FROM THE ORTHOPEDIC HOSPITAL, COPENHAGEN,
(CHIEF PHYSICIAN: POUL GUILDAL)

ON CONGENITAL AND ACQUIRED LUXATIONS OF THE CAPITULUM RADII WITH DISCUSSION OF SOME ASSOCIATED PROBLEMS

BY

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Most frequently it will not be difficult to decide whether a luxation of the capitulum radii is congenital or acquired, i. e. traumatic. Anamnestic information about an immediately preceding adequate trauma of the elbow region or the forearm, possibly in connection with an ulnar fracture (*Monteggia's* lesion) and the roentgenologic demonstration of a dislocated, normally shaped capitulum radii will secure the diagnosis: Traumatic luxation. But conditions are not always so clear and perspicuous. The postulated trauma may be of old standing and the mechanism cannot be accounted for any more. The dislocation is real enough, but the capitulum radii is deformed and the radius is apparently elongated and is lying along the anterior or posterior aspect of the capitulum humeri; unquestionable sequelae of ulnar fracture cannot be demonstrated any more. Is this now a case of congenital or acquired dislocation? It is certain that the capitulum radii always is deformed in case of congenital dislocation; but it is just as certain that this may also be so in inveterate, acquired subluxations. The question to be dealt with in the present publication—based on the material of patients of he Orthopedic Hospital—will then be: Is it possible, clinically or roentgenologically, to find a safe means of deciding whether a case of dislocation of the capitulum radii is congenital or traumatic? Is there a typical deformity of the capitulum radii in congenital dislocations as opposed to the traumatic ones?

As far as the congenital dislocation of the capitulum radii is concerned, *Richard Pfeiffer,* in a very interesting publication of 1938, advocated the opinion that the dislocation must only be considered a conspicuously gross symptom of general maldevelopment of the entire elbow joint, the dysplasia or hypoplasia of the joint being the primary feature of the facies morbi. The dislocation itself thus only becomes an especially frequent manifestation of the complex "dysplasia of the elbow joit", and the reason of the fairly frequent occurrence of luxatio capituli radii must be sought in the fact that, both as regards articulation, muscles, and ligaments, the articular connection between the radius and the humerus is far less secured than the humeroulnar joint.

It will be seen from Fig. 1 how this dysplasia of the elbow joint manifests itself roentgenologically in its typical form. The pictures represent both elbow joints of a girl, aged 16 years, who has come for years for observation at this hospital for a hemiparesis spastica dxt.

The most conspicuous is the dislocated right radius, the diminished conical capitulum of which is situated laterally and in front of the lateral epicondyle. The radius is apparently elongated and far thinner and more slender than the radius of the left arm. Nearthrosis or calcification of the soft parts is not seen. There is no fovea capituli radii.

A characteristic feature of the ulna is that the incisura radialis ulnae is entirely absent; on the contrary an increase of width of the ulna is seen here, prominating radial, as if pushing the radius away from the contact with the humerus. There will also often be a flattening of the incisura semilunaris ulnae with a faintly developed proc. coronoideus ulnae and olecranon with incongruity of the articular surfaces between the humerus and the ulna (cf. Fig. 3).

The distal end of the humerus, too, is the seat of dysplasia: The capitulum humeri is faintly developed, or almost completely absent, as seen in Fig. 1. The entire distal end of the humerus is rough and undifferentiated and, what is especially characteristic, *with lacking or decreased deflection anteriorly.* In order

