(FROM THE ORTHOPEDIC CLINIC OF THE UNIVERSITY OF LUND. CHIEF: PROF. GUNNAR WIBERG)

BIPARTITE CARPAL SCAPHOID BONE

BY

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When speaking of a bipartite scaphoid bone most authors (Pfitzner, Wolff, Köhler etc.) mean a congenital division of the scaphoid across the waist into two approximately equal parts, viz., a radio-distal, and a proximo-ulnar fragment. Other authors (Faulkner, Hardman and Wigoder, Watson-Jones etc.) however, conceive in the above term also a persistency of certain accessory bones in the neighbourhood of the scaphoid, to wit, the os radiale externum and the os centrale.

From embryological and comparative anatomical investigations it is known that in early ontogenetic and phylogenetic stages there exist a great number of primordial accessory carpals, which later on disintegrate completely or fuse with other carpals and thus cease to continue as independent elements (Pfitzner). As far as the bipartite carpal is concerned, only two carpals are of interest, namely, the os radiale externum and the os centrale.

The os radiale externum lies adjacent the radio-distal part of the scaphoid. It appears almost constantly up to mammals including monkeys. Very seldom, however, does it appear even embryonally in man. During embryonic development the os radiale externum disintegrates or fuses with the scaphoid or trapezium and thus ceases to exist as an independent element. In an anatomic examination of 1456 adult wrists an os radiale externum was met with as a separate bone in 0.25 per cent of the cases and partly synostosed with a scaphoid in 0.5 per cent of the cases (Pfitzner). Hardmann and Wigoder report a case in which a radiographic examination of a 15 year-old patient

who had sustained an injury of the right hand, disclosed a "broken-off" tubercle of the scaphoid. A radiographic examination of the other wrist exhibited exactly the same picture. Both wrists were re-examined after the elapse of one year and the radiographs showed that the tubercle of either scaphoid had fused completely with the rest of its appropriate scaphoid to form an integral bone. Much speaks in favour of this case being an example of a persistent os radiale externum, which, however, seems to be a very rare occurrence in man; Köhler, for example, contends that it has hitherto been impossible radiographically to reveal the existence of an os radiale externum.

The os centrale lies between the scaphoid, the trapezoid, and the capitate on the dorsal side of the wrist. It appears regularly as a permanent bone in certain mammals and always embryonally in man. It generally disappears during embryonic life, either by complete disintegration or by fusion most frequently with the scaphoid or, in exceptional cases, with the capitate and the trapezoid. In an anatomic examination of 1456 wrists a separate os centrale was encountered in 0.5 per cent of the cases (Pfitzner). Even other authors, such as Boyd, report the discovery of an os centrale during the dissection of wrists. It is but seldom radiographically met with as a separate bone (Köhler). Of the three developmental anomalies, viz., the os radiale externum, os centrale, and the true bipartite scaphoid, the os centrale is the most common abnomality among adults (Watson-Jones).

A true bipartite scaphoid is as good as equally divided into a radio-distal and a proximo-ulnar fragment by a joint generally extending from a point near the lateral corner of the surface facing the radius, to the middle of the concave articular surface presented to the capitate (Boyd) (The term "bipartite scaphoid" will henceforth be used in the strict sense of the expression i.e., it will nit include a persistent os radiale externum or os centrale). From a comparative anatomical point of view as well as from an embryological standpoint, our knowledge of the development of a bipartite schaphoid is much vaguer than it is of the os radiale externum or os centrale. Phylogenetically, Pfitzner sees in a bipartite scaphoid the re-appearance of a premevil

