



## Research article

## Possible scurvy in the prisoners of Old Quebec: A re-evaluation of evidence in adult skeletal remains



Megan B. Brickley\*, Annabelle Schattmann, Joelle Ingram

Department of Anthropology, McMaster University, Chester New Hall 518, 1280 Main Street West, Hamilton, Ontario L8S 4L9, Canada

## ARTICLE INFO

## Article history:

Received 25 February 2016

Received in revised form 17 October 2016

Accepted 25 October 2016

Available online 14 November 2016

## Keywords:

Paleopathology

Scurvy

Vitamin C

Skeletal remains

Prisoners

Quebec City

## ABSTRACT

Scurvy is known to have been present in many past communities but recognising the condition in adult skeletal remains poses significant challenges. Fifty skeletons of Protestant prisoners who died between 1746 and 1747 were excavated in 1986–1987 from the walls of Old Quebec, Canada. Documentary sources indicate scurvy was present, and those considered the most likely candidates ( $n=9$ ) were selected for re-evaluation using recently published macroscopic diagnostic criteria. Cranial porosity, hypertrophy and periosteal new bone formation (PNBF) were compared. The non-specific nature of skeletal changes in adult scurvy has a considerable effect on the potential to suggest a diagnosis. It is conceivable that all individuals had scurvy close to the time of death, but just two displayed probable evidence of scurvy and a further two had possible evidence of scurvy. Remaining cases had insufficient evidence for diagnosis. Although not straightforward, significantly more information was obtained by combining the results of the three types of pathological changes considered. Recent work has highlighted the difficulties of using PNBF in paleopathology, but careful evaluation of location and approximate stage of healing at the time of death contributes useful information that can be used to indicate level of disease burden and possible co-occurrence of conditions.

© 2016 Elsevier Inc. All rights reserved.

## 1. Introduction

The examination of scurvy, a disease caused by vitamin C (ascorbic acid) deficiency, has the potential to provide important information on social and cultural changes that have taken place since the appearance of anatomically modern humans. Vitamin C can only be obtained from ingested sources: fresh fruits and vegetables, and some preserved foods and animal products (Brickley and Ives, 2008:Table 4.1). Research is still being undertaken on all the roles of vitamin C, but the importance of this nutrient in collagen formation is clearly established (Magiorkinis et al., 2011).

In contemporary developed societies cases of scurvy in adults are reported in alcoholics, elderly individuals, the homeless, and people with extreme food preferences (see review in Brickley and Ives, 2008). In all groups self-neglect and poverty are important factors. Chronic diarrhea, which can be caused by alcohol abuse, can result in malabsorption, and alcohol is also suggested to cause increased urinary excretion of vitamin C (Ong and Randhawa, 2014). Historical sources have described the condition in soldiers, sailors and individuals who emigrated to regions with different

environmental conditions. For example, colonists in northern areas of the American continent were badly affected by scurvy. Hess (1920:3) comments that the French met with such high mortality during the severe winters in what is now Canada that they frequently debated the wisdom of abandoning their settlement. A review of the likely occurrence of scurvy in North American communities during European colonisation is provided by Pendery and Koon (2013). Another group in which scurvy is noted to have frequently occurred is prisoners. In a review on reports of scurvy cases, Hess (1920:2) found that the propensity for the condition to flourish amongst prisoners was noted as early as 1555 by Magnus in his “History of the Northern Nations” and has been reported from various locations and time periods (Hess, 1920:4–56). Prisoners held in North American colonial settlements would have been at increased risk of developing scurvy due to high levels of the condition amongst European settlers, coupled with the restricted diets of inmates.

As pointed out by Mays (2014), most historical texts that refer to scurvy discuss the condition in adults, and it was only in the 19th century that attention began to be paid to infantile scurvy. The earliest studies in paleopathology focussed on adults (e.g., Wells, 1964), but as the limitations of skeletal paleopathology were realised, the focus shifted to juvenile scurvy, where rapid growth means that changes in bones develop quickly and are more clearly visible macroscopically (Brickley and Ives, 2008:55, 72–74). Ortner

\* Corresponding Author.

