NOTCHING OF THE CARPAL NAVICULAR

BY

R. L. SWEZEY AND S. J. ALEXANDER

Departments of Physical Medicine and Rehabilitation and of Medicine, Clinical Immunology and Rheumatic Diseases Section, from the University of Southern California School of Medicine, Los Angeles County—University of Southern California Medical Center, Los Angeles, California

The admonition to know the normal so that the abnormal can be recognized has once again proved its worth. In the course of evaluating a patient with degenerative osteoarthritis, a striking concave notch on the radial aspect of the left carpal navicular was observed. As both hands were x-rayed in the posterior and anterior view on one film, it was possible by comparing the wrists to immediately offer an explanation for the notch (Fig. 1).

The right wrist was radially deviated allowing the radial styloid to approximate the navicular at the site of the corresponding notch on the left hand. Since the awareness of this apparently normal phenomenon was not general, it was decided to investigate the incidence of these navicular notches to see if they were related to the normal anatomy or represented a manifestation of some more subtle pathological process.

Fig. 1.—Carpal navicular notching with radial styloid in notch on right.

Procedure

46 cases of traumatic wrist or hand involvement in which an anterior and posterior x-ray of the wrist was available were randomly selected and reviewed from the Hand Surgery Clinic of Los Angeles County-University of Southern California Medical Center. 57 additional cases from the teaching files of the Department of Radiology (including fourteen patients with rheumatoid arthritis, six with gout, six with osteoarthritis, 21 with hyperparathyroidism, and ten with a miscellaneous assortment of diagnoses including gonorrhoea, tuberculosis, Buerger's disease, ankylosing spondylitis, pulmonary osteoarthritis, and arteriosclerosis) were also reviewed. Thirty children under 18 years of age were also studied as a separate group.

The Table shows the number of cases with navicular notching in each category, the age span, and the average age. The average age of the 103 adults was 47 years, and of those with a navicular notch 57 years (range 18 to 78). Of the 103 adults, 54 (48 per cent.) were female (average age 50 yrs), of whom 22 (41 per cent.) showed notching (average age 59 yrs). Of the 49 adult males (average age 44 yrs) sixteen (31 per cent.) showed notching (average age 56 yrs). The most decisive notching was seen in three patients with rheumatoid arthritis and one with tuberculosis of the wrist.

The carpal navicular is not identifiable by x rays before age 4½ years in girls and 5½ years in boys, when visible calcification occurs. Thereafter it becomes curvilinear on the radial aspect until age 11 years, when it assumes a mature form. At maturity the radial surface of the navicular is concave and may show indentations or notching (Greulich and Pyle, 1959).

Discussion

A search of the literature has revealed no mention in any standard work on anatomy, radiology, or orthopaedics of the rather striking notching of the

radial aspect of the carpal navicular observed in our case and seen even more clearly in association with inflammatory or demineralizing osseous and articular diseases. Köhler and Zimmer (1967) illustrated various shapes of the carpal navicular and showed eight such variations including one practically identical to that seen in our case, but did not comment on the notch.

Grant (1958) illustrated the encroachment of the radial styloid on the navicular in abduction or radial deviation of the wrist, but did not stress the notch-like moulding of the navicular which may ensue.

A similar erosion of the lower femur by the patella on the fully extended knee, particularly in association with osteoporosis and synovial hypertrophy, has been reported by Doppman (1964).

Hall (1966) also illustrated the proximity of the radial styloid to the navicular, but his illustration, although it shows a mild navicular indentation, does not demonstrate actual notching.

The special view of Meschan (1959) to demonstrate the navicular shows no evidence of indentation by the radial styloid and in his projection this may well not be possible, but Clark (1964) in a 30° oblique posterior and anterior view of the wrist showed the notch with radial deviation and the radial styloid in the notch.

It seems apparent that there is considerable variation in the shape and size of the carpal navicular and, therefore, in its relationship to the radial styloid, but that it is not uncommon for the juxtaposition of the radial styloid to the navicular to produce indentation or frank notching. Our case demonstrates this, and the condition was seen to

TABLE
INCIDENCE OF NOTCHING OF CARPAL NAVICULAR BY AGE AND DIAGNOSIS

Diagnosis	No. of Cases	Cases with Notching		Age (yrs)	
		No.	Per cent.	Range	Mean
Trauma	46	12	25	22-65	42
Rheumatoid Arthritis	14	8	57	23-76	55
Gout	6	2	33	63-65	64
Osteoarthritis	6	2	33	62-78	70
Hyperparathyroidism	*21	11	52	39-69	54
Miscellaneous Conditions	10	3	30	45-70	57
†Children x-rayed for Bone Age	19	6	32	11-18	14
	1	1	—	11	—
	10	0	—	0-5	—
Total	133	44+1	37	11-78 } 0-5	—

*Nineteen cases of primary and two cases of secondary hyperparathyroidism.

†For trauma and bone age survey for short stature.

some extent in 37 per cent. of our patients. That it is not due entirely to a process of ageing is demonstrated by the fact that notching was observed in one 11-year-old boy as well as in six (32 per cent.) of nineteen other children aged 11 to 18 years (Fig. 2). In only one of these six children was the notching marked; in ten children under age 5, no navicular could be identified.