reptilian phenomenon. This assumption, for which no evidence can be produced, is not accepted by Wolff. Opinions also differ concerning its ontogenesis. Pfitzner suggests that the scaphoid is embryologically laid down as two separate cartilaginous anlages or, of this should not be the rule, that the existence of a dual cartilaginous anlage may at any rate be made possible by some anomaly or other. Von Bardeleben reports a case of two embryonically separate cartilaginous anlages. Other investigators of the embryology of the skeleton of the hand make no mention of dualistic cartilaginous anlages of the scaphoid (Cited from Wolff). Neither did Tröll meet with a single dualistic cartilaginous anlage of the scaphoid during his embryological studies of the hand (Cited from Blencke). Gruber admits that the cause of the arisal of a bipartite scaphoid might be the result of a development of the bone from two primordial cartilaginous nuclei, but at the same time points out that it is more probably to be ascribed to an ossification process from two ossification centres in one and the same cartilaginous anlage. He bases his opinion on observations made by Rambaut and Renault, who report on the anatomical discovery of two separate bone nuclei in the scaphoid (Cited from Wolff). Hasselwander describes one case in which he found two separate bone nuclei in one and the same scaphoid, the nuclei being about the size of a pin-head and spaced a few millimetres apart; he also reports a second case in which he discovered two irregularly shaped, comparatively large bone nuclei in a hypothyreotic dwarf. According to Köhler, the development of two ossification centres in the scaphoid is possible, but presumably only in the presence of disturbing factors impairing the course of ossification (hypothyreosis, cretinism etc.) and according to Pokrowski, also in the presence of hereditary factors. In the above-mentioned examination of 1456 wrists, Pfitzner found bipartite scaphoids as separate bones in 0.5 per cent of the cases, whilts 2-3 per cent exhibited incomplete fusions.

Wolff challenged the high frequency of the bipartite scaphoid, the os radiale externum, and the os centrale of the cases examined by Pfitzner, and asserted that the majority of the cases pub-

lished were nothing but pseudarthrosis due to earlier scaphoid fractures. As far as the anatomical establishment of a bipartite scaphoid is concerned, Wolff claims that an indispensable condition is the existence of normal cartilage between the fragments of the boen, not only macroscopical but also microscopical, because pseudarthrous texture can have a striking likeness to cartilage. After a perusal of relevant publications from this angle, Wolff draws the conclusion that a bipartite scaphoid, an os radiale externum and an os centrale are very rare indeed.

Later several authors have published single cases of bipartite scaphoids, the diagnosis of which they consider for some reason or other to be founded on adequate evidence. To give a few examples, it might be mentioned that Bayer describes a case of a 20 year-old youth, whose skeleton on the whole was still in an early stage of development as was evidenced inter alia by the fact that the carpals were still in their bone nuclear stage. In this case the scaphoid was composed bilaterally of a relatively small proximal fragment and a somewhat larger distal fragment. Pokrowski mentions a case of a bilateral symmetric bipartite scaphoid in which not only the patient himself but also some of his nearest relatives suffered from cengenital heart disease and hereditary deformations of the thumbs and little fingers. Faulkner gives a description of a case of a bilateral bipartite scaphoid, which, on account of complicating arthritis, possibly due to gonorrheoa, gave the patient so much pain, that it was considered advisable to extirpate the bones. In this case Faulkner could show that the appositional surfaces were covered throughout with cartilage; no microscopic examination was, however, made. Most authors of later date agree with Wolff in his belief that a bipartite scaphoid is a very rare occurrence indeed (Bayer, Köhler, Gollasch etc.), whereas Andreesen contends, that many cases of bipartite scaphoids are overlooked and that the actual frequency of this abnormality is not so low as one might be inclined to think.

Some time ago at the Orthopedic Clinic of the University of Lund there occurred what was considered to be an undeniably

established case of a bipartite scaphoid, a brief description of which will now be given.

An 18 year-old youth. He could not remember ever having sustained an injury of either wrist. Hereditary—nothing of interest. No known congenital deformations among relatives. On 22nd. March 1946, he fell from a height of two or three metres. He landed on his left side but could not remember whether he buffered the shock with his left hand or not. The right hand was not injured by the accident. Immediately after the fall, even the very slightest movement of the left wrist caused a sharp pain across the radial side of same. No subjective trouble whatsoever from the right wrist. The following day he sought aid at the nearest hospital, where the injury was diagnosed as a left scaphoid fracture. In February, 1947, the Public Health Insurance Company passed the patient on to the Orthopedic Clinic of the University of Lund for control-examination. The patient was then both subjectively and objectively altogether free of trouble. A radiographic examination of the left wrist revealed a transverse rarefaction line across the scaphoid. The well-defined, even contours of those parts of the bone bordering the line of rarefaction as well as the absolutely normal bone texture could not very well be brought into conformity with the assumption of a scaphoidal pseudarthrosis, for which reason the right wrist was then also radiographically examined: it was thereby discovered that the radiograph of the right scaphoid was exactly symmetric with that of the left. The radiographs were examined at the Roentgenological Clinic of the University of Lund and the following report was issued.[1]

"Radiograph 23/3/46: os naviculare sin. is divided into two parts by a line of rarefaction only 1 mm. or slightly more at its broadest part near the capitate. This line extends from the middle of the articular surface presented to the capitate, to the radial edge somewhat nearer the trapezium. On either side of the rarefaction line is a fine, even corticalis. There is no dis-

[1] I beg to express my sincere thanks to Prof. H. Hellmer and Doctor O. Norman for the kind assistance they gave me in this matter.

placement of the fragments, the bone texture is normal throughout, and there are no discernible signs of sclerosis.

