

Cribræ Orbitalia in the Aborigines of Hawaii and Australia

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ABSTRACT Crania of 53 Hawaiian aboriginal infants and children, and 45 from Australian aboriginal children were inspected. Cribræ orbitalia was present in 22.8% of the former and 26.6% of the latter; osteoporotic pitting (symmetrical osteoporosis; porotic hyperostosis) was also present in the latter. The frequency compares favorably with that found in pre-Columbian North American Pueblo Indians, 24.7%. It is associated with a widespread skeletal involvement suggestive of an active bone marrow.

The findings support the concept that cribræ orbitalia is related to symmetrical osteoporosis and that it may be associated with a blood disorder.

Cribræ orbitalia is a sieving of the orbital bone of unknown cause. It is usually bilateral and present mainly in its superior portion. Hrdlička ('14), described it as the earliest manifestation of symmetrical osteoporosis, a condition also known as spongy or porotic hyperostosis and cribræ cranii. Symmetrical osteoporosis is sieving with cancellous bone thickening of the frontal, parietal and occipital bones; its etiology and its relationship to cribræ orbitalia remains uncertain.

MATERIALS AND METHODS

This report deals with the skeletal remains of pre-European aborigines of two areas in the Pacific: Hawaii and Australia.

In Hawaii the collection was from the Sand Dune Burial at Mokapu, Oahu, excavated in 1938 and 1940, and kept at the Bernice P. Bishop Museum in Honolulu. The absence of European artifacts at this site places this in the pre-European or pre-Cook period. Here we examined the crania of 53 infants and children from newborn to about 12 years of age, and also in some instances the ribs, scapulae, vertebrae and pelvis, and the long bones.

The second collection we examined was made up of 544 crania from New South Wales, Australia, of which there were 45 infants and children. These are kept at the University of Sydney and at the Australian Museum in Sydney. The skeletal

material was obtained predominantly from unmarked burials as a result of chance and a few were obtained as a result of deliberate excavations. Most of the crania are from coastal New South Wales, with a few from the inland. Crania from coastal New South Wales are exceptionally rare and very few, if any, are located in museums outside of Australia (Larnach and Freedman, '64).

Assessment of age was done by criteria that are fairly reliable in this young age group (Brothwell, '63). The appearance of the anterior and posterior fontanelles and fusion of the suture lines was used in the perinatal period and, in the older infants and children, the general sequence of eruption of the deciduous and permanent teeth.

FINDINGS

In cribræ orbitalia there is absence of the outer table of the bone revealing widened cancellous spaces. We found that it occurred almost exclusively in the orbital plate of the frontal bone. It was usually bilateral and the extent of involvement was approximately the same in each orbit, although it may have been more prominent in one orbit.

In the 53 crania of infants and children of Hawaii, there was cribræ orbitalia in 13, a frequency of 22.8%. The greatest degree of involvement was in the skull of a 2-2.5 year old and the oldest was in the skull of a 11-12 year old. In one sieving



Fig. 1 Cribra orbitalia in an Australian aborigine, age 11-12.

was also present in the proximal portion of the humerus.

In the Australian aborigines the cribra orbitalia was similar in appearance. Here, we found the greatest degree of involvement in an 11-12 year old (fig. 1). In another skull, a 12-13 year old, there was also sieving and thickening of the occipital bone. In the Australian collections, the remainder of the skeletons were not available for study. In the 544 crania examined, there was an overall frequency of cribra orbitalia of 4.2% ; 2.4% in adults and 26.6% in infants and children.

DISCUSSION

We were unable to find published figures on cribra orbitalia in Hawaiian aborigines to compare with the frequency of 22.8% in infants and children in this area.

In Australian aborigines, the published frequency of cribra orbitalia is 0% (Larnach and MacIntosh, '63), and 5.6% (Brothwell, '63). These two reports were based mainly on adult skulls and therefore can not be compared with the 26.6% that we found in infants and children.

Since we believe cribra orbitalia and symmetrical osteoporosis to be very serious conditions of the young, we feel that reports of their frequency should be specifically categorized according to age group.

Williams ('29) made histological sections of frontal and parietal bones, ribs and vertebrae of young Indian children of Arizona and Utah with symmetrical osteoporosis, describing characteristic sieving in all these bones. He regarded it as evidence of a disorder of the bone marrow with systemic disease. Rickets was ruled out because of the absence of involvement of the margins of the bones, the epiphysis of growing bones; and the absence of widening of chondro-osseous junctions excluded scurvy.

Koganei ('11) concluded that cribra orbitalia and cribra cranii were analogous and that the commonest initial involvement was in the frontal bone with later involvement of the parietal, and occipital bones.

Brothwell ('63) indicated that cribra orbitalia is related to symmetrical osteoporosis.

The frequency of symmetrical osteoporosis is 24.7% in the Indians of the Southwest United States and almost all of these crania had bilateral cribra orbitalia (Zaino, '67).

Spectrophotometric analysis of the bones of Pueblo Indians was normal (Zaino, '68) suggesting that iron deficiency and nutrition by themselves were unlikely causes of cribra orbitalia. These Indians had good nutrition; they were farmers growing maize, squash, and beans, and raising turkeys. They had stone drills, knives, scrapers, darts, rabbit sticks, atlatl, and throwing spears as well as bows and arrows to obtain wild game (Reed, '64).

Skull x-rays of symmetrical osteoporosis show a "hair-on-end" appearance (Zaino, '64). Similar roentgenological findings are present in severe anemic diseases such as thalassemia and sickle cell anemia (Baker, '64; Coffey, '37); in both of these conditions there is an active bone marrow responsible for the bone changes. We have seen x-rays of orbits in thalassemia major that are consistent with cribra orbitalia.

These findings support the concept that cribra orbitalia is related to symmetrical osteoporosis and may be associated with a blood disorder.

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