

## Rickets and the crippled child: an historical perspective

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Nicholas Andry (1658-1742), who gave orthopaedics both its name and the symbol of the crooked tree, was a physician. In his 40s he wrote a physicianly treatise, *An Account Of the Breeding of Worms in Human Bodies*<sup>1</sup>: *L'Orthopédie*<sup>2</sup> (*Orthopaedia*<sup>3</sup> in the English edition), his most influential work, was published when he had reached the mature age of 83. The art of correcting and preventing deformities forms the subtitle, more appropriately given in the reverse order in the original French edition. In many northern countries of Europe, notably in England, childhood rickets was the most common of all causes of deformities. Doubtless Andry would have been impressed by present day prevention of this disease, but he would have had to live another two centuries to witness the elucidation of the intricate aetiology of rickets.

### The English disease

It was the prerogative of English physicians to publish the first descriptions of rickets, about a century before Andry's *Orthopaedia* appeared. On the Continent the condition soon became known as the English disease.

There is a disease of infants . . . having scarcely as yet gotten a proper name in Latin, called the rickets; wherein the head waxeth too great, whilst the legs and lower parts wane too little.<sup>4</sup>

This was a comment by Thomas Fuller (1608-1661), a divine living in Exeter, which he made in a pious work *Good Thoughts in Worse Times*. The author went on to invite his readers to ponder a spiritual analogy of rickets.

Have not many nowadays the same sickness of their souls, their heads swelling to a vast proportion and they wonderfully enabled with knowledge to discourse? But, alas, how little their legs, poor their practice, and lazy their walking in a godly conversation<sup>4</sup>.

His readers would have been sufficiently familiar with rickets to appreciate the analogy.

In the mid seventeenth century rickets was rife, most notably in the West Country, where it occurred in epidemic and florid form, making such an impact that both Whistler and Glisson, each of whom later became President of the College of Physicians, thought it was a completely new disease. Glisson wrote in 1650:

This disease became first known as near as we could gather from the relation of others, after sedulous inquiry, about thirty years since, in the counties of Dorset and Somerset . . . since which time the observation of it hath been derived unto all the southern and western parts of the Kingdom<sup>5</sup>.

Francis Glisson (1597-1677) was born in the village of Rampisham in Dorset and brought up in that county. Daniel Whistler (1619-1684), who wrote the first detailed description of the disease 5 years before Glisson, was schooled in Thame, educated at Oxford and Leiden, and practised successfully as a physician in London. When he was a student of 25 he defended his disputation for the Leiden MD on the subject *De morbo puerili anglorum, quem patrio idiomate indigenae vocant the Rickets. (Concerning the disease of English children, which in native speech they call the rickets)*. His thesis was published in 1645 in Leiden, but was probably not much read in his lifetime. It was re-published in 1684, the year of his death, when he had become President of the College of Physicians.

In addition to his excellent clinical description, he proposed an alternative name for the disease, 'Paedoplanchnosteocaces'<sup>6</sup>. No doubt he thought this name would convey the gravity of the disease and also the gravitas of the doctors. It is no surprise that the polysyllabic name did not catch on. If it had survived it would have emphasized that severe rickets is more than a disease of bones, and may include serious systemic manifestations contributing to mortality in childhood. Both Whistler and Glisson fully recognized these non-skeletal and life-threatening aspects.

Daniel Whistler's account of rickets was overshadowed by that of Francis Glisson, published in 1650 in a book which immediately became popular and widely read<sup>7</sup>. An English translation of the Latin appeared after only a year. Attention was given to the anatomical and clinical features of the disease, as well as some consideration to the morbid anatomy. Though Glisson got the credit, he was in fact a co-author, together with George Bate, a 'vicar of Bray' among physicians in his affiliations, and with Dr Assuerus Regimorter, who was born in London of Dutch parentage. The work can be regarded as the first report on a disease by a working party from the College of Physicians. It also reflected something of a new approach to clinical medicine, trusting more on physical evidence and enquiry than on theoretical speculation.

