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# RESTORATION OF LOST ROTATION OF THE FOREARM AND HAND BY INTENTIONAL PERMANENT DEFECT IN THE LOWER ULNA

*By*

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Resection in the lower part of the ulna with the object of restoring the rotation of the forearm, blocked by the sequels of a fracture in the wrist,—for instance a Colles fracture—was performed the first time, as far as I have been able to see, by the French surgeons *Le Fort* and *Cololian*. In 1918 a paper was published by them on: „Pseudarthroses et pertes de substance du cubitus", in which a case is reported (obs XIII) of a soldier, who had lost the rotation of his forearm and hand after a fracture of the radius and the ulna above the wrist. The authors excised a piece of the ulna, 2–3 cm., above the pronator quadratus muscle with its periosteum in order to create here a permanent pseudarthrosis. The patient after finishing the treatment had gained a rotation of the hand of 135°.

However, the idea that pseudarthroses of the lower part of the ulna are rather innocuous is older still. In a paper by *Guilleminet* and *Lacour* of 1952 the reader is referred to a couple of publications from 1908 (Thèse de *Vion-Delphin* et Thèse de *Bosquette*, both from Lyons). It appears from these authors that *Destot* had recognised the "providential" part which the pseudarthroses of the lower part of the ulna may play and has remarked that they should occasionally be left alone. But Destot did not apply the principle for practical, therapeutic purposes.

In 1913 *Darrach* published a paper: "Partial excision of lower shaft of ulna for deformity following Colles fracture" and I quote: "The periosteum is carefully reflected and about half an inch of the shaft removed. The bone was cut with cutting forceps, an effort thus being made to obtain a more rapid regeneration". A starch bandage was applied for 5 weeks.

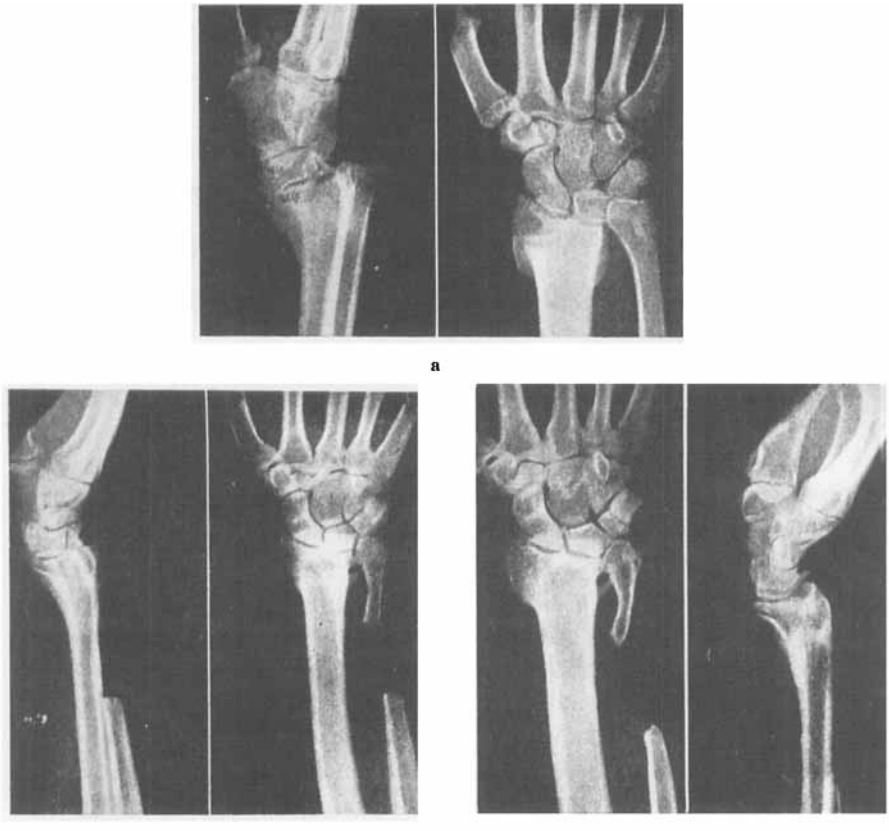

*Fig. 1. Case 1.*

a. Solid, vicious position (reverse Colles fracture) on admission, February, 1935.
b. 2 months after extraperiosteal excision of the ulna.
c. 2 years after the excision of the ulna.

