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Brief Communication

A palaeopathological example of Legg-Calvé-Perthes disease from Argentina

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ABSTRACT

Legg-Calvé-Perthes (LCP) disease is a very uncommon condition that affects one in 10,000 paediatric patients. Examples described in the palaeopathological literature are scarce and for this reason the exceptional examples found in archaeological contexts are worthy of analysis, description and reporting. We record an archaeological example from Argentina, skeleton 12 Cápiz Alto (12 CA) that shows skeletal signs compatible with this condition.

1. Description of burial 12 Cápiz Alto (12 CA)

Individual 12 (12 CA) was buried in Cápiz Alto, a cemetery located 14 km from the village of San Carlos in Mendoza province, Argentina (Figs. 1 and 2) and used for burial during the post-European contact period (late-16th and 17th centuries) (Novellino et al., 2003). The first rescue excavations were performed in 1998, following building construction, and continued until 2002, resulting in the recovery of 19 individuals.

Burial 12 CA (Fig. 3) included the well-preserved skeleton of a juvenile individual aged 14–16 at the time of death. Age estimation emphasised the epiphyseal union of the post-cranial skeleton and dental development according to Buikstra and Ubelaker (1994) and Scheuer and Black (2004). Sex estimation was not attempted because the individual was too young to show distinctive dimorphic features.

1.1. Gross pathology

Morphological changes of the right femoral proximal epiphysis and acetabulum included a flattened head and excrescences arising from the joint margins that gave a "mushroom-like" appearance to the epiphysis (Fig. 4). The right femoral neck was shorter and wider than the left. Therefore, when the unfused greater trochanteric epiphyses were relocated in anatomical position, the centre of the right femoral head was at almost the same height as the greater trochanter. On the left side, the head was positioned well above the trochanter (Fig. 4). Comparative osteometric analysis carried out on both femora suggested that the right femur was shorter than the left, and the vertical diameter of the left femoral head was smaller than the affected right side (Table 1).

The right acetabulum showed changes in overall dimensions and contour when compared with the left (Fig. 5). The acetabular rim was abnormally thickened and coarse but it showed signs of being functional despite articulating with a dysplastic femoral head. Indeed, when the femoral head was in anatomical position, the lateral portion of the head was not completely covered by the acetabulum. In line with the loss of femoral head containment, the right acetabulum was shallower in depth and less concave in shape than the left. Its abnormal width correlated with the flattened femoral head, resulting in an increase in both vertical and transverse diameters when compared with the left (Table 1).

1.2. Plain film radiology

The radiograph taken of the affected femur showed widening and irregularity of the growth plate and broadening of the metaphysis (Fig. 6). There was also evidence of fragmentation surrounding the fovea capitis suggesting disruption of the vascular supply. The femoral head appeared radiodense, indicating that sclerosis was a secondary phenomenon caused by compression of trabeculae and revascularisation, with deposition of new bone on necrotic trabeculae. The right hemipelvis also showed sclerotic areas

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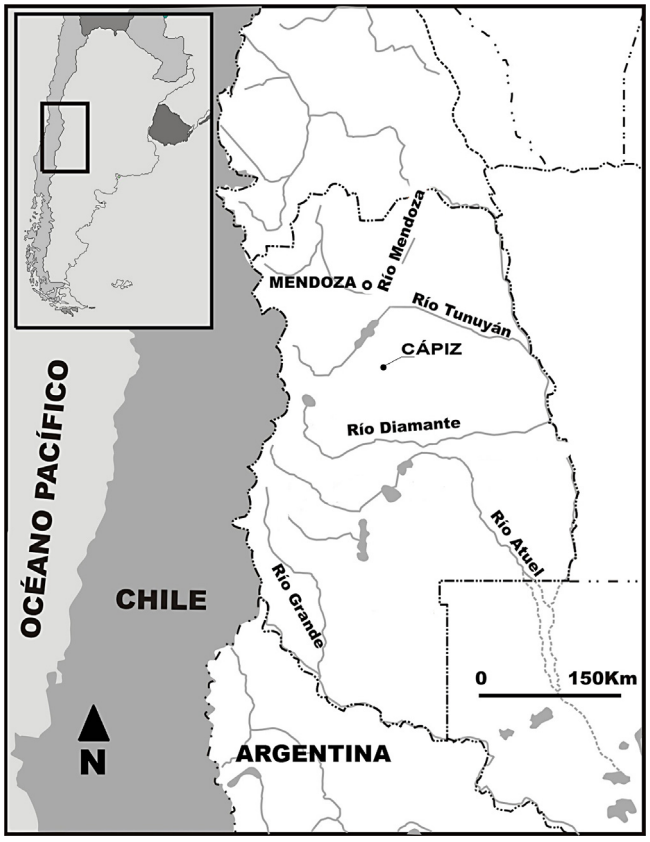

Fig. 1. Geographic location of cemetery Cápiz Alto (Mendoza, Argentina).

