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Some Radiographic Peculiarities in the Wrist Joint Complex with Hamatolunate Joint

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The data from the literature sources show variation of the occurrence of the hamatolunate joint (HLJ) in the wrist joint between 26.7% to 73% due to the different research methods. Three methods were applied on one and the same material in the current study. The aim of this study was to evaluate the degree and the circumstances in which these methods can determine the presence of the HLJ. Twenty cadaver wrist joint complexes were studied for the presence of HLJ. The methods applied were radiological, dissection and macerated bones. In 3 cases the radiological method shows no sign of a HLJ, even though such a joint was detected by the two other methods. The radiological method cannot verify the presence of a HLJ in the cases where the width of the medial facet of the os lunatum for the os hanatum was less than 3mm.

Key words: wrist joint complex, types of lunate bone, hamatolunate joint, X-ray study morphometry.

Introduction

Recent studies on the presence of the HLJ and the types of the lunate bone that lead to the presence or the absence of such a joint show significant difference in the frequency of that variation in the wrist joint complex [6, 18]. The radiological study of D h a r a p et al. [5] shows that the *os lunatum* type II (with additional medial facet for *os hamatum*) [16] determines the presence of the HLJ and can be found in 26.7% of the studied cases. According to V i e g a s et al. [17] the same type *os lunatum* can be found in 73% of the cases using the wrist dissection (Table 1). In our opinion that significant difference is due to the abilities of the applied methods for visual detection of the medial facet of *os lunatum* — scopical observation of the macerated bones, cadaver wrist dissection, radiological, arthroscopical, and MRI images. S a g e r m a n et al. [12] estimated that the accuracy of the radiological determination of the different types of *os lunatum* vary between 64% to 72%. The aim of this study was to evaluate the degree and the circumstances in which any of the three methods can fail to detect cases with HLJ (e.g. *os lunatum* type II). The three methods applied on same material were radiological, dissection, and scopical observation of macerated bones with present morphometrics (Table 1).

Table 1.

Method of examination	Authors, year	os lunatum type I - %	os lunatum type II - %
Macerated bones	Dyankova, S. [6]	34 %	66 %
Dissection of wrists	Dyankova, S. [18]	44 %	56 %
	Viegas, S. F. [15]	39.3 %	60.7%
	Viegas, S. F. et al. [16]	34.5 %	65.5%
	Viegas, S. F. et al. [17]	27 %	73 %
	Arai T. [1]	42.5%	57.5%
Roentgenography of wrists	Aufauvre, B. et al. [2]	44 %	56 %
	Viegas, S. F. et al. [16]	46.1%	53.9%
	Tsude, S., Nakamura, R. [14]		
	■ Contralateral unaffected wrists of patients with trauma	42%	42%
	■ Contralateral unaffected wrists of patients with Kienböck's disease	37%	37%
	■ Bilateral wrists of volunteers	35%	35%
	Dharap, A. S. et al. [4]	61.2%	38.8%
	Dharap, A. S. et al. [5]	73.3%	26.7%
Arthroscopy	Dautel, G., Merle M. [3]	44.9%	55.1%
	Thurston, A. J., Stanley J. K. [13]	50%	50%
MRI and arthroscopy	Malik, A. M. et al. [7]	42,5 %	57.5 %
MRI and arthrography	Pfirrmann, C. W. A. et al. [11]	50%	50%

Material and Methods

Twenty cadaver wrist joints from the collection of the Department of Anatomy, Histology and Embryology at the Medical University — Varna, Bulgaria, were studied following all the ethical rules of work on cadaver material. The methods applied were antero-posterior radiography with PA-1-3 (60 κV, 10 mA, 1,2 mAXS, 100cm FFA); dissection of the wrist joints with measurement of the joint surfaces; scopical observation for the number of the joint facets on the distal and the proximal surface, and anthropometrical measurement [8] of the macerated bones.