Subsequent examinations made on 1st, 6th and 29th April

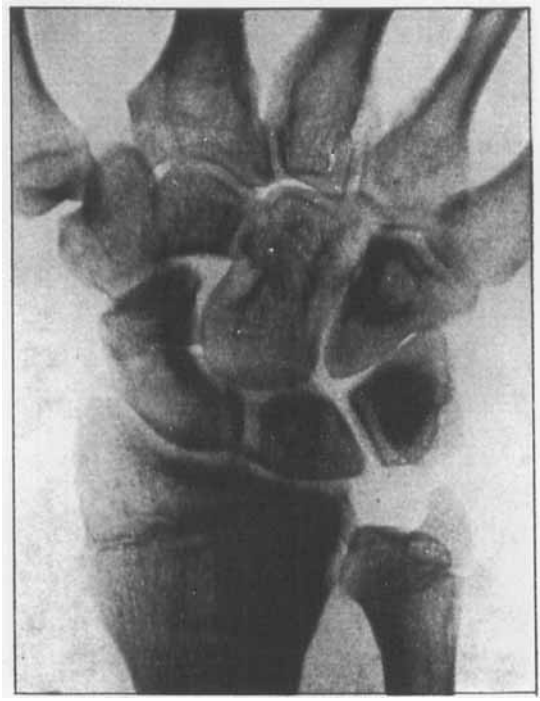

Fig. 1
Radiograph of left wrist on 27.2.47.

and 9th May as well as on 4th. October, 1946, and at the Orthopedic Clinic of the University of Lund on 27th. February 1947, showed that the state of the case had remained unchanged.

Comparatice radiographs of the right wrist now give a picture identic with that of the left.

The radiograph produced on 23rd March 1946 would not fit into the picture of a recent fracture, and as the status has remained constant during eleven months of observation, it cannot be ascribed to the above mentioned trauma, which the patient sustained on 22nd March 1946.

The history of the case contains no mention of this 18 year old youth having sustained earlier injury. This bilateral symmetric change—fine corticalis on either side of the line of rare-

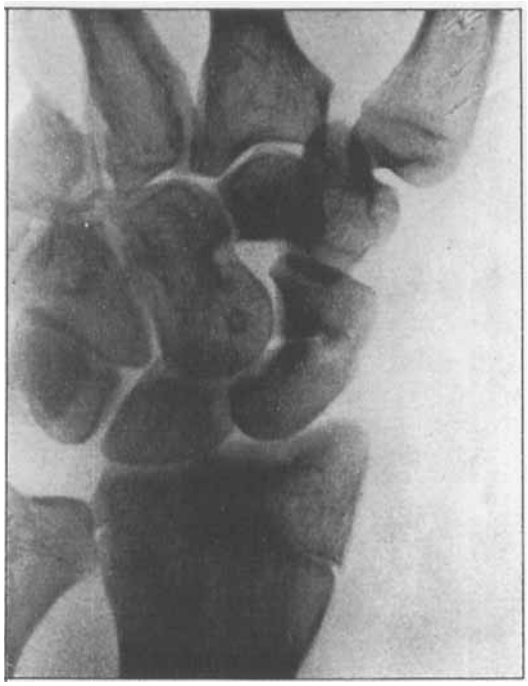

Fig. 2
Radiograph of right wrist on 27.2.47.

faction—in a bone with unchanged texture also contradicts the conception of an old fracture.

This is a case of an anomalous ossification of the type of the bipartite carpal scaphoid."

Of diagnostic interest in this conjunction is the fact that even if the radiographic examination of the wrists reveals an absolutely clear case of pseudarthrosis of the scaphoid, it is nevertheless often impossible to trace any relevant trauma, no matter how much and how carefully one may question the patient. Whether the above experience is due to the fact that the

causative trauma was so slight or whether it was sustained so much earlier that the patient simply cannot recollect it, or whether it is due to some instigating mechanism of scaphoidal necrosis with consequential fracture and pseudarthrosis, as is suggested by some authors to be the case with lunato-malacia (*Blencke*), will not be discussed here. The author would only point out, that a patient with scaphoidal pseudarthrosis sometimes does not remember a blow or injury that might possibly be brought into connection with the diagnosed pseudarthrosis. Conversely it is obvious that the absence in the history of the case of any trace of trauma adequate to bring about a scaphoidal fracture is of comparatively little importance as far as the diagnosis of a bipartite scaphoid is concerned.