I did not know the above mentioned publications, when in 1935 I performed my first extraperiosteal excision of a piece of the ulna above the pronator quadratus muscle in order to create a permanent defect and restore rotation of the hand. The case was published the same year. Since then we have performed the operation on the same indication in 4 cases, and all our observations on these follow later.

Under the title of "Derangement of the inferior radio-ulnar articulation" *Darrach* in 1936 published a series of cases in which he had excised subperiosteally the lower end of the ulna excluding the styloid process, which was left behind with the ulnar collateral ligament. "Following this procedure there is a regeneration of bone within the periosteal sleeve ... After a few weeks the patients find their rotation restored".

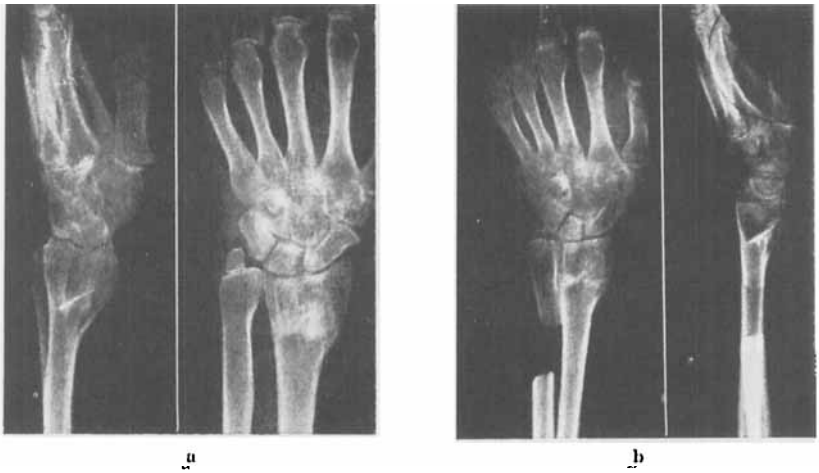

*Fig. 2. Case 2.*
a. On admission, 4 months after fracture. Rotation impossible.
b. After extraperiosteal excision of the ulna.

*Dingman* operated on a series of patients following the procedure of Darrach, among whom 13 had malunion of Colles fracture. Dingman concludes that while emphazising the subperiosteal excision of the distal part of the ulna in order to encourage regeneration, the ulnar styloid process should be left in situ, the purpose of these measures being restoration of the normal anatomy of the distal radio-ulnar articulation.

The latter proposition demonstrates the difference between the operation of Darrach-Dingman and the extraperiosteal excision of the ulna above the pronator quadratus muscle, leaving intact the most distal part of the ulna and the inferior radio-ulnar joint. This operation is extremely simple. It is performed in local anesthesia through a latero dorsal incision going right to the underlying ulna, from which is excised —strictly extraperiosteally—a piece of 2–3 cm. length. The extra-periosteal excision will prevent any possibility of bone regeneration, and it did not occur in any of my observations. In all these cases the head of the ulna was—as a consequence of the fracture—solidly united to the lower end of the radius abolishing movements in the radio-ulnar joint. After the excision of the piece of the ulna therefore its head and the superjacent 3–4 cm. left below the excision will move with the lower end of the radius and the wrist. The patient is able to rotate his hand, even before the wound is closed, and is encouraged to continue this exercise in the following days. Of course no splint is applied. The patient has no pain.