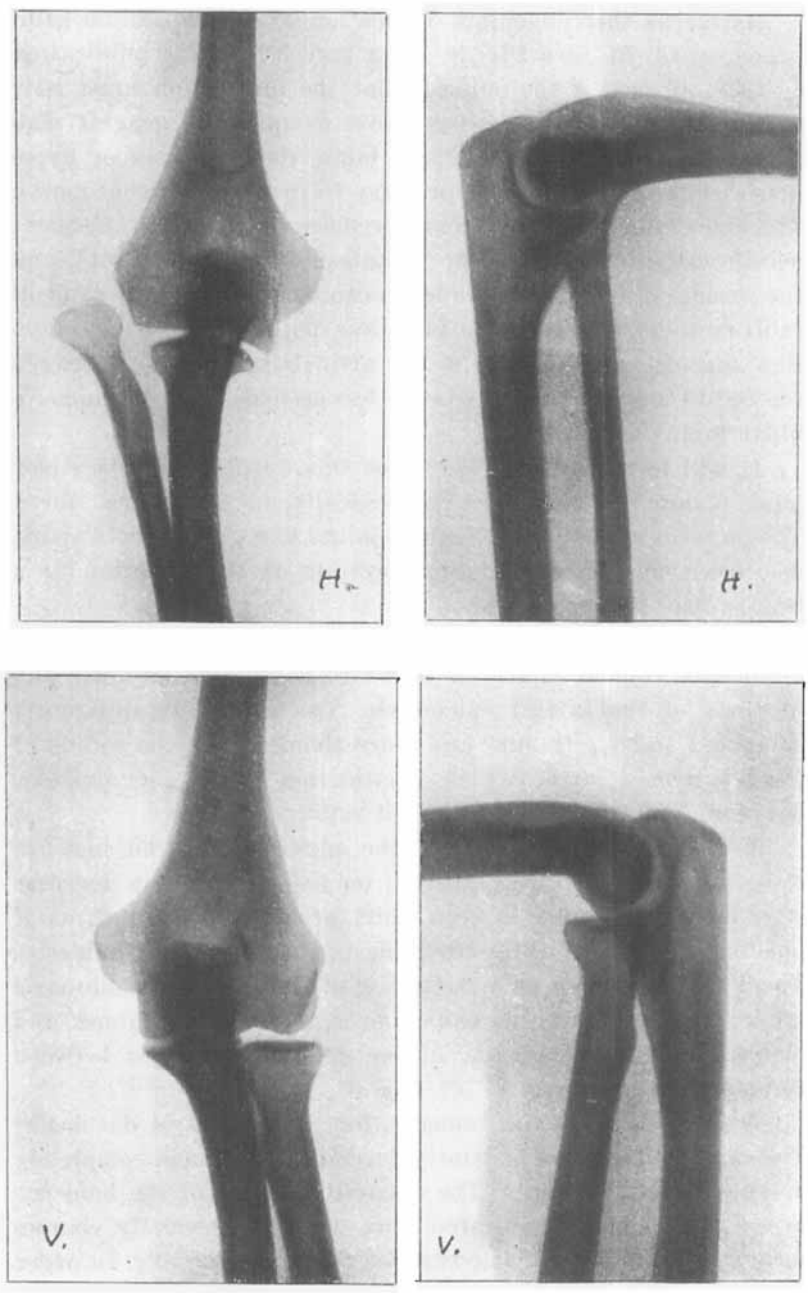


Fig. 1.
Luxatio congenita capituli radii dx. in a girl, aged 16 years, with hemiparesis spastica dx. Left elbow joint natural.
Case rec. 2029/27.

distinctly to see the lacking deflection an exact lateral projection is required. Fig. 2 originates from Pfeiffer's publication and shows a number of sketches of elbow joints with absent anterior deflection of the distal and of the humerus in congenital dislocation (upper series).

Cubitus valgus is not always found in luxatio congenita radii, neither primarily nor later on in life. In Fig. 1 there is

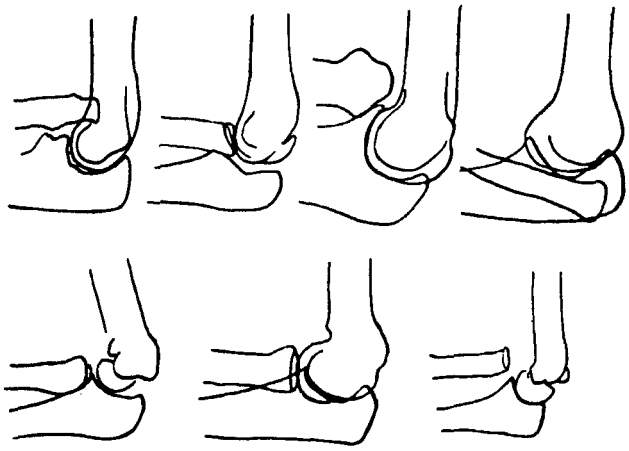


Fig. 2.
Sketches of elbow joints with lacking anterior deflection of distal end of the humerus in congenital dislocation (upper row) from Pfeiffer's publication.

rather a few degrees varus position, the ulna being highly curved radial and taking support under the articular surface of the humerus.