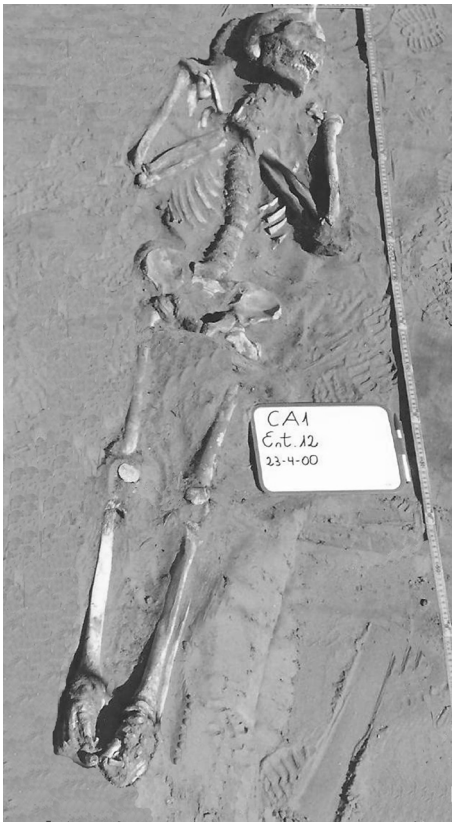

Fig. 3. Photo of individual 12 Cápiz Alto buried *in situ* (12 CA).

surrounding the acetabular rim (Fig. 7). These probably resulted from an incongruent and deformed femoral head articulating with the acetabulum.

2. Discussion

There are a number of conditions that can lead to the anatomical changes observed in Burial 12 CA. These include slipped capital femoral epiphysis, developmental dysplasia of the hip and LCP disease.

Table 1
Comparative osteometric analysis of femora and ilia.

Bone	Measurement	Right	Left
Femur	Maximum length	39.00 cm	40.06 cm
	Vertical diameter of the femoral head	0.53 cm	0.41 cm
Ilium	Vertical diameter of acetabulum	6.0 cm	5.8 cm
	Transversal diameter of acetabulum	6.6 cm	6.0 cm
	Depth of acetabulum	2.5 cm	2.8 cm

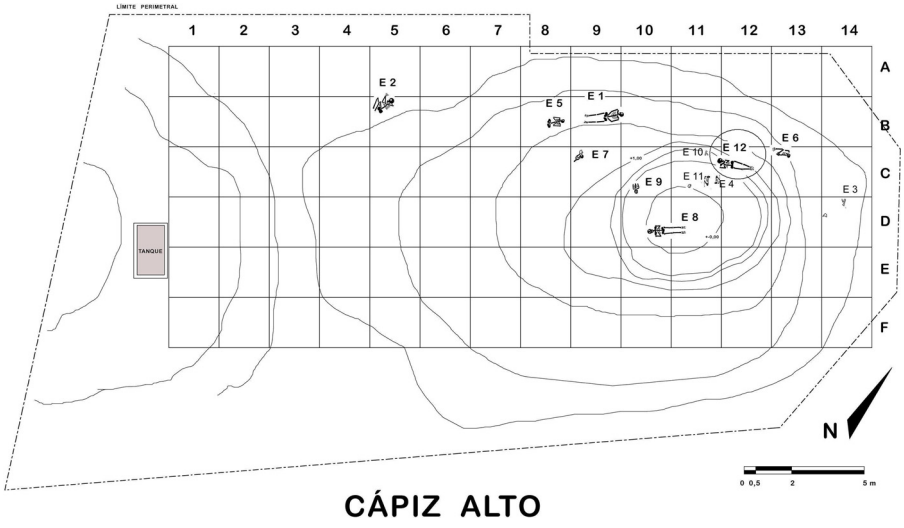

Fig. 2. Map of cemetery Cápiz Alto (Mendoza, Argentina).

Fig. 4. Right femoral head showing a "mushroom-like" appearance.

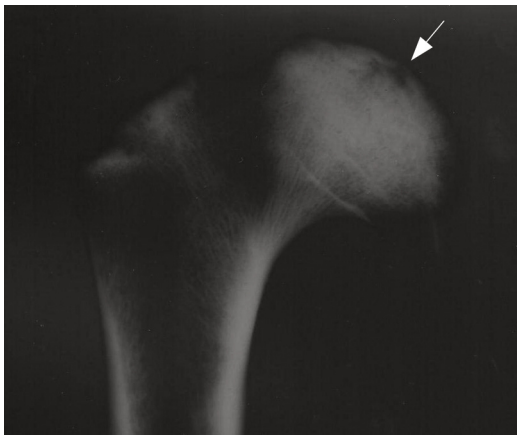

Fig. 6. Right femur with arrow pointing at the necrotic area beneath the cortex.

