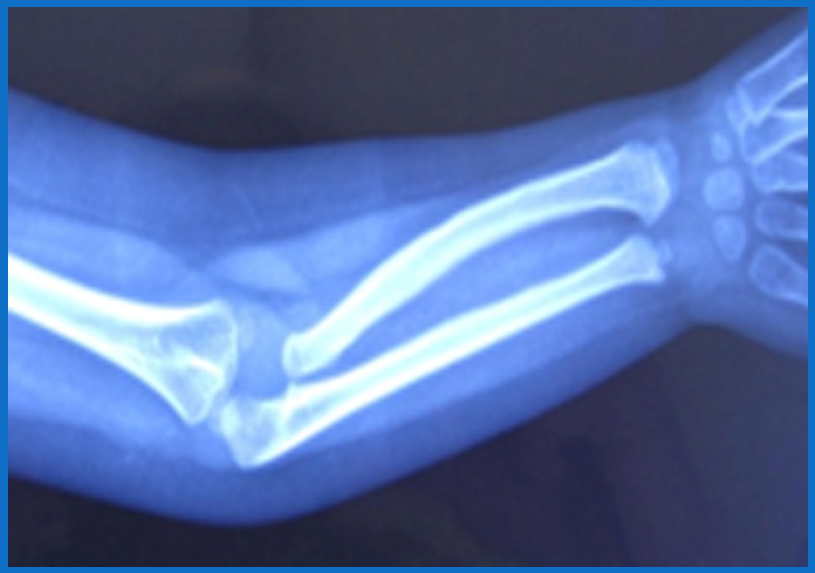


Fig 12. X-rays showed antero-lateral radial bow and posterior Radial head dislocation at 6 years old.

The result of this treatment strategy was satisfactory after a follow-up of thirty – nine months. With full flexion-extension arc as 120°, a full pronation arc as 70°, and a full supination arc as 80°. No increase in valgus angle was seen, and elbow function was not painful.

Complications

- Nounion in one patien
- There were no cases of growth disturbance,
- Avascular necrosis of the radial head 1 case
- Infection: No

DISCUSSION

Etiology

Congenital radial head dislocation is the most common congenital anomaly of the elbow, with an estimated incidence rate of 0.06% to 0.16% [1].

In approximately 60% of all cases, congenital dislocation of the radial head is seen in conjunction with various syndromes (eg, nailpatella syndrome, Silver's syndrome, Ehlers-Danlos syndrome), congenital radioulnar synostosis, mental retardation, and scoliosis [13].

The exact cause of CRHD remains unknown.

There have been reports of familial occurrence, but no definitive hereditary pattern has been established [14, 15].

Trauma had also been stated to be the cause of radial head dislocations in newborn, especially if it occurs unilateral.

A pulled elbow of infancy resulting in radial head sub-luxation and laxity of the annular ligament may occur as shortly after birth.

Now, some criterias had been used diagnosing CRHD was keys:

McFariand's criteria. 1936 [17]

1. Retively short ulna or long redius
2. Hypoplastic or absent capitellum
3. Partially defective trochlea
4. Prominent alnar epicondyle
5. Groove in distal radius
6. Dome shaped radial head with long marrow neck

Mardam-Bey and Ger criteria. 1979 [3]

1. Bilateral involvement
2. Familial history
3. Concomitial congenital anomalies
4. No history of trauma
5. Not reducible by closed methods
6. Dislocation seem at birth

Clinical

Congenital dislocation of the radial head is a rare condition that frequently is not diagnosed until years after birth [2].

Almquist et al. (1969) [20] reported that almost half of congenital radial head dislocations were anterior, almost half posterior and one tenth lateral.

Almost half of the dislocations were bilateral. We had 4 case of unilateral anterior, 1 case of unilateral posterior radial head dislocation in this study (**Table 1**).

Almquist E E, Gordon C H, Blue A I*. Congenital dislocation of the head of the radius. J Bone Joint Surg (Am) 1969; 51: 118-27.*

Strategy of treatment

We elected to proceed with a conservative course of observation, for several reasons:

First, the dislocated radial head produced no clinical symptoms.
Second, the deformity was cosmetic, not functional.
Third, the dislocation was intracapsular.

There were a nonoperative course of observation (Wiley et al. 1991 [12] ...