Results and Discussion

The X-ray image of the wrist joint complex without a HLJ presents a continuous oval in the mediocarpal joint (Fig. 1, 3—A), while the wrist complex with a HLJ presents an interrupted oval (Fig. 2, 3—B).

Fig. 1. Wrist joint complex without a HLJ

Fig. 2. Wrist joint complex with a HLJ

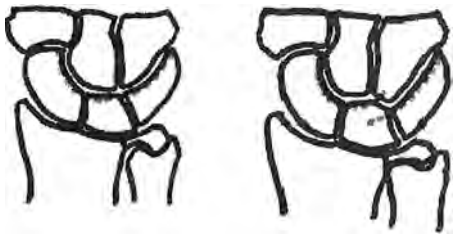

Fig. 3 *A* — Wrist joint complex without a HLJ - ontinuous oval in *art. mediocarpalis*; *B* — Wrist joint complex with a HLJ - interrupted oval in *articilatio mediocarpalis*

Table 2

Method of examination	Without a HLJ	With a HLJ
X-ray images	13	7
Cadaver wrist joints	10	10
Macerated bones	10	10

Fig. 4. X-ray image without visibility of the medial facet

Fig. 5. Cadaver wrist joints of the same wrist. The width of the medial facet is 1.8 mm

The data obtained through X-ray indicated a presence of the HLJ in 7 wrist joint complexes while the scopical observation on cadaver material and macerated bones revealed such a joint in 10 cases (Table 2).

Three X-ray images indicated no presence of a HLJ while the scopical observation showed its existence (Figs. 4, 5).

The morphometric measurements of the width of the joint facet of *os lunatum* for *os hamatum* on the wrist material was 1.8 mm, 2.1 mm, 2.8 mm correspondingly while on the macerated bones - 1.7 mm, 1.8 mm и 2.5 mm (Table 3).

Table 3

X-ray visibility of the medial facet	Cadaver wrist joints	Macerated bones
Cases without visibility	1.8 mm 2.1 mm 2.8 mm	1.7 mm 1.8 mm 2.5 mm;
Cases with visibility	3.2 mm и 5.6 mm	3 mm и 5.4 mm

The absolute measurements of the joint surfaces for *os capitatum* and *os hamatum* in case of *os lunatum* type II and their biomechanical and clinical significance are often discussed by different authors. According to V i e g a s et al. [16] the width of the facet for *os hamatum*, measured on cadaver material falls mainly in the 2-3 mm range; according to P f i r r m a n n et al. [11], who used the MRI method, the mean size is 4.5mm. The data of the current study suggests that facets smaller than 3mm cannot always be detected by X-rays which would result in a classification of such wrist joint complexes as ones without a HLJ. This can explain the differences in the data of the various studies, especially the data obtained through X-rays.

This fact deserves attention by the clinical practice for two reasons. The literature proves that *os lunatum* type II can be accompanied by frequent deep erosions of the cartilage in the proximal pole of *os hamatum* [1, 3, 9, 11, 14, 16]. Secondly, the presence of the medial joint facet has a significance for the development of the Kienböck's disease [10, 13, 18].

Therefore, we paid special attention to other factors that could help us in detecting the presence or absence of the HLJ using an X-ray image. Among these factors is the distance from the proximal pole of *os hamatum* to the medial end of the distal surface of *os lunatum*. The current study indicated that this distance was greater when *os lunatum* type II was present.

Conclusion

Wrists without a HLJ present a continuous oval in the midcarpal joint while wrists with present HLJ present an interrupted oval. The X-ray detection of the medial facet is problematic when the facet width is smaller than 3mm. Wrists without a HLJ have greater hamato-lunate distance in comparison to wrists with a HLJ.