Slipped capital femoral epiphysis results from a fracture or a series of minor traumatic events on the metaphyseal side of the femoral head growth plate. This leads to a forward displacement of the femoral neck while the epiphysis remains located within the acetabulum (Bullough, 2010; Solomon et al., 2010). As the condition progresses, a number of events may occur, including avascular necrosis due to disruption of the blood supply to the femoral head, premature fusion of the epiphysis or early onset degenerative joint disease of the hip (Solomon et al., 2010).

Developmental dysplasia of the hip is a term used to describe a group of disorders including acetabular dysplasia, hip subluxation and dislocation (Mitchell and Redfern, 2008, 2011; Bullough, 2010). It is characterised by a femoral head that is abnormally positioned within the acetabulum at the time of birth (Bullough, 2010). The dysplasia caused by the abnormal joint load during weight bearing, induces the long term formation of a false socket above the poorly formed acetabulum and an underdeveloped femoral head. In severe cases the outcome may be flattening of the femoral head, acetabular dysplasia and incongruency of the hip (Solomon et al., 2010).

Legg-Calvé-Perthes is a low incidence, unusual condition that affects 1:10,000 paediatric patients (Solomon et al., 2010). The condition is triggered by a traumatic disruption in the epiphyseal blood supply. This results in avascular necrosis of the trabeculae and the marrow, leading to structural failure of the femoral head. The consequent collapse and flattening produces a permanent "mushroom-like" appearance (Aufderheide and Rodríguez-Martín, 1998; Resnick, 2002; Ortner, 2003; Solomon et al., 2010). Along with this, the femoral neck may widen and shorten, consequently producing a decrease in the length of the affected limb (Bullough, 2010). The acetabulum may also be affected, demonstrating a flattened, elongated and irregular articular cavity (Solomon et al., 2010).

Waldron (2009) suggested that the morphological changes of LCP disease in human skeletal remains can include; a flattened mushroom-shaped femoral head with overhanging margins, the normal position of the femoral head in relation to the axis, the thickening and shortening of the femoral neck along with a wide and shallow acetabulum. These can be considered distinctive diagnostic features of LCP disease for palaeopathologists. We believe that these features are consistent with the changes observed in the right femur and hip of Burial 12 CA. The absence of macroscopic and radiological evidence for displacement or separation of the femoral head from the neck and the absence of a healed fracture in the metaphysis of the femoral head would discount slipped femoral capital epiphysis. The normal location of the femoral head in relation to the neck and the diaphyseal axis would also reject this possibility.

Similarly, as observed macroscopically and confirmed with radiography, the right hemipelvis does not show evidence of a new false or secondary acetabulum, nor labral tears, osteophytes or cysts

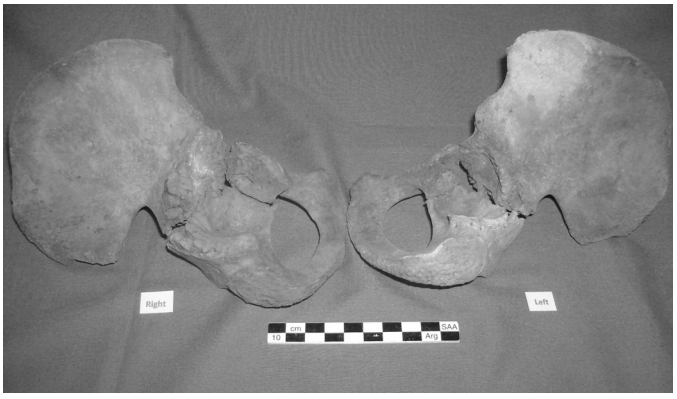

Fig. 5. Right os coxa showing a wide and shallow acetabulum.

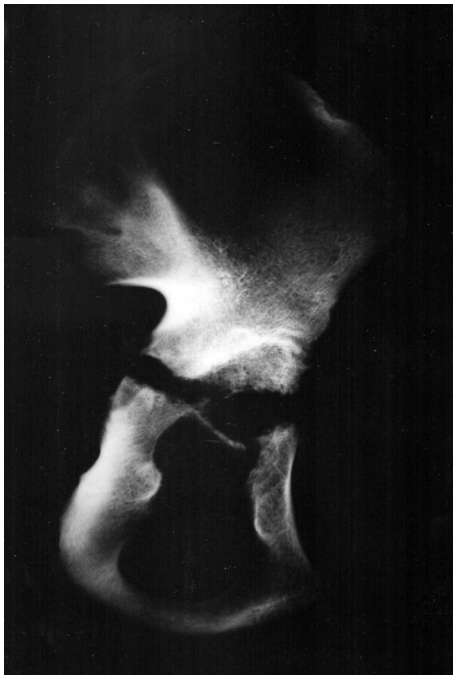

Fig. 7. Right os coxa showing sclerotic margins on the abnormally wide acetabulum.

