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Brief communication

Differential diagnosis of a fused wrist with a partially destroyed capitate from Kazakhstan (1st–3rd century AD)

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ABSTRACT

We discuss here the differential diagnosis of carpal ankylosis along with the second and third metacarpals of the right hand in an adult male skeleton buried in a kurgan from Mayemer, Kazakhstan (86–242 AD, 95.4% cal.). Our assessment was conducted via macroscopic analysis as well as with the use of radiographic methods. Several groups of pathologies were considered: congenital diseases, inflammatory and infectious diseases, and trauma. Differential diagnosis was challenging due to the very poor preservation of the skeleton, and while several diseases are possible (e.g., rheumatoid arthritis, spondylarthropathy), we think the fusion is most likely of traumatic origin. Evidence for trauma was found, suggesting a scaphocapitate fracture syndrome, followed by ankylosis.

1. Introduction

Carpal fusion is an occasional finding in the archaeological record (Aufderheide and Rodriguez-Martin, 1998; Isidro et al., 2015; Jurmain, 1988; Kacki et al., 2013; Paja, 2012; Smrčka et al., 2009; Waldron, 2009). It can be the result of many different diseases, sometimes interdependent, which makes its origin difficult to specify. Differential diagnosis should include congenital diseases (Senecail et al., 2007; Singh et al., 2003), rheumatic diseases, such as spondylarthropathy (Kacki et al., 2013; Rothschild and Woods, 1991) and rheumatoid arthritis (RA) (Giuffra et al., 2009; Kaye et al., 1987; Kilgore, 1989; Leden et al., 2012; Maldonado-Cocco et al., 1980; Waldron, 2009), infectious diseases (Kotwal and Khan, 2009; Paja, 2012; Robins, 1967) and trauma (Gupta, 1998; Jurmain, 1988; Saffar, 1990). This adult male skeleton from the Kazakhian site of Mayemer (1st–3rd century AD) with carpal fusion of the right hand is a further case of this multifactorial pathological condition.

This skeleton was incomplete, fragmented and poorly preserved, but displayed noteworthy lesions, important for estimating pathologies prevalent in this time and region. Being aware of the limits of this case, we were still able to narrow down the possible diagnoses, which underscores the potential of analysing even poorly preserved skeletons. Although the diagnosis is still not definitive, the syndrome appears to be one not previously described in the paleopathological literature.

2. Materials and methods

The site of Mayemer (Fig. 1) in Eastern Kazakhstan was excavated in 2010 by a German-Kazakhian team. Four Kurgans were excavated, dating from the 4th century BC to the 2nd century AD (personal communication by Boroffka 2010. Eleven adult skeletons, seven males, three females and one of indeterminate sex included this individual (Object 4, Skeleton 2) (Fig. 2)), who was buried next to another young male. A radiocarbon date of 86–242 cal. AD (95.4%) (Poz-64502) was obtained directly from the remains. For sex estimation, the greater sciatic notch as well as the glabella, the supra orbital margin, the mastoid process and the nuchal crest indicated that the individual was a male (Buikstra and Ubelaker, 1994). Age estimation, which employed dental attrition (Brothwell, 1981) and cranial suture closure (Buikstra and Ubelaker, 1994; Rösing, 1977), suggested a 25–35 year age range. Degenerative changes were identified through the development of osteophytes and alterations of the joint contours (lipping), as well as changes of the articular surface (pitting and eburnation). For inflammatory changes, sclerosis and periostitis as well as bone destruction are recognized indicators[A1] . Plain film radiography (Faxitron 43,805N by Hewlett-Packard at the German Archaeological Institute, Berlin) and computed tomography (Toshiba Aquillion One© CT, DICOM-reader© software at the Charité, Berlin) aided the diagnosis.

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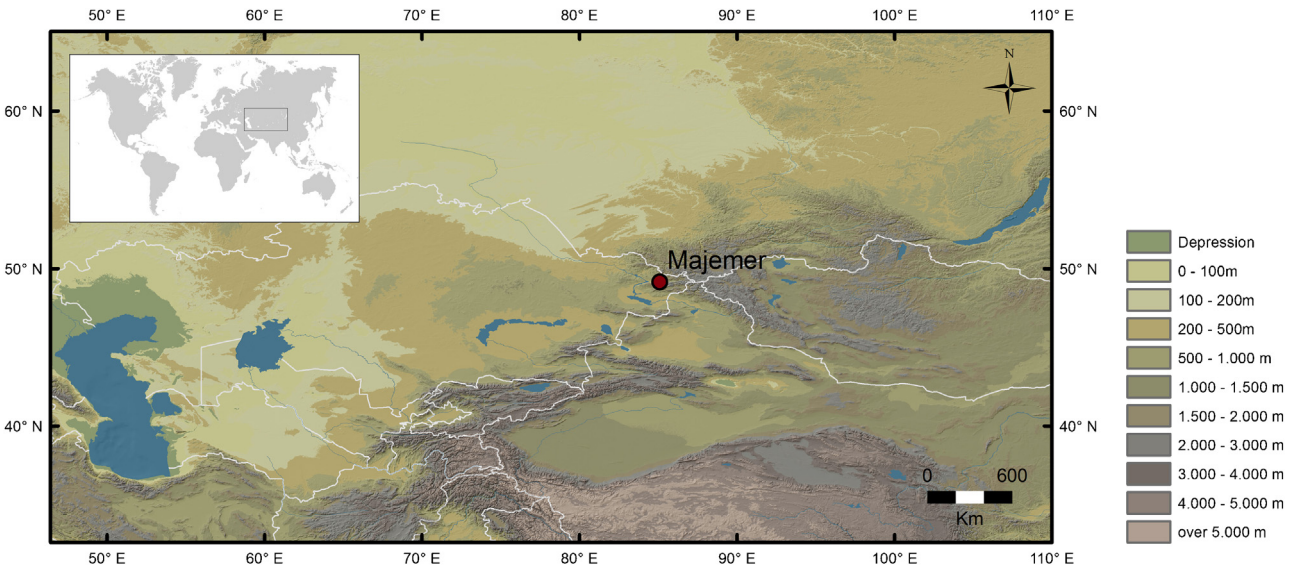