In Fig. 3 (2038/33), representing the right elbow of a girl, aged 14 years, with congenital dislocation, the lacking anterior curve of the distal and of the humerus is finely represented as well as a flat and steep incisura semilunaris ulnae and a bracket-like prominence of the ulna towards the radius that is dislocated posteriorly.

Fig. 4 shows a right-sided congenital dislocation in a child, aged 4 years. The capitulum radii is already deformed; but there is no premature development of the epiphyseal nucleus, as seen

in traumatic dislocation. The steep incisura semilunaris ulnae and the stumpy proc. coronoideus are distinctly seen. The capitulum humeri is faintly developed. On the other hand the lacking anterior curve of the humerus is not distinctly seen, as the lateral projection is not exact.

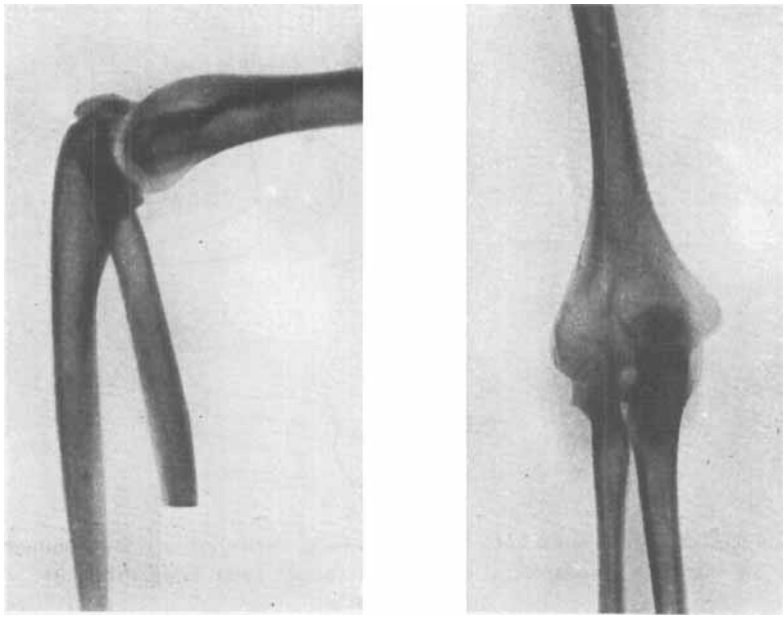


Fig. 3.
Luxatio congenita capituli radii dx. in a girl, aged 14 years, with hemiparesis spastica dx.
Case rec. 2038/33.

We have now seen some typical instances of luxatio congenita capituli radii, and *Pfeiffer* emphasized that all these changes are lacking in traumatic dislocations despite many years' standing. The following facts also speak in favour of congenital origin of the dysplasia:

1) The frequent bilateral occurrence of the dislocation and its demonstration already in the newborn or in the course of the first years of life.

2) Combinations of congenital luxatio capituli radii with other malformations, e. g. dislocation of hips, shoulder, and knee, club-feet etc. are frequently reported.
3) As a familial occurrence the dislocation is seen to be associated or alternating with other malformations of bones and joints within several generations.