Why did rickets quite suddenly become the English disease of pre-Industrial Revolution England, with a special prevalence and severity in the counties in the south-west? Social and economic historians have been mainly silent on the subject, and medical historians have placed too much emphasis on possible dietary deficiencies to provide acceptable explanations. Environmental factors were almost certainly contributory. As in the smog-enveloped cities of Victorian England, so too in seventeenth century Wessex, rickets was almost certainly more a

consequence of lack of exposure of the skin to ultraviolet light than due to deficiency of vitamin D in food. If so, why were there so many children living in the shadows rather than the sunlight?

The stage may have been set by adverse weather conditions in the first half of the seventeenth century; winters tended to be exceptionally cold and summers unduly wet. The Thames froze in London in five of 50 successive winters. Such conditions may have contributed, but the true answers are likely to lie in the special economic circumstances that prevailed in some regions more than others, and in the social practices of the time.

There is little doubt that it was the children in the high and middle ranks of society who were being affected or, as a writer of the time put it, 'especially those that were rich and opulent, and put their children out to nurse'<sup>8</sup>. The children of the poorest families, mainly those still attached to the land, were almost certainly protected by getting out of doors rather than by differences in diet. A particularly susceptible part of the population would have been that part involved in the home-based textile industry which had developed following England's monopoly of the wool trade, and which, by 1600, provided the dominant export commodity. Whole families worked from before dawn until after dusk in their homes and, whether the children were too young to work or old enough to assist in home production, they would have lived their lives predominantly indoors<sup>9</sup>.

Such socio-economic considerations in relation to access of children to sunlight, rather than precise analyses of what they were fed on and when they were weaned, are likely to explain why 'in the time of King Charles I it (rickets) was almost epidemical, few families escaping it'<sup>8</sup>.

Rickets was, of course, not confined to the West Country and it remained widespread in the pre-Industrial England of the early 18th century. From his experience in the Midlands, Sir John Floyer wrote in 1706 that 'no distemper is more frequent in infants than the rickets'<sup>10</sup>. As for many other disorders, cold bathing was his therapeutic recommendation and he even thought that immersion of infants in baptism would prevent the disorder.

### Rickets in Victorian Britain

Elizabeth Gaskell in the mid-19th century referred to a 'ritling', meaning a weakling or a child affected by rickets<sup>11</sup>. From about this time we can make some visual judgements ourselves about Victorian rickets from surviving photographs. It is evident that, although many children did have very severe rickets, there were some city communities in which milder manifestations were almost universal<sup>12</sup>. In a survey he carried out of children under the age of 2 years in Great Ormond Street Hospital, Samuel Gee found that one in three showed some features of rickets. In another survey in Clydeside, in 1884, every child examined apparently had some signs of the condition<sup>13</sup>.

Photographs of groups of city children taken at about this time give further credence to the remarkable prevalence of the condition. What were contemporary views on causation and treatment for a disease which was so widespread? A few sentences taken from the entry on rickets in Quain's *Dictionary of Medicine* (1882) reflect some concepts of the period.

As rickets is the direct result of malnutrition produced by the anti-hygienic conditions in which the child has been living, our first care must be to alter these conditions. We must see that the living rooms are thoroughly ventilated; that the child is taken out regularly into the open air; . . . and that his skin is kept perfectly clean by the abundant use of soap and water. We must next select a diet for the patient which is at once sufficiently digestible and nutritious<sup>14</sup>.

William Macewan working in Glasgow had unrivalled experience of rickets, which he had gained from his treatment of leg deformities by osteotomy. Based on observations made on hundreds of children with ricketty deformities he concluded that environmental factors, including deprivation of sunlight, outweighed faulty nutrition as the cause of the condition. He referred to children reared in some parts of a city like Glasgow being

shut out from the light partly by the height of the houses (and) partly from the fact that even the sun's rays which do manage to struggle through the canopy of smoke which envelops them, are so diluted that they are of comparatively little value.