In more recent years the extraperiosteal excision of the ulna has

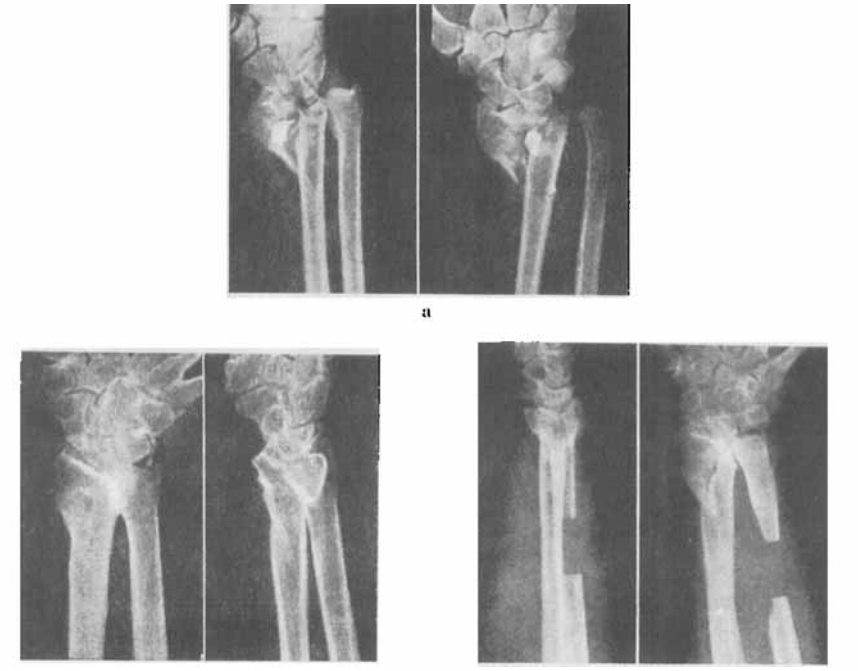

*Fig. 3. Case 3.*

a. On admission, the day of the accident.
b. 6 months after the accident. Consolidation, rotation impossible.
c. After extraperiosteal excision of the ulna.

been performed on the indication mentioned above by *Lindvall, Oberthur, Schubert, Boppe, Santy* and *Duroux, Monsaingeon* and *Fatio, Merle d'Aubigné* and *Masse*,—in all these cases with satisfactory results[1].

I shall now give a report of our 5 cases[2].

1. In 1934, off the coast of West Africa, a steamboat engineer had a severe fracture of the radius of his right hand, a reverse Colles' fracture. He came to me with his fracture healed in a very bad position; rotation of the hand was almost impossible. He complained that he would have to leave his job, if he could not recover

[1] Resection of the lower part of the ulna has been performed on a different indication by *Bazy* and *Galtier*, who in 1935 removed the distal end of the ulna in a case of dislocation of its head in the wrist. And in 1936 *Sauvé* and *Kapandji* resected 1.5 cm. of the ulna above the capitulum which was screwed to the adjoining radius for the same purpose.

[2] 4 of these 5 patients were presented at the meeting of the Norwegian Surgical Association, November, 1954.