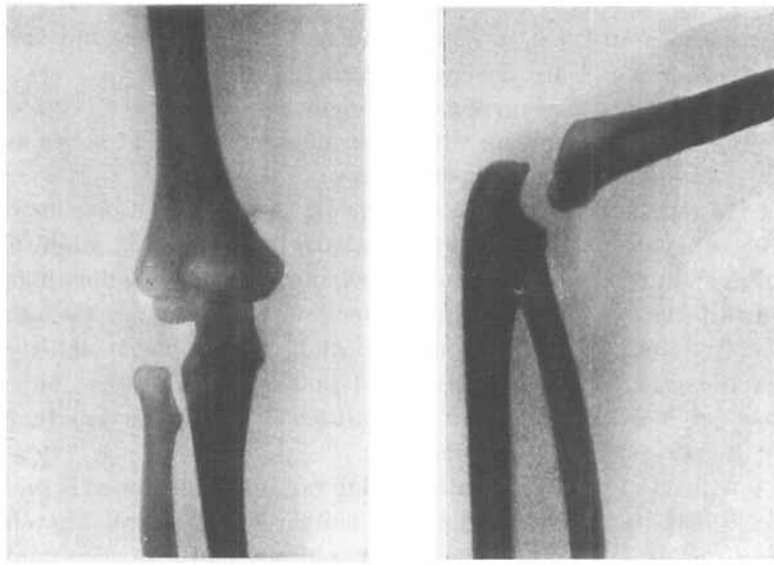
In our material, of the Orthopedic Hospital of Copenhagen, the congenital dislocation thus occurs together with inhibition of growth of the extr. distal. ulnae and synostosis radio-ulnaris distalis in two generations, mother and daughter. In the same family—and also in the mother and the daughter—multiple cartilaginous exostoses are found in four generations; but it has not been ascertained if dislocation of the radius was found in the two elder generations, too.

A marked example of alternating familial occurrence is given by *Guilleminet and Leclerć*: The mother had bilateral hip-joint and radius dislocation; her 4-years-old son had a luxatio cubiti posterior and a newborn male child had a bilateral hip-joint dislocation and bilateral luxatio cubiti posterior.

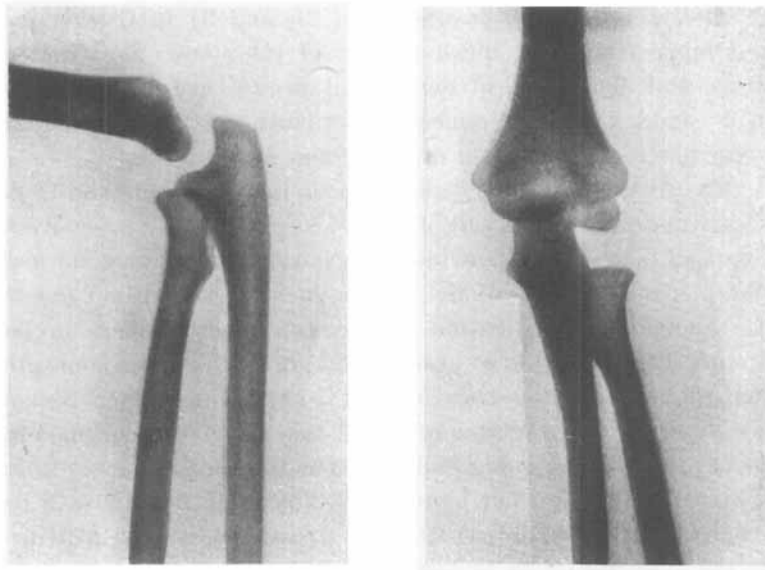
The facts referred to under 1), 2), and 3) further support the supposition that the dysplasia of the elbow joint and the congenital dislocation of the capitulum radii are often only parts of a complex of developmental disturbances that have injured great parts of the system of bones and joints.

The fresh, traumatic dislocation of the capitulum radii, with or without accompanying fracture of the ulna, is easily recognized in an X-ray, provided it is borne in mind that normally the longitudinal axis of the radius should point direct towards the nucleus of occification of the capitulum humeri in both planes. Therefore it is of practical importance in this connection that the nucleus of ossification of the capitulum humeri becomes visible already at the ages of 1 to 3 years, the dislocations often occurring in quite young children. The nucleus of the capitulum radii will, on the other hand, only appear at the age of 5 or 6 years, and the remaining epi- and apophyseal nuclei still later at the ages from 8 to 11 years.

Fig. 5 a and b show a typical dislocation in a girl, aged 10



Right elbow joint.



Left elbow joint.