Even so, while clearly recognizing the importance of sunshine, his focus of attention was more on 'bad air'.

That bad air is even more potent than scant food, may be adduced from the fact that there are many people living in the West Highlands of Scotland on very poor diet, poorer than what most of the poor classes in our towns have, and yet there seems to be little rickets among them. Although from most quarters in Scotland cases of distorted limbs have presented themselves for treatment, there has not been one from the West Highlands. The fresh air and the sea breezes appear to compensate for the lack of sufficient food<sup>15</sup>.

At this time, as one of a variety of therapies, the administration of cod liver oil was often advocated. Cod liver oil, traditionally used as a folk remedy in some northern communities, and first recommended medically by Thomas Percival in Manchester in the eighteenth century, underwent many vicissitudes. Even towards the end of the nineteenth century there were contrasting views. Samuel Fenwick, a physician at The London Hospital, wrote in the third edition of his book, *Outlines of Medical Treatment*, 'Many look upon cod liver oil as a specific and it is certainly valuable in most cases'<sup>16</sup>. This enlightened view contrasted with that of Frederick Treves, a contemporary of Fenwick on the staff, who referred to the preparation as a 'peculiarly rank and loathsome oil', which should not be inflicted on children 'who have not reached an age to appreciate the beauty of nastiness'<sup>17</sup>.

### The sunshine movement

It was only in the present century, just after the First World War, that it was conclusively shown in different studies that rickets resulted from specific dietary or environmental deprivations, or a combination of the two. Contrary to popular or, for that matter, much conventional medical understanding, it is the second of these, namely shielding of the skin from the sun's invisible ultraviolet rays, that has usually been implicated in rickets-prone communities.

By the action of ultraviolet light, the prohormone 7-dehydrocholesterol, present in the epidermis, is

converted to vitamin D<sub>3</sub> which, in turn, after two further stages of hydroxylation, becomes the active hormonal form of vitamin D. But, for at least a century before this phenomenon was demonstrated, the significance of sunlight in the treatment of certain children was sufficiently appreciated to have important influences on hospital developments and practice, and particularly in what was to become known as the speciality of orthopaedics.

Florence Nightingale and Hugh Owen Thomas were the key figures. Florence Nightingale was much concerned with the concept of miasma, a postulated malign influence in the atmosphere, thought to cause and to promote many diseases. Her very influential recommendations for the building, ventilation and siting of hospitals were based on what were perceived to be the best ways of avoiding or reducing miasmatic effects. Her views on the health-giving properties of light are less well known, but were also characteristically emphatic. She advocated 'not only daylight but sunlight' and wrote that 'fresh air must be sun-warmed and sun-penetrated air'. She went on: 'people say the effect is on the mind. So it is, but the enlightened physician tells us it is on the body too'. She was prescient when she stated that 'the sun is a sculptor as well as a painter'<sup>18</sup>.

At the same time that Florence Nightingale was advocating cleanliness, fresh air and sunlight to counter miasma, Hugh Owen Thomas was applying similar notions to his practice among crippled children in Liverpool. In 1855 he had gone as a medical student to Edinburgh, at the bequest of his father, Evan Thomas, a bonesetter. Among the many distinguished teachers in Edinburgh at that time only one man seems to have impressed Hugh Owen Thomas, namely John Hughes Bennett, the Professor of Medicine. He was a firm believer in the benefits of fresh air and 'the remarkable stimulating effects of solar light (which) must under certain circumstances be therapeutical'<sup>19</sup>.

Hugh Owen Thomas became a keen disciple of Bennett. When he returned to Liverpool he supervised the treatment of children on beds improvised from soap boxes placed outside their homes, and later, on the sun-exposed balconies at the Sea Side Hospital at Rhy<sup>20</sup>. It was at this hospital that Agnes Hunt began training as a nurse and became inspired to find a home for cripples using a house and farmsheds in the village of Baschurch in Shropshire<sup>21</sup>. With the help and powerful influence of Robert Jones a hospital model developed which involved location in the country, open air and sunshine. Though rickets was not usually the primary diagnosis of children admitted to these hospitals it is likely that sunshine promoted progress in many patients.