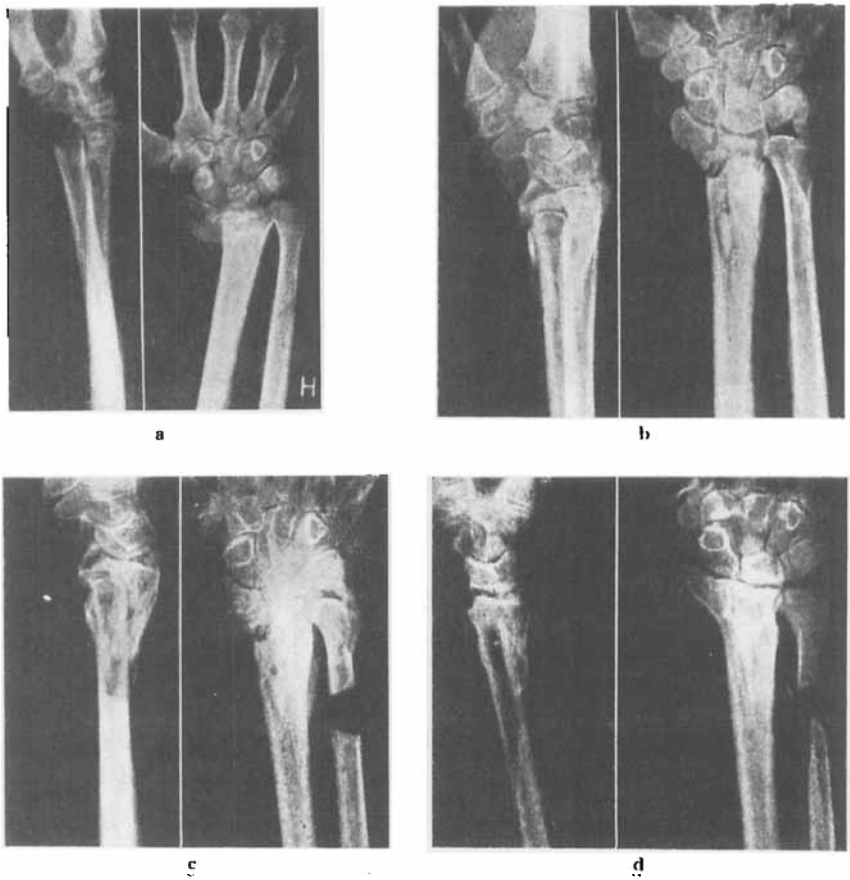

*Fig. 4. Case 4.*

a. On admission, 2 months after the accident.
b. After second reposition.
c. After extraperiosteal excision of the ulna, 6 months after the accident.
d. 3 years after the operation.

the rotation of his hand. The handling of a screw-driver, an all-important duty of a steamboat engineer, was impossible. I therefore made an extraperiosteal resection of 4 cm. of the ulna proximally from 4 cm. above the wrist. The result was excellent, there was full pronation and 75° supination (compared with 90° of the healthy side), the hand was as strong as before, the patient was delighted and went back to his job.

2 years after the operation he was examined by dr. Roscher on behalf of the National Accident Insurance. His supination was now free, the pronation reduced by about ⅓. He was actively working as a mechanical engineer.

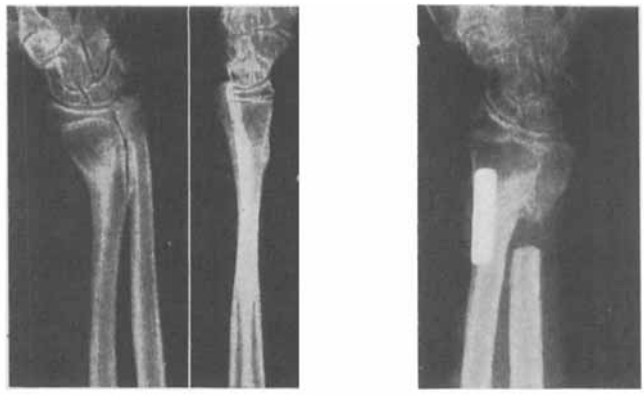

*Fig. 5. Case 5.*

a. On admission, June, 2 years after the fracture. Pro-supination impossible.
b. 3 months after cuneiform excision of radius (plate) and extraperiosteal excision of the ulna.

2. 36 years old woman. In August 1945 a fracture of the left radius viciously healed. I saw her 4 months later. Rotation of the hand was impossible. After resection of the ulna rotation was completely restored.

   I last reexamined her on the 10th of October, 1954. Pro-supination is completely free, she has no pain and full function of the left hand.

   Fig. 2.
3. 40 years old woman. Novbr. 1947: complicated fracture of the right forearm. She was referred to our surgical department the same day. The lower end of the ulna protruded through a large wound. After reduction plaster of Paris was applied. Healing occurred. After consolidation of the fracture the hand had a position of 40° of supination and was completely locked without any possibility of rotation.

   6 months later: extraperiosteal excision of piece of the ulna was performed above the pronator quadratus muscle.

   I personally reexamined her in October, 1954. She has no pain, and can do all the work of a farmer's wife, milking her cows. The hand and fingers have a normal position; flexion of the wrist 50° (60°), extension 30° (60°), the fingers move freely. Pronation of the hand 75° (80°), supination 90° (90°). She is delighted.
4. A 61 years old sailor on the 3rd of March, 1950, sustained a fracture of the radius, right hand, with severe displacement. 4 days later he was treated in Port Said. 8 weeks later he was referred to our

surgical department. Swelling, quasi immobility of hand and fingers. An attempt at reduction of the displacement through an incision gave a poor result, another attempt combined with oblique osteotomy of the ulna reduced the displacement some more. But the rotation of the hand was completely locked. On the 4th of August, that is, 5 months after the accident, an extraperiosteal resection of the ulna was performed. When he left the hospital on the 9th of October, 1950, the pro-supination of the hand was 120° (170°).

In January of the following year he went on board as a sailor and continued for 2½ years, then went ashore and was operated on for his prostate. I personally reexamined him in October, 1954. He is now 65 years old and at present is not working.