Fig. 4.
Luxatio congenita capituli radii dx. in a 4-years-old child with Duchenne-Erb paralysis of right arm.
Case rec. 3641/39.

years, in connection with a high ulnar fracture immediately after the accident (a) and 2½ years later (b). In Fig. 5 b there is only a slight deformity of the capitulum to be seen, but the epiphyseal line on the dislocated side is already closed, which is 3 or 4 years too early. Such premature ossification of the proximal epiphysis also occurs in the two cases reported by *Lachmann* and corresponds well to *Bonn*'s experiments on rabbits with dislocation of the capitulum radii and cutting through the lig. annulare:—

In all *Bonn*'s experiments there was cessation of function of the intermediary cartilage with increase of the resting layer of cartilage and after 62 days complete wasting of the zone of growth of the dislocated capitulum. In all the experiments in which the ligamentum annulare was completely torn, epiphyseal necrosis of the capitulum radii could be demonstrated histologically; *Bonn* explains this fact by stating that the lesion of the ligament produces severe nutritive disturbances of the epiphysis. It should be imagined that such epiphyseal necroses would give rise to the development of a secondary arthrosis deformans, but it was interesting to see that in none of the dislocation experiments in which the dislocation remained unchanged the least histologic signs of a secondary arthrosis appeared. If, on the other hand, luxatio radii and cutting through of the ligamentum annulare were first made in the experiment and the capitulum was then replaced in normal position immediately afterwards, which in rabbits always means a permanent reposition, a typical histological picture of arthrosis deformans with marginal osteophytes developed in the course of 71 days. The experiments thus seem to show the great importance of the articular pressure to the genesis of the deforming arthrosis.

In conformity with the experiments on animals it is seen clinically that the complete traumatic dislocations of the capitulum radii may persist for many years without any resulting deforming arthrosis. In one of *Bonn*'s cases, in which the dislocation had persisted for 10 years and the capitulum radii had been removed, no macroscopic or microscopic signs of arthrosis were found.

In *Lachmann*'s two cases X-raying 1½ to 2 years after the dislocating trauma showed a shell-shaped calcification of the capsule over the capitulum, revealing a nearthrosis formation, but no signs of arthrosis.

It is quite another matter in the case of subluxation, where the articular connection between the capitulum humeri and radii

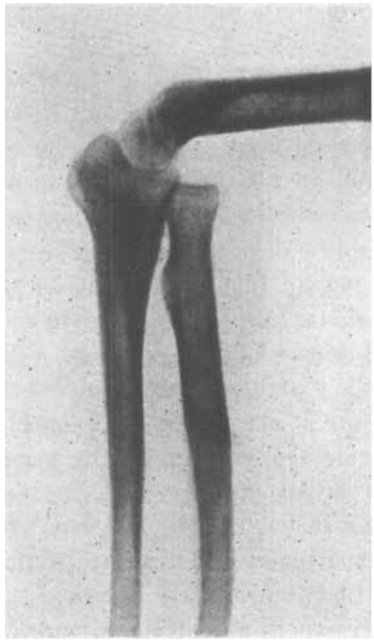


Fig. 5 a.

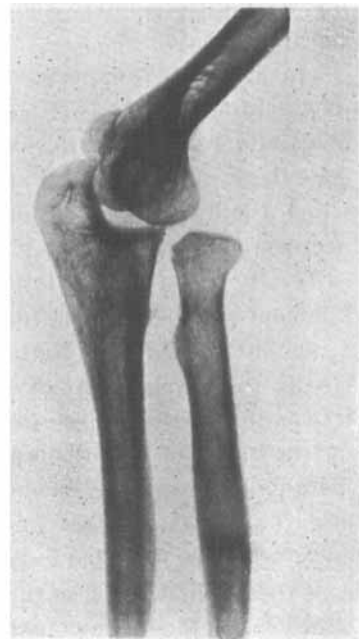


Fig. 5 b.

Luxatio capituli radii et fractura ulnae dx. (Monteggia's lesion) in a girl, aged 10 years, immediately after the lesion (5 a) and 2½ years later (5 b). Case rec. 5640/42.

is not completely discontinued and where the articular pressure, therefore, is still prevailing. In this case we get a secondary alteration of shape of the capitulum radii, which is growing anteriorly and laterally through bony apposition and thus projects still more in the roentgenogram. The fovea capituli radii is effaced and may be replaced by a conical growth in the proxi-

mal direction, resulting in an elongation of the radius excluding any attempt at reposition without simultaneous surgical adjustment and chiselling. Fig. 6.

