PUGH AND HIS TRACTION

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This article records the contribution made to the care of crippled children by Pugh of Carshalton, the centenary of whose birth fell last year.

William Thomas Gordon Pugh was the Medical Superintendent of Queen Mary's Hospital for Children, Carshalton, from 1909 until his retirement in 1937. Originally a physician, he became interested, of necessity, in children's orthopaedics, and during those twenty-eight years established and directed one of the first two long-stay children's country hospitals in the South of England. Both Pugh and his hospital became well known for the management of skeletal tuberculosis and poliomyelitis.

Pugh is best remembered for his "traction by suspension" and for his "Carshalton carriages" which were the tools he used to diminish the destructive changes so manifest in tuberculous joints treated without traction.

William Thomas Pugh was born in 1872 at Hodley, a village in Montgomeryshire. In 1899 he adopted by deed poll the additional Christian name of Gordon. He was educated at Ardwyn School, Aberystwyth, University College, Aberystwyth, and the Middlesex Hospital Medical School, where he was entrance scholar and subsequently Lyell Gold Medallist in practical surgery, Senior Broderip Scholar and Governors' Prizeman. He qualified in 1894 and graduated the following year with first class honours in surgery and honours in medicine and obstetrics. After the customary junior appointments at his teaching hospital and in children's work, he joined the fever service of the Metropolitan Asylums Board in 1897. The following year he gained the M.D. and in 1907 became Superintendent of Gore Farm Hospital (now the Southern Hospital) at Dartford in Kent. During 1905 he had described a simple staining technique, using toluidine blue in absolute alcohol and glacial acetic acid, for the detection of the diphtheria bacillus by demonstration of its Babes-Ernst bodies or polar granules (Pugh 1905).

In 1909, as a result of his expressed views on the need for children's country hospitals, he was appointed first Medical Superintendent of the Children's Infirmary at Carshalton, which was, with royal approval, redesignated Queen Mary's Hospital for Children in 1914; here he remained for the rest of his professional career. He retired in 1937 and died at Boscombe, Hampshire, eight years later (D'Arcy Power and Le Fanu 1953). By 1919 his reputation was so established in orthopaedics that he became a member of a select orthopaedic
club in company with McRae Aitken, Blundell Bankart, Rowley Bristow, Reginald Elmslie, Laming Evans, William Trethowan, Jenner Verrall and Thomas Fairbank. In 1926 Pugh was President of the Orthopaedic Section of the Royal Society of Medicine. He was an early member of the British Orthopaedic Association, and in 1935 he was elected to the Fellowship of the Royal College of Surgeons of England.

When Pugh arrived at Carshalton, the hospital, which had been completed by the Metropolitan Asylums Board in 1907, consisted in the main of twenty-four single-storey ward blocks with over 900 beds. The buildings were originally intended for a convalescent fever hospital but had never been occupied. They were situated in 136 acres of parkland on the Surrey Downs. Pugh modified some of the ward blocks in order to provide an operating theatre, gymnasium and appliance workshop (Pugh 1926). The reduced bed complement was made up by constructing verandas around the courtyards on the south side of each ward block in which 300 children might live, day and night, summer and winter, continuously in the open air. Children who required prolonged in-patient treatment were accepted from the whole of the London area on the authority of the boards of guardians and the London County Council. Under Pugh’s guidance special units were set up within the hospital to care for children with skeletal tuberculosis, poliomyelitis, cerebral palsy and rheumatic fever. The undulating countryside provided ideal conditions for the open-air treatment of skeletal tuberculosis so popular at that time. In addition, enforced rest, adequate diet and conservative surgery, which included the aspiration and incision of abscesses, were the mainstays of treatment. Pugh accepted a trial of heliotherapy (sunshine) and phototherapy (carbon arc lamp), but was not convinced of their efficacy (Pugh 1925–26); however, he was more impressed with the use of radium in the treatment of tuberculous cervical adenitis (Pugh 1937).

Gordon Pugh is best remembered in orthopaedic circles for his methods of overcoming deformity and of maintaining enforced rest of the tuberculous hip and spine. In 1924 he introduced into England “traction by suspension” for the treatment of tuberculosis of the hip, at the suggestion of Dennis W. Crile of Chicago (Pugh 1926–27). The method had first been described by Josse of Amiens in 1836 for the treatment of fractures of the femur, and Pott and Petit had experimented with inclined planes and gravity in the eighteenth century (Rang 1966). Pugh had not been satisfied with the ability of weight traction to abolish deformity caused by spasm around an inflamed hip joint.

The original apparatus used at Carshalton consisted of a fracture board and mattress on which the child was placed with the feet towards the head of the bed. Skin extension was applied to the affected limb, the extension straps were secured to the fracture board and, by attaching it to the head rail, the child was tilted head down by about 30 degrees (Fig. 2). Lateral rotation of the limb was prevented by a sandal attached to a horizontal wooden bar, and a further wooden bar was placed under the mattress at knee level to prevent backward subluxation of this joint. One night of “traction by suspension” usually sufficed to correct hip deformity caused by muscle spasm. The child was allowed relatively free mobility on the bed but was prevented from turning over by a chest band. Pugh had difficulty in finding a suitable skin extension to withstand prolonged traction. Initially, and with success, he used two large moleskin plasters which enveloped the thigh. These were later replaced by two layers of stockinette fixed to the thigh by zinc-gelatin paste which gave fewer skin complications.