References

1. A r a i, T. Roentgenographical and anatomical study of the midcarpal joint — morphology and degenerative change of ulnar side. — Nippon Seikeigeka Gakkai Zasshi., **67**, 1993, 1114-1121.
2. A u f a u v r e, B., G. H e r z b e r g, J. G a r r e t, E. B e r t h o n n e a u d, J. D i m n e t. A new radiographic method for evaluation of the position of the carpus in the coronal plane: results in normal subjects. — Surg. Radiol. Anat., **21**, 1999, 383-385.
3. D a u t e l, G., M. M e r l e. Chondral lesions of the midcarpal joint. — Arthroscopy, **13**, 1997, 97-102.
4. D h a r a p, A. S., H. A l - H a s h i m i, S. K a s s a b, M. F. A b u - H i j l e h. The hamate facet of the lunate: a radiographic study in an Arab population from Bahrain. — Surg. Radiol. Anat., **28**, 2006, 185-188.
5. D h a r a p, A. S., I. L u t f i, M. F. A b u - H i j l e h. Population variation in the incidence of the medial (hamate) facet of the carpal bone lunate. — Anthropol. Anz., **64**, 2006, 59-65.
6. D y a n k o v a, S. Lunate bone — types and morphological characteristic. — Acta Morphol. Anthropol., **10**, 2005, 304-308.
7. M a l i k, A. M., M. E. S c h w e i t z e r, R. W. C l u p, L. A. O s t e r m a n, G. M a n t o n. MR imaging of the type II lunate bone: frequency, extent, and associated findings. — Am. J. Roentgenol., **173**, 1999, 335-338.
8. M a r t i n, R., K. S a l l e r. Lehrbuch der Anthropologie. Bd.I, 1957, Bd.II, 1958, Stuttgart, G. Fischer Verl.
9. N a k a m u r a, K., R. M. P a t t e r s o n, H. M o r i t o m o, S. F. V i e g a s. Type I versus type II lunates: Ligament anatomy and presence of arthrosis. — J Hand Surg., **26A**, 2001, 428-436.
10. N a k a m u r a, K., M. B e p p u, K. M a t s u s h i t a, H. A o k i, T. I d e. Biomechanical analysis of force transmission across the midcarpal joint in Kienböck's Disease. — In 7th congress of the International Federation of Societies for surgery of the hand — Vancouver, Canada, May 24-28, 1998, 473-477.

11. Pfirrmann, C. W. A., N. H. Theumann, C. B. Chung, D. J. Trudell, D. Resnick. The hamatolunate facet: characterization and association with cartilage lesions — magnetic resonance arthrography and anatomic correlation in cadaveric wrists. — Skeletal Radiol., **31**, 2002, 451-456.
12. Sagerman, S. D., R. M. Hauk, A. K. Palmer AK. Lunate morphology: can it be predicted with routine x-ray films? — *J Hand Surg.*, **20**A, 1995, 38-41.
13. Thurston, A. J., J. K. Stanley. Hamato-lunate impingement: an uncommon cause of ulnar-sides wrist pain. — Arthroscopy, **16**, 2000, 540-544.
14. Tsuge, S., R. Nakamura. Anatomical risk factors for Kienböck's disease. — J. Hand Surg., **18B**, 1993, 70-75.
15. Viegas, S. The lunatohamate articulation of the midcarpal joint.— Arthroscopy, **6**, 1990a, 5-10.
16. Viegas, S. F, K. Wagner, R. Patterson, P. Peterson. Medial (hamate) facet of the lunate. — J. Hand Surg., **15**, 1990b, 564-571.
17. Viegas, S. F, R. M. Patterson, J. A. Hokanson, J. Davis. Wrist anatomy: incidence, distribution, and correlation of anatomic variations, tears, and arthrosis. — J. Hand Surg., **18**, 1993, 463-475.
18. Д я н к о в а, С. Морфология на китковия ставен комплекс и васкуларна анатомия на предмишничните кости с оглед някои проблеми на развитието и лечението на болестта на Kienböck. Дис. труд за „Доктор". Варна, 2005. 59 с.