Especially this picture will now and again give rise to confusion with the congenital dislocation, the lack of a fovea suggesting the latter. But the resemblance is only apparent, as

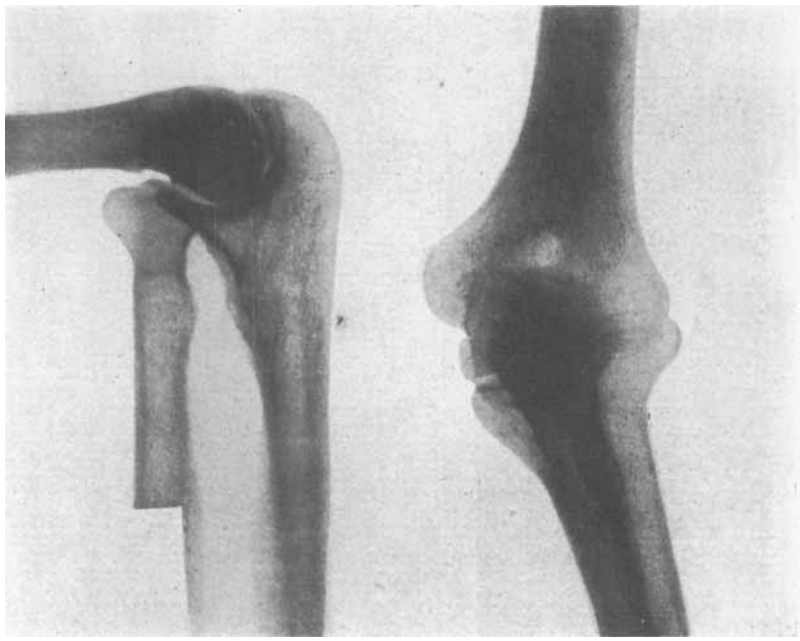


Fig. 6.
Subluxatio et deformitas capituli radii in a man, aged 36 years.
Case rec. 2312/43.

the gross capitulum increased in width is never seen in congenital dislocation, and the aplasia of the elbow joint described above is lacking. But in traumatic subluxation with arthrosis the roentgenogram is quite similar to the deformity of the capitulum radii as a consequence of osteochondritis dissecans of the capitulum humeri described so thoroughly by *Löhr* among others. Gradually as the capitulum radii is deformed and increases in size it is partially dislocated to an increasing extent

anteriorly, and only the typical defect of the capitulum humeri can establish the diagnosis (Fig. 7).

According to *Löhr* the cause of the deformity of the capitulum radii is the increased articular space and the static alterations determined by it, and the deformity occurs constantly in any dissociation of the articulation between the

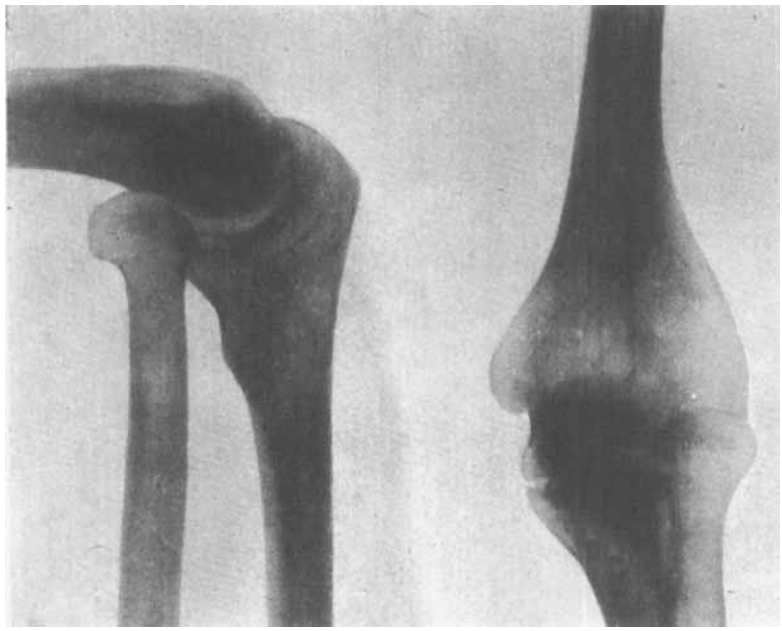


Fig. 7.
Deformitas et subluxatio capituli radii with osteochondritis dissecans capituli humeri in a man, aged 25 years.
Case rec. 11720/44.

radius and the humerus, e. g. also in dislocated fractures of the condylus ext. humeri.