Pugh also modified Robert Jones’s abduction frame to give traction by suspension in patients with advanced tuberculosis of the hip in whom the desired result was ankylosis in the best position rather than a mobile joint, as was often obtained by “Pugh’s traction” in early cases. In the early nineteen-twenties the first tip-up hip carriage was produced and this was essentially the fracture board on wheels, elevated to 30 degrees from the horizontal (Fig. 3).

For the treatment of spinal caries Pugh advocated prolonged recumbency to prevent the collapse of the diseased vertebral bodies until union had been achieved. There were no short cuts; “there had never yet been devised a jacket or splint . . . which was capable of relieving
the diseased vertebral bodies of an erect child from superincumbent weight” (Pugh 1925). He believed that recumbency could prevent deformity in the early case but did not think that hyperextension at the seat of disease, as practised by Gauvain, could produce correction if deformity was already present. Pugh argued that hyperextension opened up a gap between the vertebral bodies which interfered with bone healing. The lesion would then heal with fibrous tissue which allowed recurrence of the deformity on assumption of the upright posture despite the support of a jacket or brace. He was also against posterior spinal bone grafting as a method of shortening the duration of recumbency. He regarded the procedure as performed in the nineteen-twenties and thirties as unsuitable for children. The operation was often done while the disease was still active in an endeavour to reduce weight on the weakened vertebral bodies by bracing the posterior elements together. Pugh argued that the centre of gravity for the body was well in front of the spinal column and that, if recumbency was discontinued before healing was well advanced, collapse of the vertebral bodies could occur anteriorly. Furthermore, the graft prevented telescoping of the vertebrae and maintained the space between them with a persistent abscess and further sinus formation (Pugh 1925). Pugh was in advance of his time and his views upon spinal grafting—in those days always posterior—proved correct. Pugh attempted to neutralise the deformity after arrest of activity by encouraging the compensatory curvature in the healthy region of the spine. He had observed that in two-thirds of his children spinal caries developed before the age of six years, when the shape of the spine was readily modified (Pugh 1925).
Pugh developed the Carshalton carriages for the recumbent treatment of vertebral caries (Pugh 1921). They were made in the hospital workshop and consisted of a metal spinal frame mounted on a wooden carriage (Fig. 4). On them, children could be immobilised for months or years with little supervision, but could exercise the limbs and share in the social and educational amenities of the hospital (Fig. 5). Constructed of gas piping, the frame was shaped individually for each child to produce the appropriate compensatory spinal curvatures. The child was secured to the frame with a waistcoat of crash towelling and a folding legpiece was incorporated to rest the knees in slight flexion and prevent equinus deformity of the foot. When there was clinical and radiological evidence of healing, many children were then treated for a further lengthy period, often months or years, in a moulded jacket of non-flammable celluloid.

Renal infection and lithiasis were, at one time, common complications in recumbent children and the carriages were modified in the early nineteen-thirties to allow 30 degrees of tilt of the frame to either side, thus elevating each kidney in turn to improve urinary drainage (Fig. 6). This, in addition to a high fluid intake, restriction of dietary oxalate and oral administration of potassium citrate, solved the problem. In 1933 Pugh introduced a second hip carriage in which the spinal frame was mounted on rollers on a backward inclined slope to produce traction by suspension (Fig. 7). As on the spinal carriage, a rotary device was incorporated. This carriage was developed to allow the child to lie in the more comfortable horizontal position.

Elmslie had reported that poliomyelitis was the commonest single cause of crippling in children in the London area (Pugh 1922-23), and in 1924 the London County Council designated fifty beds at Queen Mary’s Hospital for the treatment of this condition in the second stage, that is, from the loss of muscle tenderness until the disease became stationary. Pugh did not believe in out-patient treatment, as was commonly practised then, and insisted that adequate supervision with rest, splintage, muscle training and re-education could only be done in hospital. In some cases he considered that heat, massage and electrical stimulation were beneficial, although he was fully aware of the dangers of fatigue. All treatment was under the supervision of two gymnasts. An outdoor heated swimming pool was constructed for the use of these patients in 1927. Children in the later stages of the disease were also admitted for operative correction of their deformities and for stabilisation procedures, and
many of these were done by distinguished visiting orthopaedic surgeons such as the redoubtable Willie Trethowan from Guy's.

Although skeletal tuberculosis is now uncommon in the United Kingdom, Pugh's "traction by suspension" remains of considerable value for the treatment of children with transient synovitis of the hip, Legg-Calvé-Perthes' disease, coxa vara (Watson-Jones 1952) and fractures of the femoral shaft, and provide a memento of "Pugh of Carshalton" who devoted his life to the care of crippled children.

I am grateful to Mr Geoffrey Walker for his continued encouragement and advice in the preparation of this article. I also thank all those who provided historical and other details of Pugh, especially his son, Surgeon Captain P. D. G. Pugh, O.B.E., R.N., and Mr V. S. Patel, who carried out some of the research. Miss M. Pugh (unrelated to W. T. G. Pugh's family) prepared all the illustrations from the contemporary originals. Financial assistance was provided by the South West Metropolitan Regional Hospital Board.

A much abridged version of this paper was presented to the Orthopaedic Section of the Royal Society of Medicine on June 12, 1971.

REFERENCES