25 per cent. of our traumatic cases showed the notch; it was seen in over 50 per cent. of the rheuma-

toid arthritis and hyperparathyroid cases, and was especially marked in one patient with tuberculosis of the wrist and in three with rheumatoid arthritis (Fig. 3). The incidence was 33 per cent. in our small sampling of gout and osteoarthritis. It was somewhat more evident in the adult females (41 per cent.) than in the adult males (31 per cent.), and was somewhat more frequent with increased age (average age with the notch 57 years compared with the total average of 47 years).

Fig. 2.—Carpal navicular notch in a 14-year-old boy, oblique view.

Fig. 3.—Carpal navicular notch with radial styloid in notch in a case of rheumatoid arthritis.

Summary and Conclusions

(1) A notch or indentation on the radial side of the carpal navicular is a normal variation occurring in approximately 32 per cent. of children by age 15, and in a similar percentage of unselected adults.

(2) The apparent mechanism of development of the notch formation is pressure of the radial styloid on the adjacent surface of the carpal navicular during radial deviation of the wrist. Anatomical variations with some indentation or notching of the navicular may be congenital. A case is presented

demonstrating the carpal navicular notch and the mechanism of its production by radial styloid pressure.

(3) Navicular notching is enhanced by disorders associated with demineralization of the navicular, especially in rheumatoid arthritis of the wrist, tuberculosis of the wrist, and hyperparathyroidism.

(4) In two patients with rheumatoid arthritis and one with tuberculosis the notch was distinctive, the lack of a cortical margin suggesting a true marginal erosion.

REFERENCES

- Clark, K. C. (1964). "Positioning in Radiology (An Ilford Manual)", 8th ed., p. 22. Heinemann, London.
- Doppman, J. L. (1964). *Radiology*, **82**, 240 (The association of patellofemoral erosion and synovial hypertrophy: a diagnostic entity).
- Grant, J. C. Boileau (1958). "A Method of Anatomy", 6th ed., p. 198. Williams and Wilkins, Baltimore.
- Greulich, W. W., and Pyle, S. I. (1959). "Radiographic Atlas of Skeletal Development of the Hand and Wrist", 2nd ed., pp. 90 and 152. Stanford University Press, Stanford, California.
- Hall, M. C. (1966). "The Architecture of Bone", p. 84. Thomas, Springfield, Ill.
- Kohler, A., and Zimmer, E. A. (1967). "Borderlands of the Normal and Early Pathologic in Skeletal Roentgenology", American ed., p. 79. Grune and Stratton, New York.
- Meschan, I. (1959). "An Atlas of Normal Radiographic Anatomy", 2nd ed., p. 120. Saunders, Philadelphia.

L'échancrure du scaphoïde du carpe

RÉSUMÉ

(1) Une échancrure ou entaille du côté radial du scaphoïde du carpe est une variante normale chez à peu près 33 pour cent des enfants jusqu'à l'âge de quinze ans, et chez un pourcentage à peu près égal d'adultes non-sélectionnés.

(2) Le mécanisme apparent du développement de l'échancrure est dû à la pression du styloïde radial sur la surface adjacente du scaphoïde pendant la déviation radiale du poignet. Les variantes anatomiques montrant un peu d'échancrure du carpe peuvent être congénitales. Un cas est présenté démontrant l'échancrure du scaphoïde du carpe et le mécanisme de sa production par la pression du styloïde radial.

(3) L'échancrure du scaphoïde est augmentée par les affections associées à la déminéralisation du scaphoïde, surtout dans la polyarthrite rhumatoïde du poignet, dans la tuberculose du poignet et dans l'hyperparathyroïdisme.

(4) Chez deux malades atteints de polyarthrite rhumatoïde et chez un malade atteint de tuberculose l'échancrure était distinctive, l'absence d'une marge corticale suggérant une érosion marginale réelle.

Escotadura del escafoïdes carpiano

SUMARIO

(1) Una escotadura o entalladura de la cara radial del escafoïdes carpiano es una variante normal que ocurre en aproximadamente un 33 por ciento de niños para la edad de 15 años y en una proporción aproximadamente igual de adultos no seleccionados.

(2) El mecanismo aparente de desarrollo de la escotadura se debe a la presión del estiloide radial sobre la superficie adyacente del escafoïdes carpiano durante la desviación radial de la muñeca. Las variantes anatómicas con cierta escotadura o entalladura del escafoïdes podrían ser congénitas. Se presenta un caso que muestra la escotadura del escafoïdes carpiano y el mecanismo de su formación por presión del estiloide radial.

(3) La escotadura del escafoïdes se agudiza por desórdenes asociados con desmineralización del escafoïdes, especialmente en la poliartritis reumatoide de la muñeca, tuberculosis de la muñeca e hiperparatiroidismo.

(4) En dos pacientes con poliartritis reumatoide y uno con tuberculosis la escotadura era distintiva, y la ausencia de un margen cortical sugería una verdadera erosión marginal.