As discerned in the radiograph, the appositional faces of a bipartite scaphoid are characterized by thin, even and absolutely regular corticalis of uniform thickness throughout. In the case of pseudarthrosis of the scaphoid, there will be an increasing sclerosis of these surfaces, which will be reflected in the radiograph by an irregular and uneven line of demarcation. The bone texture of the two fragments of a bipartite scaphoid is absolutely normal, whereas scaphoidal pseudarthrosis is often accompanied by the formation of cyst and interposed sclerotic patches. The blood supply of the two fragments of a bipartite scaphoid is normal so that, unlike many cases of pseudarthrosis, avascular necrosis does not occur. The roentgenologic differential diagnosis between a bipartite scaphoid and a scaphoidal pseudarthrosis may sometimes be very difficult, and in cases with complicating arthrous changes, for example, often absolutely impossible. In such cases it ought to be borne in mind that a scaphoidal pseudarthrosis is a frequent occurrence, whereas a bipartite scaphoid is encountered but very seldom indeed. In certain cases, however, it is possible, at least with the aid of clinical observation, radiographically to diagnose even unilateral bipartite scaphoids (Reckling, Lindgren).

A bilateral division of a scaphoid alone is naturally not adequate evidence to diagnose a case as a bipartite scaphoid, for the simple reason that scaphoid fractures with subsequent pseud-

arthrosis do not so seldom appear bilaterally. In those cases in which the differential diagnosis between scaphoidal pseudarthrosis and a bipartite scaphoid is doubtful, one is justified in assuming that the fact that the division is bilateral, suggests same to be of endogenic origin, all the more if the changes in the scaphoids are symmetric.

In the case under discussion:

(a) the patient could not recollect any injury of the right wrist,
(b) the radiograph gives a typical picture of a bipartite scaphoid bone,
(c) a bilateral division of the scaphoid is discernible,
(d) there is exact bilateral symmetry.

As pointed out above, the absence of any trace or remark of earlier traumata to the right hand is of little importance as far as the diagnosis is concerned. In the present case the establishment of a bipartite scaphoid must be considered as an indisputably correct diagnosis, because not only is the radiograph fully characteristic but the bilateral changes are also absolutely symmetric.

A correct diagnosis in those cases, where it is possible, is obviously of such importance for the treatment and for determining the question of compensation, that it is needless to discuss it. If the clinical behaviour of a supposed scaphoid fracture or scaphoidal pseudarthrosis differs from that expected, or if the radiographic examination results in a picture that is not characteristic of either of the above, it should be borne in mind that there does exist such a thing as a congenital anomalous ossification of the scaphoid. A radiographic examination of the other wrist can then produce valuable clues.

SUMMARY

The author describes a case of a bilateral bipartite carpal scaphoid bone. In conjunction herewith a brief description of comparative anatomy and embryology is given. Diagnostics is discussed. In case of unexpected clinical behaviour or unex-

pected radiographic picture of assumed scaphoid fracture or scaphoidal pseudarthrosis, a radiographic control-examination of the other wrist can give valuable clues.

RÉSUMÉ

L'auteur décrit un cas de os naviculare carpi bipartitum bilaterale. A ce sujet il fait un bref compte-rendu d'anatomie comparées et d'embryologie. Discussion du diagnostic. Si en cas de fracture ou de pseudarthrose supposées du naviculaire, le développement clinique prend une marche inattendue, ou que la plaque radiographique donne une image inattendue, un examen radiographique de l'autre poignet peut donner de précieux renseignements.

ZUSAMMENFASSUNG

Der Verfasser beschreibt einen Fall eines zweiseitigen os naviculare bipartum carpale. In diesem Zusammenhang wird eine kurze Darstellung der Vergleichsanatomie und Embryologie gegeben. Die Diagnostik wird diskutiert. Falls der klinische Verlauf oder die Röntgenaufnahme einer vermuteten Fraktur oder Pseudarthrosis des os naviculare anders ist, als erwartet war, so kann eine röntgenologische Kontrolluntersuchung des anderen Handgelenks wertvolle Auskunft geben.

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