E-mail addresses: [brickley@mcmaster.ca](mailto:brickley@mcmaster.ca) (M.B. Brickley), [schattaf@mcmaster.ca](mailto:schattaf@mcmaster.ca) (A. Schattmann), [jxaingram@gmail.com](mailto:jxaingram@gmail.com) (J. Ingram).

(2003:384) summed this up by stating, “the skeletal manifestations of scurvy are most marked in infants and rather minor in adults.” Many of the pathological changes that develop in scurvy will not leave skeletal lesions, but defective collagen and impaired osteoid formation can produce reactions that could be observed in skeletal material. Skeletal changes that occur in scurvy are limited, comprising development of osteopenia (Fain, 2005) and features that develop secondary to hemorrhage (Jaffe, 1972). Osteopenia poses significant diagnostic and interpretive challenges for those working in paleopathology (Ortner, 2012:263–4), and as discussed in this paper, hemorrhagic changes are also challenging (Section 4). As a result, relatively little work has been undertaken on adult scurvy in paleopathology. Determining which members of past communities were most at risk of nutritional deficiencies such as scurvy and making comparisons between adults and juveniles would provide a unique perspective on aspects of social organisation.

Using prisoners of the French-English war in 18th-century Old Quebec, Canada (Fig. 1), for which there was strong documentary evidence that scurvy was present (Cybulski, 1988), this investigation aimed to evaluate the likelihood of identification of cases of adult scurvy from attritional cemeteries. The potential to suggest a diagnosis of scurvy was assessed using recently published diagnostic criteria for scurvy in adult skeletal remains: sub-periosteal new bone formation (PNBF) and porotic hyperostosis in the skull, and PNBF in the post-cranial skeleton. The possibility that future studies of scurvy might include individuals of all ages, enabling more to be said about past communities, is considered.

## 2. Materials and methods

Fifty skeletal individuals were discovered and excavated from the base of the historic fortification walls in Quebec City in 1986 and 1987, during a Parks Canada restoration project. Quebec historians provided evidence that these individuals were prisoners who died in captivity (Cybulski, 1988). They were held by the French colonists in 1746–1747 during the war of the Austrian succession between France and England (1744–1748). Documentary evidence indicates that as many as 67 of the prisoners died and were buried in this area (Cybulski, 1988:64). Limited information on diagnostic criteria for scurvy was available at the time of the original analysis, but using information set out by Saul (1972:56–66) it was determined that some of these individuals may have had scurvy (Cybulski, 1988; Piedalue and Cybulski, 1997). The skeletons are in the collections of the Canadian Museum of History, Gatineau, Quebec, and nine individuals considered the most likely candidates for having scurvy were selected by Dr. Jerome Cybulski for re-evaluation in this study.

An assessment of the bones present was undertaken, as skeletal completeness is an important consideration in paleopathological evaluations of scurvy (see Table 1). The criteria set out in Table 1 for determining presence of an element is a minimum; many elements were much more complete. Sex was assessed using techniques set out in Buikstra and Ubelaker (1994) for the os coxae and cranial morphology. Age-at-death was estimated using the Suchey-Brooks pubic symphysis scoring system (Suchey and Katz, 1986; Brooks and Suchey, 1990) and auricular surface scores based on Lovejoy et al. (1985) and Meindl and Lovejoy (1989). Epiphyseal formation and fusion, as set out by Schaefer et al. (2009), were used to identify individuals who might be placed in the adolescent and young adult age categories as defined by Buikstra and Ubelaker (1994).