There were 2 patients have used course of observation in this study (**Table 1**)

Surgical Approach

Various therapeutic possibilities have been discussed: resection or rotation osteotomy of the radial head, an ulnar osteotomy, reconstruction of the annular ligament,

The surgical technique consists: lengthening and angulation or ulnar rotation osteotomy [27]

[27]. Liu R, Miao W, Mu M, Wu GM, Ou I. Wu Y. *Ulnar Rotation Osteotomy for Congenital Radial Head Dislocation. J Hand Surg Am 2015; 40 (9): 1769-75*

Excision usually relieves pain, but does not always lead to significant functional improvement.

Generally, patients become symptomatic by adolescence and are treated by radial head resection.

We agree with Blount [27] that**:** Certainly, the admonition

"Never excise the radial head in a growing child"

27. Blount WP. *Fractures in Children, Baltimore. Williams and Wilkins, pp. 56-58. 1955.*

Complications

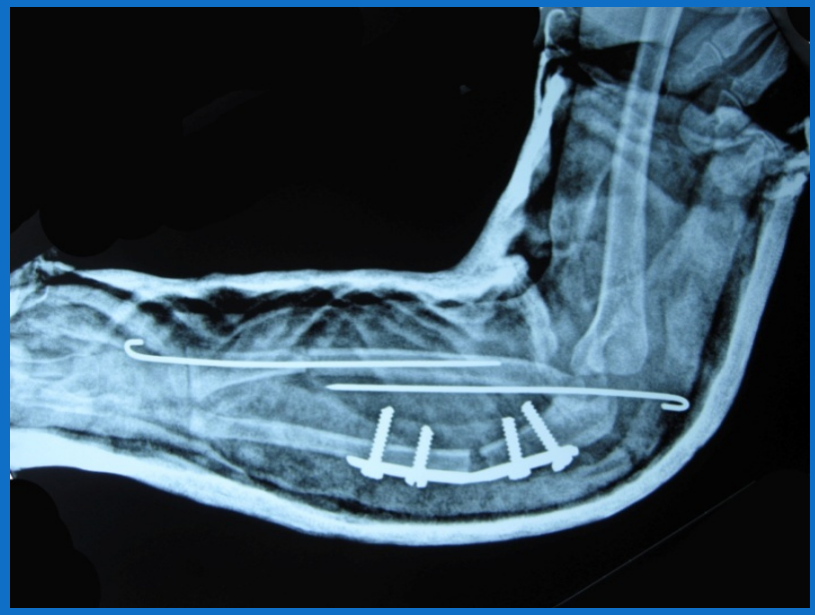
Pain. Complications include pain in the distal radioulnar joint due to proximalization of the radius, instability.

Progressive cubitus valgus has often been mentioned as an inevitable consequence of excision of the radial head before the cessation of growth [36, 37].

Regrowth of the radial head and ***radio-ulnar synostosis*** have also been reported in the literature [1, 38]. Three of the follow-up studies commented on this complication.

Case 2

Fig 3. X-rays showed anterior dislocation of an underdeveloped radial head



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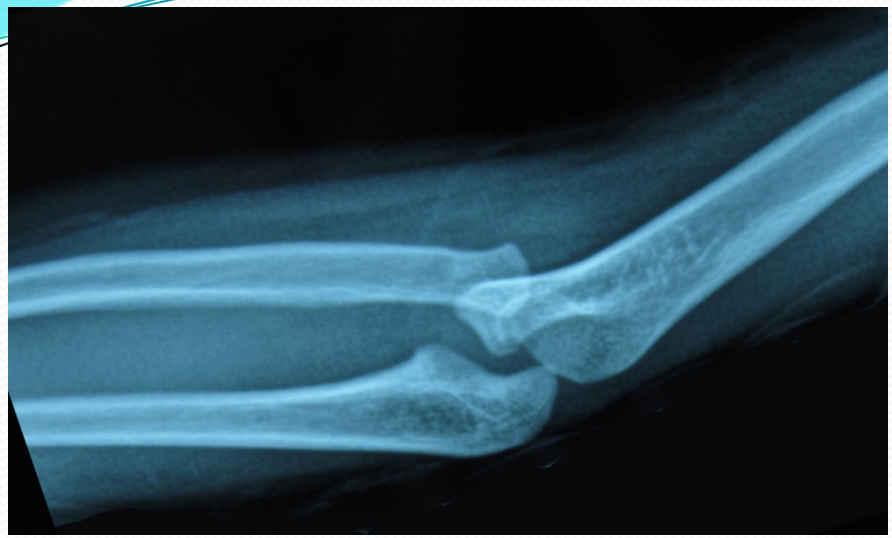
Post-operative fourty- two months, had painless elbow but with the full flexion-extension arc as 130°, a full pronation arc as 70°, and a full supination arc as 70°)

