Developmental Dysplasia of the Hip in a Child from Medieval Poland

Amanda M. Agnew[1,2], Hedy M. Justus[2,3]

The Ohio State University: [1]Division of Anatomy, [2]Department of Anthropology, Columbus, OH

[3]Joint POW/MIA Accounting Command, Joint Base Pearl Harbor-Hickam, Hawaii

Contact:

Amanda M. Agnew, PhD

Director, Skeletal Biology Research Lab

Assistant Professor, Div. of Anatomy

The Ohio State University

Email: amanda.agnew@osumc.edu

INTRODUCTION

Developmental dysplasia of the hip (DHH) has an unknown etiology, but certainly genetic as well as environmental factors influence the progression of the malformation. Risk factors include breech positioning, first-born, swaddling, and a family history of the condition (Loder and Skopelja, 2011). Variations of DHH from mild to severe include dysplasia (acetabular changes, but with normal femoral articulation), subluxation (lateral displacement of the femoral head articulation) and dislocation (creation of a false acetabulum on the lateral ilium) (Mitchell and Redfern, 2011).

Modern trends reveal a higher frequency of unilateral involvement, predominantly in the left hip, with females affected more often than males. Eastern Europeans currently have one of the highest incidences of DHH, and Polish groups, in particular, are identified as being at high risk for the condition (Loder and Skopelia, 2011). To the best of our knowledge, no cases have been reported in the paleopathological literature of DHH in Polish populations.

CASE DESCRIPTION

The Giecz Collection (11-12th c., medieval Poland) includes the excellently preserved skeletons of 180 adults and 97 subadults. Grave 7/08 is the only one exhibiting any evidence of developmental dysplasia of the hip. The closest geographical and temporal comparative case comes from Slovakia, in which only one case of DHH was found out of 137 adult skeletons (Masnicova and Benus, 2003).

Grave 7/08, a child of 8-10 years of unknown sex, exhibits evidence of unilateral (left) developmental dysplasia of the hip joint, including malformation of the ilium, ischium and proximal femur. The right hip joint appears normal (Fig. 1a-c).

In this case, the femoral head was not clearly dislocated from the joint itself as there is no evidence of a false acetabulum or secondary joint formed elsewhere on the pelvis. Instead, a deepening of the developing acetabulum is seen with sclerotic reaction surrounding the joint (Fig. 1b). However, a noticeable foramen has been formed on the ilium superior to (and in communication with) the normal acetabular location (Fig. 1a,b). This could indicate a progression of subluxation. Lack of a defined secondary articular surface suggests the condition may be congenital and not traumatic in nature.

DISCUSSION

Figure 1 a-c: Elements comprising the hip joint with a comparison of left (affected) vs right (unaffected) elements. a) postero-lateral view of the ilia, b) inferolateral view of the acetabular surfaces of the ilia, c) posterior view of the femora. Detailed: d) supero-anterior and e) anterior views of the proximal left femur illustrating head and neck disfigurement. Scales are in cm.

While the absence of a femoral head/neck has been reported in other cases, both are present but deformed in this case (Fig. 1c-e) and appear to fit within the similarly abnormal and deepened acetabulum (Fig. 2), suggesting that articulation was occurring. No epiphyses of the left proximal femur were recovered, so it is possible that a separate bony femoral head did not actually exist. This may be the case since preservation is excellent and the authors themselves performed the excavation and recovered the femoral head and greater trochanter epiphyses from the unaffected right side.

Most cases of DHH or similar conditions are described in mature skeletal remains. It is especially difficult to diagnose in immature remains, as in this case, because the ilium, ischium, and pubis have not yet fused together to create a defined bony acetabulum (Mitchell and Redfern, 2011). Additionally, the femoral head, if present, would not have been fused yet, making it challenging to identify true articulations.

The entire left lower extremity is atrophied relative to the right with involvement of the femur, tibia, and fibula (Fig. 3). In adults, a mean reduction in femoral circumference of 14% is reported by Mitchell and Redfern (2008), but the reduction in this case is only 9.2%. This could be the result of having only a limited time for development, as the child is young. However, the tibial and fibular reductions in circumference are 14.3% and 25%, respectively.

