Cribra Orbitalia in the Aborigines of Hawaii and Australia

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ABSTRACT Cranii of 53 Hawaiian aboriginal infants and children, and
45 from Australian aboriginal children were inspected. Cribra 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 cribra orbitalia is related to sym-
metrical osteoporosis and that it may be associated with a blood disorder.

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

MATERIALS AND METHODS

This report deals with the skeletal rem-
ains of pre-European aborigines of two
areas in the Pacific: Hawaii and Aus-
tralia.

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

The second collection we examined was
made up of 544 cranii from New South
Wales, Australia, of which there were 45
infants and children. These are kept at
the University of Sydney and at the Aus-
tralian 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 cranii
are from coastal New South Wales, with
a few from the inland. Cranii from coastal
New South Wales are exceptionally rare
and very few, if any, are located in mu-
seums 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 perma-
nent teeth.

FINDINGS

In cribra orbitalia there is absence of the
outer table of the bone revealing widened cancellous spaces. We found that
it occurred almost exclusively in the orbi-
tal plate of the frontal bone. It was usu-
ally bilateral and the extent of involve-
ment was approximately the same in each
orbit, although it may have been more
prominent in one orbit.

In the 53 cranii of infants and children
of Hawaii, there was cribra orbitalia in
13, a frequency of 22.8%. The greatest
degree of involvement was in the skull of
a 2–3.5 year old and the oldest was in the
skull of a 11–12 year old. In one sieving

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 cranii 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 ('39) 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 cranii had bilateral cribra orbitalia (Zaino, '68).

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, '68). 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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