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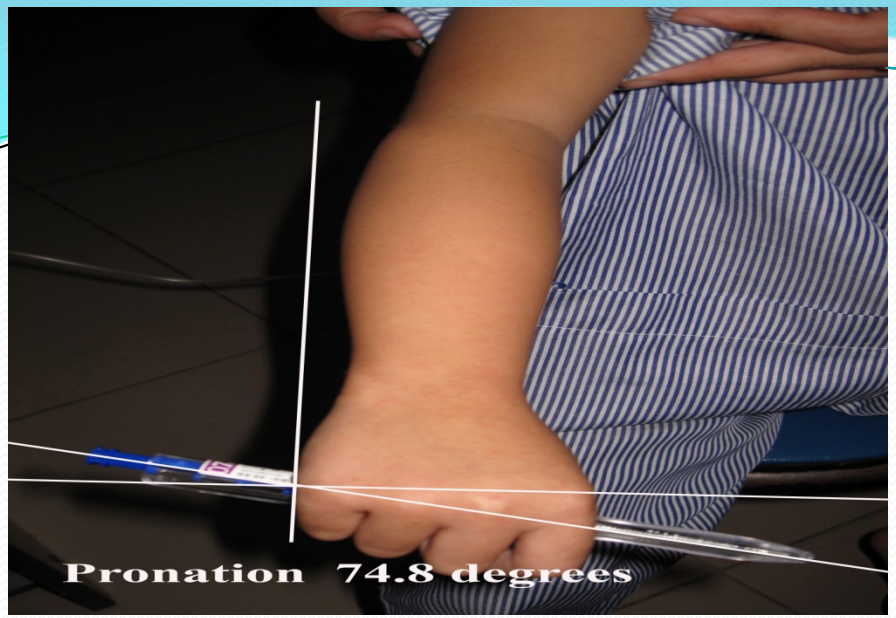
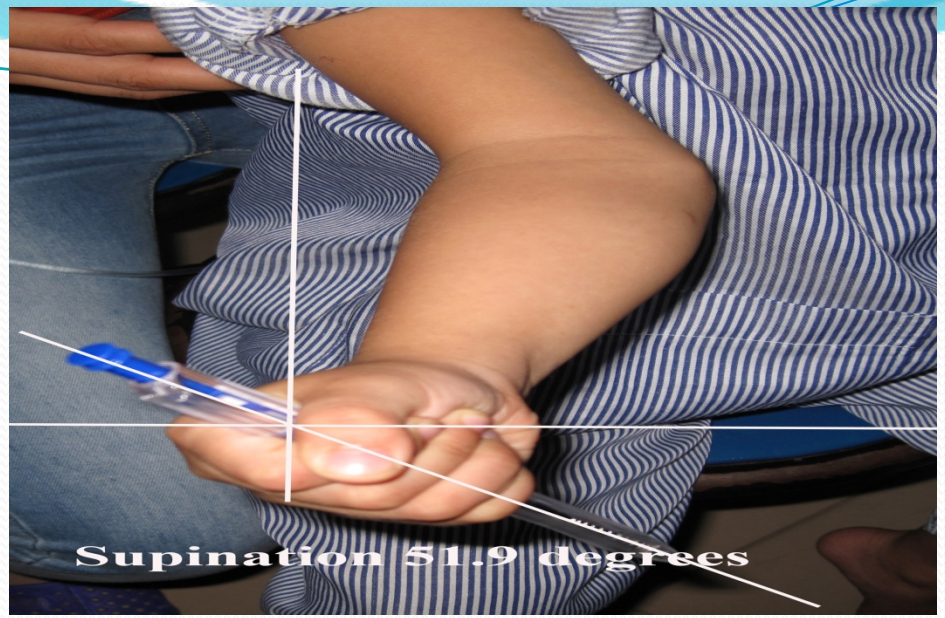