along the acetabular rim. The femoral head, despite its flatness, does not show signs of underdevelopment eburnation, subchondral cysts or osteophytes on the medial part of its superior surface, excluding any possible indication of developmental dysplasia of the hip or hip subluxation. Solomon et al. (2010) suggested that some of the later stages of developmental dysplasia may resemble those of LCP (poorly formed acetabulum and flattening of the femoral head), but despite the acetabulum being shallow and the coverage of the femoral head deficient, the hip joint is congruent, thus excluding developmental dysplasia of the hip as a possible diagnosis. Furthermore, despite the flatness of the femoral head of Burial 12 CA, it does not show signs of underdevelopment.

The palaeopathological evidence of LCP disease is scarce. Reported archaeological examples include that of Ortner (2003), Smrcka et al. (2009), Herrerín and Garralda (2010), and Hooper (1984). As emphasised by Roberts and Cox (2003: p. 400), this is a condition so infrequently reported in palaeopathology, that the exceptional examples are worthy of description and analysis. Since LCP is a very uncommon condition, the aim of this study was to report an example in an archaeological skeleton from Argentina to contribute to its morphological, geographical and temporal understanding in past populations.

3. Conclusion

We have described the morphological changes observed in the right femur and hemipelvis of Burial 12 CA, a 14–16 years old individual dating to the late 16th and 17th centuries. We have excluded slipped capital femoral epiphysis and developmental dysplasia of the hip as possible diagnoses. The combined macroscopic, osteometric and radiological examination indicate that the most likely diagnosis is Legg-Calvé-Perthes disease. To the best of our knowledge, this is the first palaeopathological example of the condition reported in an archaeological skeleton from Argentina.

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References

Aufderheide, A., Rodríguez-Martín, C., 1998. The Cambridge Encyclopedia of Human Paleopathology. University Press, Cambridge, Cambridge.
Buikstra, J., Ubelaker, D., 1994. Standards for Data Collection from Human Skeletal Remains. Archaeological Survey, Research Series 44, Fayetteville, AR.
Bullough, P., 2010. Bone infarction (osteonecrosis). In: Bullough, P. (Ed.), Orthopaedic Pathology. Mosby Elsevier, Missouri, pp. 343–359.
Herrerín, J., Garralda, M., 2010. Legg-Calvé-Perthes disease and unifocal eosinophilic granuloma in a Visigoth from Duratón Necropolis (Segovia Spain). Int. J. Osteoarchaeol. 22, 86–97.
Hooper, B., 1984. Anatomical considerations. In: Cunliffe, B. (Ed.), Danebury: an Iron Age Hillfort in Hampshire, London, Council for British Archaeology. Research Report 52. , pp. 463–474.
Mitchell, P., Redfern, R., 2008. Diagnostic criteria for developmental dislocation of the hip in human skeletal remains. Int. J. Osteoarchaeol. 18, 61–71.
Mitchell, P., Redfern, R., 2011. Brief communication: developmental dysplasia of the hip in medieval London. Am. J. Phys. Anthropol. 144, 479–484.
Novellino, P., Durán, V., Prieto, C., 2003. Cápiz Alto: aspectos bioarqueológicos y arqueológicos del cementerio indígena de época post-contacto (provincia de Mendoza, Argentina). Paleopatología 1, 1–16.
Ortner, D., 2003. Identification of Pathological Conditions in Human Skeletal Remains. Academic Press, New York.
Resnick, D., 2002. Osteochondroses. In: Resnick, D. (Ed.), Diagnosis of Bone and Joint Disorders. W.B. Saunders, Philadelphia, pp. 3686–3742.
Roberts, C., Cox, M., 2003. Health and Disease in Britain: From Prehistory to the Present Day. Sutton Publishing, Stroud.
Scheuer, L., Black, S., 2004. The Juvenile Skeleton. Elsevier Academic Press, Amsterdam.
Smrcka, V., Marik, I., Svenssonova, M., Likovsky, J., 2009. Legg-Calvé-Perthes disease in Czech archaeological material. Clin. Orthop. Relat. Res. 467, 293–297.
Solomon, L., Ganz, R., Leunig, M., Monsell, F., Learmonth, I., 2010. The hip. In: Solomon, L., Warwick, D., Nayagam, S. (Eds.), Apley's System of Orthopaedics and Fractures. Hodder Arnold, Kent, pp. 493–545.
Waldron, T., 2009. Palaeopathology. Cambridge University Press, Cambridge.