#### Ultraviolet irradiation: physiology and therapy

The sunshine movement was well under way many years before scientific evidence became available in its support. In 1889 a British Medical Association working party reported on the geographical distribution of various diseases, including rickets, and confirmed that it was a disease of large industrial towns and their environs at that time<sup>22</sup>. However, the association between rickets and air pollution functioning as a barrier to sunlight in industrial and high density domestic coal burning areas of Britain was not appreciated<sup>23</sup>. A year after this report Dr Theobald Adrian Palm, a general practitioner in

Cumbria, who had previously been a medical missionary in Japan published his conclusion that rickets occurred as a result of deprivation of sunlight<sup>24</sup>. When he was in Japan, he had been struck by the absence of rickets, which prompted him to enquire from his missionary colleagues as to their experiences of the disease in other countries in the world. Their answers left him in no doubt that there was an inverse relationship between exposure to the sun and prevalence of rickets. His work attracted little attention at the time, but he was accorded recognition 34 years later when he was invited to be the first president of the newly formed Sunlight League. The importance of social and religious practices within particular populations in reducing exposure to sunshine was later shown to apply in India<sup>25</sup>.

The proof of the efficacy of ultraviolet light on the skin was provided in 1919 by Kurt Huldshinsky<sup>26</sup>, a paediatrician in Berlin. He demonstrated the curative effects of light from a mercury-vapour quartz lamp on four children with advanced rickets. He then went a stage further by irradiating only one arm of a rachitic child with ultraviolet light, and showed that this was followed by radiological improvement in the bones of both arms. He deduced that irradiation of the skin had released a chemical into the bloodstream which had the power to heal rickets at a distance. This work was carried out at a period when there was excitement about vital amines or vitamins, the name proposed in 1912 by Casimir Funk, to describe organic compounds present in trace amounts which prevented or cured certain diseases. Edward Mellanby produced rickets in rats by dietary manipulation and found that it responded to a trace substance in certain fats. In painstaking studies on children in Vienna over a period of 3 years a team from the Medical Research Council showed that both cod liver oil and exposure to sunlight healed rickets independently of each other<sup>27</sup>.

The scientific endorsement of the healing and health-giving properties of both one of the vitamins and of sunlight stimulated the imagination of the public in the 1920s, to an extent that the therapeutic potential of the sun's rays assumed almost mystical significance. Such perceptions provided a stimulus for the further provision of hospitals for children in the country for open air treatment. In addition, there was a demand for facilities such as light departments and solaria. A medical subspecialty developed in some areas of the country. Listed in the appointments of one author was that of Honorary Consulting Phytotherapist to the Sun Babies Home in Hoxton<sup>28</sup>. An illustration in a textbook showing a happy seaside scene at Hayling Island, where Sir Henry Gauvain had established a cure resort for crippled children, carried the legend 'natural heliotherapy with hydrotherapy'<sup>29</sup>. The heyday for such treatments was in the two decades before the Second World War. Since then vitamins have multiplied and prospered, whereas warnings are now issued to the fair-skinned to avoid excessive exposure to sunlight.

The successful prevention of rickets in this country has tended to divert attention from the historical importance of deficiency of ultraviolet light as the cause *par excellence* of the condition in times past. In the last century and early part of this century sun seekers and promoters within the medical and nursing professions exerted a profound influence on hospital practice, particularly in the emerging

specialty of orthopaedics. Their ideas and recommendations anticipated the scientific demonstration of the phytochemical effects of ultraviolet light on human skin by many decades. These enthusiasts relied on ancient wisdom, epitomized in an old Persian aphorism: where the sun and air do not enter, the physician enters often.

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