Pronation 74.8 degrees


Supination 51.9 degrees


Pronation 76.9 degrees

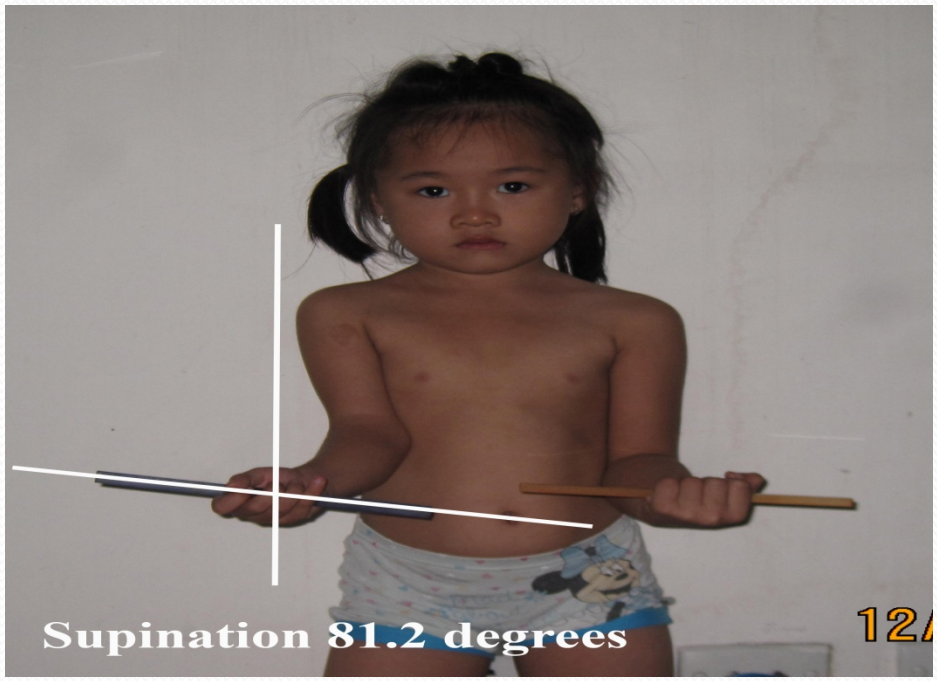

Supination 81.2 degrees

Table 4. Post- Operative Results and Approach

Author	Number Paitient	Gender		Age at Operative (Years)	Approach	Follow-Up (Months)	Pre-Post Operation				
		Male	Femaile				Pain	Flexion	Extension	Pronation	Supination
Exarhou 1970 [6]	2	1		18	EHR	6	Pa/Pail	120°/120°	80°/80°	75°/75°	85°/85°
			1	16	EHR	14	Pa/Pail	140°/140°	30°/30°	75°/75°	85°/85°
Campbell. 1992 [25]	8	No	No	13	EHR	84	Pa/Pail	Improve >11°		Improve > 53°	
Bengard 2012 [23]	16	No	No	No	EHR	No	Pa/Pa Relief	137°/135°	27°/33°	100°/119°	
Karuppal. 2014 [33]	1		1	8	U&R Osteo.	12	Pa/Pail	130°		75°/75°	Improve > 40°
Hung 2017	3	1		15	U&R Osteo.	34	Pa/Pail	120°/125°		65°/70°	75°/80°
		1		13	U&R Osteo.	42	Pa/Pail	110°/130°		60°/70°	70°/70°
			1	12	U&R Osteo	46	Pa/Pail	125°/130°		65°/65°	70°/70°

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		16	EHR	14	Pa/Pail	140°/140°	30°/30°	75°/75°	85°/85°
Campbell. 1992 [25]	8	13	EHR	84	Pa/Pail	Improve >11°		Improve > 53°	
Bengard 2012 [24]	16	No	EHR	No	Pa/PaRelief	137°/135°	27°/33°	100°/119°	
Karuppal. 2014 [35]	1	8	U&R Osteo.	12	Pa/Pail	130°/130°		75°/75°	Improve > 40°
Hung . 2017	3	15	U&R Osteo.	34	Pa/Pail	120°/125°		65°/70°	75°/80°
		13	U&R Osteo.	42	Pa/Pail	110°/130°		60°/70°	70°/70°
		12	U&R Osteo	46	Pa/Pail	125°/130°		65°/65°	70°/70°

CONCLUSION

- Congenital dislocation of the radial head is rare,

- If child complaint or limitations are present, should operated early to prevent some complications.

- Ulnar and Radial osteotomy combined Annular ligament reconstruction had good post-operation and save surgery


Thanks for Your Attention