Previous paleopathological investigations have identified a series of lesions that can be linked to clinical findings in cases of scurvy and are observable in dry bone (reviewed in Brickley and Ives, 2008; Brown and Ortner, 2011; Geber and Murphy, 2012). Three different types of pathological changes have been considered, as there is no single lesion in adults that provides a definitive

diagnosis. Porosity at sites of blood vessels in the cranial bones, PNBF and/or hyperostosis on the cranial bones, and PNBF on the long bones have been independently evaluated and the results were compared. The terms hyperostosis, which refers to an excessive enlargement of the outer layer of bone and clinically is generally considered harmless, and hypertrophy, an increase in size of a tissue or organ due to enlargement of cells (definitions from Martin, 1996), have both been used in the paleopathological literature in relation to scurvy. Ortner mainly used the term hyperostosis, but also used the term hypertrophy in 2011 (Brown and Ortner, 2011), apparently in relation to similar bone changes. Neither of these terms are entirely appropriate for describing the changes seen in dry bone, and this is likely why Ortner occasionally inserted the phrase ‘porous’ prior to the term hyperostosis.

Brown and Ortner (2011) state that assessing a combination of lesion types at different skeletal locations will give a more reliable diagnosis for cases of scurvy. This type of approach is particularly important in adults where skeletal changes are slight. Mays (2014) notes that although some of the possible features of scurvy identified by Ortner et al. (1999) (Ortner and Ericksen, 1997; Brown and Ortner, 2011) can be found in adults, they appear less often than in juveniles and are not as well developed. Pathological changes have been exclusively evaluated through macroscopic examination under a strong light. Hence although the terms ‘probable’, ‘possible’ and ‘insufficient evidence’ are used throughout the following sections, in the final diagnosis less weight is afforded to the findings for cranial PNBF and/or hyperostosis than findings for porosity, as a wider range of conditions can produce these changes. The least weight was given to post-cranial PNBF, as these pathological changes have a number of possible causes. In the case of PNBF, Weston (2008, 2009), Jaffe (1972), Ortner (2003), Aufderheide and Rodríguez-Martín (1998), and Khalil et al. (1999) were consulted, along with more recent clinical work in making differential diagnoses (see references and discussion in Section 4.2). Analysis was undertaken without reference to the original report (Cybulski, 1988). Ingram undertook evaluation of cranial porosity, while the cranial and long bone PNBF and hyperostosis analysis was completed by Schattmann.

### 2.1. Cranial porosity methodology and diagnosis

For paleopathologists, hemorrhage is the most important pathological change produced by scurvy as there is a complex feedback mechanism between hemorrhage and inflammatory responses that result in the development of porosity in cortical bone (Brown and Ortner, 2011:198). Cortical bone of the cranium and mandible was evaluated for pores measuring 1 mm or less in diameter and penetrating the cortex, as described by Ortner and Ericksen (1997). Eleven regions were selected (Table 2) based on previous paleopathological work (Ortner and Ericksen, 1997; Ortner et al., 2001; Geber and Murphy, 2012).

All “definite” indicators of scurvy found in individuals examined by Geber and Murphy (2012:4) involved areas of porous bone. In particular, bilateral lesions on the greater wing of the sphenoid are widely agreed to be strongly diagnostic or ‘virtually’ pathognomonic of the presence of scurvy (Ortner and Ericksen, 1997:214; Ortner et al., 2001; Geber and Murphy, 2012). The presence of bilateral lesions would ideally be used in all cases, but poor preservation of archaeological bone frequently hinders this observation. To accommodate this problem, slightly greater weight was given to unilateral lesions where post-mortem damage precluded observation of bilateral lesions. In order to suggest the presence of scurvy, porosity had to be present at the greater wing of the sphenoid and in at least one other site not compromised by dental pathology. Brown and Ortner (2011:348) noted that scurvy could affect the skeleton without involving the greater wing of the sphenoid. Thus,

Download English Version:

<https://daneshyari.com/en/article/4760576>

Download Persian Version:

<https://daneshyari.com/article/4760576>

[Daneshyari.com](https://daneshyari.com)