The Impact of Industrialisation on Female Health: Understanding the Aetiology of Hyperostosis Frontalis Interna

Modern society is rapidly changing into an aging population. Improved sanitation, medical care, nutrition and declining birth rates have all contributed to much greater life expectancies, particularly in females. The Economic Policy Committee of the European Union predicts an increase in its old age population to 52% by 2030.

Key to this demographic shift is the process of industrialisation. The Industrial period in Britain marks the shift from the pre-1750 pathogenesis dominated by acute infectious diseases to one that is burgeoning with the degenerative and age related chronic conditions that we see amongst the elderly population in society today.

A skeletal condition now occurring in record numbers of old age females is Hyperostosis Frontalis Interna (HFI). Its precise aetiology is poorly understood but recent clinical research suggests that reduced parity and breast feeding as well as increased longevity may all play a role in leading to a lifetime’s over-exposure to oestrogens in women, triggering the condition.

So what is HFI and how is its recent dramatic rise related to the impact of industrialisation on female health? Only by looking at the female population of London indicates that the female body is physically adapting to social changes in modernisation of lifestyles. Industrialisation brings with it a change in social conditions leading to reduced family sizes, altered breast feeding regimes and the uptake of medical hormone treatments.

HFI Definition
HFI typically manifests skeletally by forming lobulated, smooth bone growth located on the endocranial surface of the frontal bone (a). The distribution of the lesions is bilateral and there is an absence of involvement in the sagittal sinus area, meningeal arteries and suture lines. The frontal bone is thickened.

Anatomy
HFI rarely involves the parietal bones. The anatomy of the frontal bone is unique and comprises a special vascularisation forming a separate angiosome. In addition, there is close adherence of the dura mater. These anatomical features are considered to be pivotal in its almost singular involvement in the expression of this condition. Oestrogen in may re-activate the bilateral primary ossification centres of the bone.

Clinical Observations
HFI is most often observed in older adult females over the age of 60 years old and is progressive, with more severe cases occurring in older age groups. HFI is also observed in males but is not age-related; it is most frequently observed in those males with hypogonadism or in those undergoing androgen-block therapy for prostate cancer. HFI is also frequently associated with Morgagni-Stewart-Morel syndrome featuring obesity, sex gland disturbances, excessive hair growth, headaches and diabetes mellitus.

Skeletal and Documentary Analysis
Data from historical and skeletal sources based on the female population of London indicates that the industrial period was a critical era for the health of women. For the first time, we see an increase in the percentage of females living into old age (50+ years), representing the start of a trend that is continuing today.

Digital Direct Radiography (DDR) was carried out to help provide accurate prevalence rates of HFI. Past studies of the condition have been restricted due to its location on the endocranial surface of the cranium.

A sample of 74 biographically documented females from St Bride’s Crypt, London (1676 to 1853) were examined to determine the presence of HFI and its correlation to age and parturition.

Results
HFI was present in 21.6% of females (N=74), with 75% of identified HFI cases occurring in the over 60’s, mirroring the trend recorded in clinical observations. There was no relationship between parity and HFI occurrence in the sample of females with known obstetric history (N=27). Overall, individual age was a significant predictor of HFI.

In modern populations, HFI can be found macroscopically in up to 56.7% of females; however, between 61% and 91% of females live into old age. Only 51.6% of females from the industrial period survived to be old adults; thus, the lower rate of HFI corresponds well with expected longevity.

Conclusion
The female body is physically adapting to social agencies emerging through time as a result of the modernisation of lifestyles. Industrialisation brings about changes not only in health care and disease prevalence that result in increased female longevity but also changes in social conditions leading to reduced family sizes, altered breast feeding regimes and the uptake of medical hormone treatments.

The palaeopathological evidence suggests that this societal process is linked to the manifestation of HFI, primarily through the increased longevity of women. No relationship between HFI and parity was identified in this small sample. However, we hope to expand to our work on the relationship between parity, social status and the presence of HFI in this critical period of development for female health in the near future.

Jelena Bekvalac, Museum of London, jbekvalac@museumoflondon.org.uk
Gaynor Western, Ossafreelance, info@ossafreelance.co.uk
Mark Farmer, Hampshire Hospitals Foundation Trust, mfarmer@gmail.com

Access to the crypt individuals kindly enabled by the Venerable David Meara, Rector of St Bride’s and the St Bride’s team. Digital x-ray in the crypt of St Bride’s carried out by Professor Jerry Conlogue, Quinnipiac University, USA and the portable digital x-ray equipment provided through REVEAL Imaging Ltd.