Limb shortening as evidenced by reduced long bone length is present as well. Table 1 provides quantification of these bilateral differences. As also noted by Mitchell and Redfern (2008), the greater sciatic notch on the affected side appears wider than on the unaffected side (Fig. 1a).

Table 1. Comparison of left (affected) vs right (unaffected) lower extremity measurements. Left measurements are all noticeably less.

	Femur		Tibia		Fibula	
(mm)	L	R	L	R	L	R
Max length	255	267	209	211	-	206
A-P diameter	17.14	17.20	19.60	22.55	7.86	10.67
M-L diameter	13.57	16.82	15.50	17.79	5.60	7.07
Circumference	59	65	66	77	30	40

Figure 2. Postero-lateral view of articulated left os coxa showing malformation of the acetabular articular surfaces. Scale is in cm.

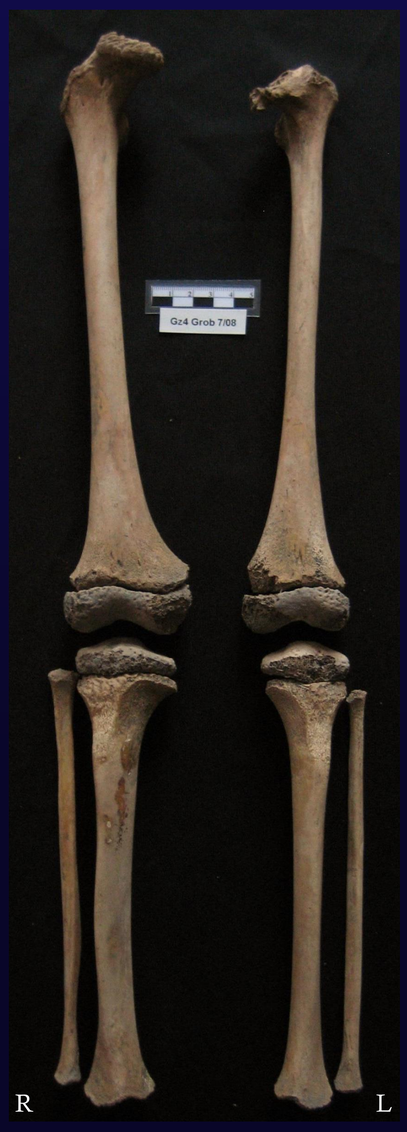

Figure 3. Anterior overview of long bone elements from the lower extremity. Note the atrophy of the left (L) limb compared to the right (R). Scale is in cm.

CONCLUSIONS

The occurrence of DHH in archaeological populations is rarely reported (and usually in adults). The case described here offers a unique glimpse of the condition in an immature skeleton, but offers little information on general prevalence in medieval Poland. An increased number of large-scale archaeological reports on the prevalence of such developmental defects of the skeleton will be useful for comparison to modern rates in the future.

Acknowledgements

Teresa Krysztofiak, Marek Polcyn, Kinga Monczak-Zamelska, Elżbieta Indycka, the Muzeum Pierwszych Piastów, and the Slavia Foundation for their continued support. Thanks are also extended to all past students of the Mortuary Archaeology Field School in Giecz.

References Cited

Loder R, Skopelja E. 2011. The epidemiology and demographics of hip dysplasia. International Scholarly Research Network Orthopedics 2011:46. **M**asnicova S, Benus R. 2003. Developmental anomalies in skeletal remains from the Great Moravia and Middle Ages cemeteries at Devin (Slovakia). International Journal of Osteoarchaeology 13:266-274. **M**itchell PD, Redfern RC. 2008. Diagnostic criteria for developmental dislocation of the hip in human skeletal remains. International Journal of Osteoarchaeology 18:61-71. **M**itchell PD, Redfern RC. 2011. Developmental dysplasia of the hip in medieval London. Am J Phys Anthropol 144:479-484.