The hand: Normal position of the wrist.
Motion in the wrist to the dorsal side 20° (50°).
„ „ volar „ 15° (45°).
„ „ ulnar „ 10° (20°).
„ „ radial „ 5° (20°).
Pronation of the hand 90° (90°).
Supination „ „ „ 80° (80°).

5. 15 years old boy, July, 1949: fractures of the left arm—above the wrist and above the elbow. He was treated in another hospital and then referred to our surgical department on the 22nd of June, 1951. On admission he had ischemic contracture of the fingers, pro-supination was impossible. The roentgenogram showed angulation of radius and radio-ulnar synostosis.—On the 26th of June, 1951: cuneiform excision of radius, and extraperiosteal excision of 5 cm. of the ulna above the pronator quadratus muscle. 3½ months later he could rotate his hand outwards 45°, inwards 15°.

I personally reexamined him in October, 1954 (5 years after the operation). He now works as a carpenter and gains 3 kr. pr. hour. He can lift (with both hands) 50 kg. Left hand: Position of 10° flexion in the wrist (but when the fingers are actively bent, the position in the wrist is straight).

The fingers are in a position of 15° of flexion in the ground and middle joints but can be stretched, when the hand is bent from the wrist.

In the flexor-muscle group of the forearm a hard infiltration can be palpated, about the size of a pigeon egg, and the ischemic contracture is probably responsible for the limited rotation of his hand; pronation 30°, supination 50°.

SUMMARY

A report is given of 5 patients who, after having sustained a fracture of the radius or the forearm above the wrist, had lost more or less completely the possibility of rotation of the forearm and hand. The rotation has been restored by an extraperiosteal excision of a few cm. of the ulna above the pronator quadratus muscle.

These results give evidence of what may be presumed from the normal anatomy of the forearm, that the lower part of the ulna is of only insignificant importance in the stability and function of the forearm and hand, and that the radius is the more important of the 2 bones distally, the ulna proximally.

Conclusions:

Restoration of the lost rotation of the forearm and hand consequential to a fracture of the radius or the forearm in the lower half can easily be obtained by an extraperiosteal excision of 3–4 cm. of the ulna above the pronator quadratus muscle. The position and the stability of the hand is not disturbed by the permanent defect in the ulna.

RESUME

Il est rendu compte de 5 malades qui, après avoir subi une fracture du radius ou de l'avant-bras au-dessus du poignet, ont perdu plus ou moins complètement la possibilité de rotation de l'avant-bras et de la main. La rotation a été récupérée par une excision extrapériostale de quelques centimètres du cubitus au-dessus du muscle pronateur carré.

Ces résultats montrent ce que peut faire présumer l'anatomie normale de l'avant-bras, à savoir que la partie inférieure du cubitus est d'une importance insignifiante pour la stabilité et la fonction de l'avant-bras et de la main; le radius est le plus important des deux os distalement, le cubitus proximalement.

Conclusions:

La récupération de la rotation perdue de l'avant-bras et de la main à la suite d'une fracture du radius ou de la moitié inférieure de l'avant-bras peut être facilement obtenue en pratiquant une excision extrapériostale de 3 à 4 cm du cubitus au-dessus du muscle pronateur carré. La position et la stabilité de la main ne sont pas entravées par un défaut permanent du cubitus.

ZUSAMMENFASSUNG

Ein Bericht über 5 Patienten, die nach Bruch des Radius oder Unterarms oberhalb des Handgelenkes, die Fähigkeit der Rotation des Unter-

armes und der Hand mehr oder weniger vollständig verloren hatten. Die Wiederherstellung der Rotation gelang mittels extraperiostaler Excision von wenigen cm der Ulna oberhalb des m. pronator quadratus.

Diese Ergebnisse erweisen, dass der untere Teil der Ulna von nur geringer Wichtigkeit für die Funktion des Unterarms und der Hand ist, ein Umstand der schon aus der normalen Anatomie vermutet werden kann. Der Radius ist der wichtigere Knochen distal, die Ulna proximal.

Schlussfolgerung:

Die Wiederherstellung der verlorengegangenen Rotation des Unterarmes und der Hand kann auf einfache Weise durch eine extraperiostale Excision von 3–4 cm der Ulna erreicht werden. Die Stellung und die Stabilitet der Hand werden durch den Defekt in der Ulna nicht ungünstig beeinflusst.

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