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Palaeopathology by proxy: the case of Egil's bones

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Abstract

Egil Skallagrimsson, the ambiguous poet–Viking hero of Egil's Saga, had bone deformities and symptoms that are known only from their descriptions in the Saga. By "excavating words", previous workers have concluded that Egil suffered from Paget's disease. However, the descriptions in the Saga are arguably also consistent with skeletal fluorosis, a condition not previously considered in Egil's differential diagnosis. The literary and historical evidence available about Egil and the environment in which he lived is reconsidered to examine this possible alternative diagnosis.

Endemic fluorosis occurs in places with high fluoride levels in soil, water, and food, with one environmental source being volcanic ash. There are ample records of fluorosis in Icelandic sheep and other stock (including *gaddur*), and a possible historical reference to human fluorosis following the Laki Fissure eruption in 1783. A travel history removing Egil from fluoride exposure does not support the diagnosis, but the reliability of the various pieces of evidence presented in the Saga must be weighed against their presumed significance in the historical and sociocultural context in which the Saga was written.

The location and analysis of Egil's actual bones, which were re-interred "on the edge of the graveyard at Mosfell", would put the question of Egil's diagnosis to rest. The case illustrates the potential value of interpreting historical narrative as a supplement to archaeological and palaeopathological investigation.

Keywords: Palaeopathology; Fluorosis; Iceland; Saga; Egil

1. Aim

Egil Skallagrimsson, the ambiguous poet–Viking hero of Egil's Saga, had bone abnormalities that are known only from their description in the Saga, where they are reported as being thick and hard (osteosclerosis) and carrying outgrowths (exostosis). In a paper based on an earlier work in Icelandic, Hardarson and Snorradottir [12] interpret these historical descriptions as indicative of Paget's disease. A similar conclusion was reached by Byock [4] in a landmark study that bridged the fields of medical science, history, archaeology and literary analysis. The reported features of Egil's bones and symptoms are consistent with Paget's disease, but also with skeletal fluorosis, a condition not discussed by these authors. To determine if skeletal fluorosis is a possible alternative diagnosis to Paget's disease, this paper re-examines the literary and historical evidence available about Egil and the environment in which he lived.

2. Background

Egil had bones that were "much bigger than ordinary human bones" ([7] Ch 86), and a skull that was "an exceptionally large one and its weight was even more remarkable. It was ridged all over like a scallop shell…" ([7] Ch 86). The skull was also hard enough to withstand a blow from the reverse side of an axe. Although Egil

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was "far above normal height" and heavily built with broad shoulders ([7] Ch 55), the description above suggests that his bones were more than just large. A detailed examination of the possible causes for Egil's bones to appear as they did falls in the field of human palaeopathology – "the study of disease in ancient populations by the examination of human remains" [1, p. xv]. Unusually though, study of this case is made difficult by its dependence on a millennium-old description of human remains, rather than on the remains themselves. Conversely, we have in Egil's Saga a rich source of descriptions of symptoms that might be associated with the bone pathology, a luxury that is rarely available to palaeopathologists. By "excavating words" [27], many scientific conclusions have been drawn in the absence of physical evidence, and the approach has been used extensively in the study of the environmental impact of volcanism in Iceland [9,11,23,25]. Words written about a folk-hero are, however, likely to be subject to bias, and the reliability of the various pieces of evidence about Egil presented in the Saga must be weighed against their presumed significance in the historical and sociocultural context in which the Saga was written.

3. Re-examining the evidence

3.1. Egil's signs and symptoms

Paget's disease, the diagnosis previously proposed for Egil, is a metabolic bone disorder characterized by abnormal bone resorbtion and regrowth. The regrown bone is often larger, softer, and deformed compared to normal bone, generally affecting the skull, pelvis, leg and back bones. The disease is common in Scandinavia, and details of the features that link it to Egil's signs and symptoms are discussed in detail by Hardarson and Snorradottir [12] and Byock [4]. Some of these details are reconsidered below, but the major focus is on fluorosis, a disease which has not before been considered in relation to Egil Skallagrimsson.

Fluorosis is a disease caused by an excessive intake fluoride (the ionic form of the element fluorine). Fluoride has a protective effect against dental caries and has been added to most public drinking water supplies since the 1950s, at concentrations of about one part per million (ppm). At higher concentrations it can, unfortunately, also act as a poison, and chronic intoxication can have a range of outcomes, from fluoride stained teeth to full-blown skeletal fluorosis. In the Third World, skeletal fluorosis is endemic in some specific geographic areas, and sufferers may exhibit crippling through overgrowth and distortion of bone. It is because of these bone manifestations that the disease is of possible relevance to the differential diagnosis of Egil's condition.

In endemic fluorosis, the bones are described as "heavy and irregular [with] a dull colour due to the irregular deposition of fluoride, [...] muscular and tendinous insertions rendered abnormally prominent by excessive periosteal reaction with development of multiple exostoses [outgrowths]" [20, p. 231]. This description is compatible with that of Egil's large and heavy bones, including ridging. Egil's skull turns white on impact ([7] Ch 86), as would the porous, brittle layer of new growth covering fluorotic bone. Singh et al. [20] also report that skull involvement is not conspicuous, but Aufderheide and Rodrígues-Martín [1] state that "the thick skull vault bones" are characteristic (p. 317). In Egil, the skull is "an exceptionally large one [...] ridged all over like a scallop shell" ([7] Ch 86), a description which is arguably also consistent with skeletal fluorosis. In the literature, there are reports of skeletal fluorosis in ancient human remains. For example, Lukacs et al. [14] describe dental fluorosis in teeth from a prehistoric population in Pakistan, an area in which the disease still occurs today. Although there is no physical evidence to match this from Iceland, aspects of the Rev Jón Steingrímsson's accurate and detailed contemporaneous report of disease following the Laki eruption in 1783 could be considered as evidence for human fluorosis (see Section 3.2).

Egil's deafness is consistent with new bone growth compressing the auditory nerve as it runs through a channel in the skull, from the brain to the ear. This symptom has been reported in endemic fluorosis [19], but it is certainly not a constant feature [20]. A similar pathology is the compression of the spinal cord and its nerve roots by constriction of the bony canals in which they run. Headaches could result (from which Egil suffered), but so would muscular wasting, paralysis, and pains in the back and extremities (from which he did not suffer). There is often "limitation of movement, particularly of the cervical spine" [20, p. 232], and a hunchbacked appearance that could result in a "rock-helm of a head" ([7] Ch 61). It is said of Egil that "In old age his movements became heavy" ([7] Ch 85), again consistent with fluorosis. However, in order to account for the disfigurement of Egil's facial features, the onset of fluorosis would have had to occur early in his life, almost certainly crippling him rather than just slowing him down by the age of 80. Egil's facial features are described at age 27, seated at King Athelstan's table in 937 AD: "Egil was a man who caught the eye. He had a wide forehead, bushy eyebrows and a nose, not long, but impressively large. A great broad beard grew on a chin as massive as his jaws" ([7] Ch 55). If these features were attributable to fluorosis, he would not have been still able to ride, carrying two chests of silver, at age 80 ([7] Ch 85). Egil's symptoms of blindness and cold feet are also not consistent with fluorosis, but could obviously be accounted for if concurrent pathology were