Fig. 1. Map of the area of Mayemer in Kazakhstan (D. Hosner, DAI).

Table 1
Key features of pathological conditions that may cause carpal fusion.

Nature of pathology	Congenital diseases	Fractures of carpals	Syphilitic arthritis	Tuberculous arthritis	Rheumatoid arthritis	Septic arthritis	Spondyl-arthropathy
Bony ankylosis of carpals	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Metacarpals included	No	Yes	Yes	Yes	Yes	Yes	Yes
Missing head of capitate	No	Possibly	Unlikely	Possibly	Possibly	Possibly	Possibly
Age of onset (years)	Congenital	Each age class, mainly young	Young adults	Middle aged or older	20–50	Young > older	15–35
Symmetry of the lesions	symm/asymm	asymm	asymm	asymm	symm	asymm	asymm
Number of affected joints	Mono-poly	Mono-poly	Mono	Mono/oligo	Poly	Mono	Mono/oligo
Main location	Hands, skull long bones	Whole skeleton	Mainly knee joint	Large joints (knee and hip) but also all others	Erosive reactions on joints of the fingers, the hand, feet, and cervical spine	Mainly knee and hip (especially in infants)	Axial arthritis, sacroiliitis, spondylitis, oligoarthritis, entheseal changes
Bony changes	– Massive deformation or displacement of carpals – Other changes on the skeleton	Fracture lines or compression, remnants of kallus	– Osteophytes – Marginal lipping and eburnation – Discrete destruction of articular surfaces	– Juxta articular osteoporosis – Peripherically located osseous erosions – Gradual narrowing of joint space – Little bony proliferation and periostitis	– Marginal erosions – Osteoporosis – Significant loss of joint space – Little bony proliferation – Destruction of adjacent bone – Joint malposition	– Bone destruction – Large bony proliferation (sclerosis and periostitis) – Marginal erosions – Early joint space loss	– Apophyseal joint erosion and fusion – Subchondral and marginal erosions – No periarticular osteoporosis – Reactive (entheseal) new bone formation

symm: symmetrical; asymm: asymmetrical.

3. Results

Macroscopic examination

The carpal ankylosis of the right hand included the scaphoid, part of the lunate, trapezium, trapezoid, capitate (which is lacking the head), hamate and two proximal metacarpals (MC II and III) (Figs. 3–5). The bases of the MC II and III have fused completely, although the distal portions were lost postmortem. There is clear evidence that the remaining metacarpals had not fused to the carpals because the carpo-metacarpal facets of the trapezium and hamate do not show signs of ankylosis (Fig. 6). The triquetral and pisiform have been lost postmortem but could have fused to the block as well, since there are no joint facets on the hamate and scaphoid. The dorsal surface of the block (Fig. 3) was heavily abraded postmortem, and the evenly distributed trabecular bone is visible. The palmar surface displays a cortical layer interrupted by three deep (5 × 4 mm, 7.5 × 3 mm, 5 × 3 mm) and one shallow, oval (2.5 × 2.5 mm) cavities, possibly from ligamentous embedding (*Lig. carpi radiatum, Ligg. metacarpalia palmaria*) (Fig. 4). The metacarpals do not exhibit any pathological alterations, such as fractures or pronounced inflammatory changes.

The distal carpals are in correct anatomical position. Unfortunately, because of intensive postmortem destruction, assessing the proximal row is a more complicated. The scaphoid seems to be in anatomical position, but the distance between the tubercle and the joint facet for the radius appears to be shortened (Fig. 7). The palmar rim of the radial joint surface has become enlarged and thickened (Fig. 8), while the proximal aspect displays a 12 × 12 mm cavity with a smooth surface on the joint facet for the capitate (Fig. 9). The capitate head has been completely destroyed, with parts of the neck present on the palmar side. The capitate body appears to have a normal shape (the dorsal part is destroyed post-