A feature that has given rise to many deliberations and discussions is the frequent elongation of the dislocated radius. Especially in congenital dislocation the capitulum radii will often reach far up on the lateral aspect of the humerus, but in traumatic dislocations, too, elongations of 2 or 3 cm. are seen.

Is this elongation now apparent or real and, in the latter case, what is it caused by? It can only be decided whether the elongation is apparent or real by means of teleradiography of both forearms with sufficient focal distance; in traumatic dislocations it has appeared then that there is never any real elongation of the radius, apart from the one determined by the arthrotically deformed capitulum radii. The greater differences of 2 or 3 cm., on the other hand, are due to a shortening or curving of the ulna as a consequence of an accompanying fracture (*Monteggia's* lesion). In some cases there is no shortening of the ulna either, and the apparent elongation is then due to the radius being pushed upwards owing to a radial flexion position in the wrist, which brings about a manus vara position.

In the congenital dislocations it has been pointed out especially that there is an elongation of the radius on the basis of the hypothesis that decreased pressure would further the longitudinal growth; but roentgenologic measurings are also lacking entirely in these cases. Such examinations were made in the case of the material of the Orthopedic Hospital but did not afford any proof, in the beforementioned cases as the congenital dislocations in this material were found in patients with spastic hemiparesis in whom the whole of the diseased extremity is shorter and less developed than the healthy one. On comparative measuring of the ulna and the radius of either side the relative shortening of the ulna is, however, found to be 2 or 3 times greater than that of the radius which—when compared with our knowledge of the conditions in traumatic dislocation—seems to indicate that here, too, it is the ulna that has been most shortened, namely owing to an increased pressure.

Only in one case of congenial dislocation recently observed in a girl, aged 19 years, who was otherwise in good health—Fig. 8—teleradiography of both forearms showed a shortening of the ulna of 1 cm. and only an elongation of the radius of a couple of mm. caused by the conical deformity of the capitulum radii. *It is thus proved in this case that the apparent elongation of the dislocated radius is due to an actual shortening of the homolateral ulna.*

That an abnormal pressure results in inhibition of growth was showen by *W. Müller* who in an experiment sutured an extremity in the gluteal muscles, which caused the extremity to be relieved of the pressure, whereas the other one was overstrained. Some time after there were disburbances of the enchondral ossification of the strained extremity.

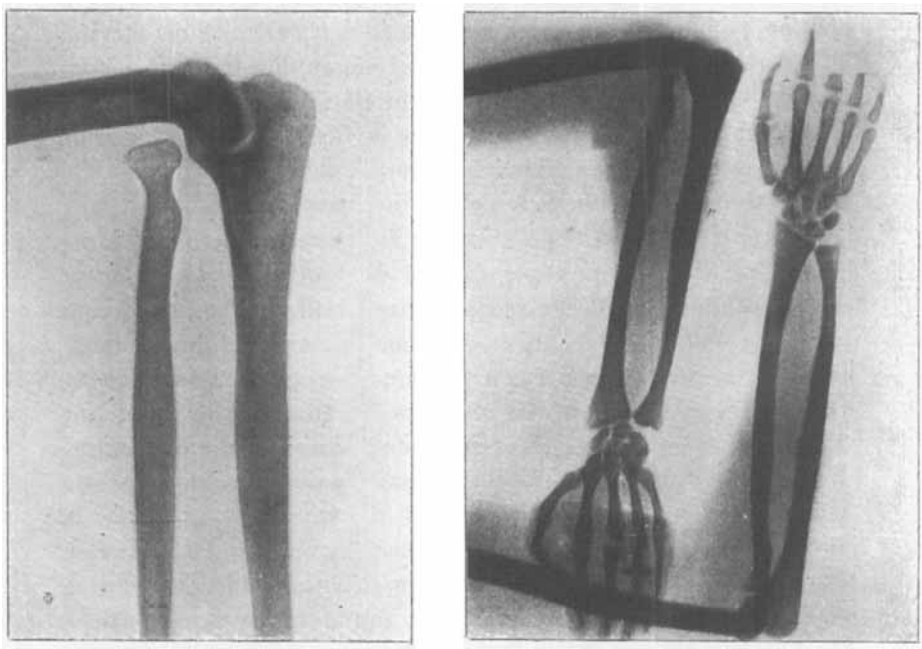


Fig. 8.
Luxatio congenita capituli radii with actual shortening of the homolateral ulna, in a 19-years-old girl.

Bonn's dislocation experiments also disprove the hypothesis that a decreased pressure should further the longitudinal growth, as the discontinuation of the articular contact, and thus also of the static pressure, would just cause a too early destruction of the zone of growth. On the contrary, a shortening of the dislocated radius must rather be expected, and when this is not the case it is perhaps due to the fact that functionally

the proximal zone of growth of the forearm is the least valuable, the discontinuation of its function being compensated by the activity of the distal epiphysis.

Conclusion: The congenital dislocation of the capitulum radii is essentially different from the traumatic dislocation, as the former must only be considered an especially frequent manifestation of the complex "dysplasia of the elbow joint" which is part of a number of developmental disturbances that have afflicted great parts of the bony and articular system. Henceforward it will as a rule be possible to distinguish between congenital and traumatic dislocation. A secondary deforming arthrosis only occurs in subluxations in which a certain articular pressure still exists.

In all probability there is no real elongation of the dislocated radius, neither in congenital nor in traumatic dislocations.

SUMMARY

On the basis of a patient material from the Orthopedic Hospital, Copenhagen, a description is given of the roentgenographic changes which, according to Pfeiffer, are typical of congenital dislocation of the capitulum radii. It is emphasized that similar changes never appear in traumatic dislocation even when this has persisted for years.

The secondary arthrosis developing in cases of traumatic subluxation is not encountered in the complete dislocations—congenital or traumatic—as its production requires a certain joint pressure. This has been confirmed by Bonn's experiments on animals.

In a case of congenital dislocation the writer proves by teleradiographic measuring of the forearm that the lengthening of the dislocated radius is merely apparent, being due to an actual shortening of the homolateral ulna.

ZUSAMMENFASSUNG

Auf Grundlage einer Reihe von Beobachtungen an Kranken im Orthopädischen Hospital zu Kopenhagen werden die typi-

schen Pfeiffer'schen röntgenologischen Abänderungen bei angeborenen Verrenkungen am Kopf der Speiche beschrieben. Es wird hervorgehoben, dass derartige Abänderungen niemals bei traumatischen Verrenkungen in Erscheinung treten, selbst wenn diese jahrelang bestanden haben.

Die sekundäre Arthrose, die sich bei unvollständigen traumatischen Verrenkungen entwickelt, zeigt sich nicht bei totalen Verrenkungen (weder angeborenen noch traumatischen), da es eines gewissen Gelenkdrucks bedarf, um die Arthrose hervorzurufen. Die Tierversuche von Bonn bestätigen diese Tatsachen.

In einem Falle von angeborener Verrenkung wird mittels der röntgenologischen Messung des Unterarms bewiesen, dass die Verlängerung der verrenkten Speiche nur scheinbar ist und auf einer gleichzeitigen tatsächlichen Verkurzung des Ellbogenbeins beruht.

RÉSUMÉ

Sur la base d'une série d'observations de malades de l'Hôpital Orthopédique de Copenhague, les modifications radiologiques typiques de Pfeiffer dans les luxations congénitales de la tête du radius sont décrites. Il est souligné que des modifications de ce genre ne se manifestent jamais dans les cas de luxation traumatique, même si elles ont subsisté pendant de nombreuses années.

L'arthrose secondaire qui se développe dans les subluxations traumatiques ne se voit pas dans les luxations complètes (congénitales ou traumatiques), étant donné qu'il faut une certaine pression articulaire pour provoquer l'arthrose. Les expériences sur animaux pratiquées par Bonn confirment ces faits.

Dans un cas de luxation congenitale, il est donné la preuve, au moyen de la mesure téléradiographique de l'avantbras que le prolongement du radius luxé n'est qu'apparent et qu'il est causé par un raccurcissement réel du cubitus simultané.

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