Conclusions.

From the above series of cases it would appear justifiable to conclude that the treatment of thrombosis by this method does quickly arrest the process. From the patient's point of view the almost immediate release from pain was most gratifying.

The comparison of a series of cases is always a difficult matter. To obviate this difficulty cases were treated alternately by the two methods, and so may be considered unselected. In reality the cases treated by the intravenous method were, on the whole, the more serious.

Analysis of the two groups shows that in those treated by the intravenous method the subsequent period of pyrexia was shorter by an average of four days and the onset of convalescence by an average of ten days than in those cases treated by the oral method.

Reference to the table also shows that the average number of days from the onset of thrombosis to evacuation in the cases treated by the intravenous method was thirty days, while in those cases treated by the oral method it was thirty-nine. It will, moreover, be noted that, whereas in the series of seven cases treated by the intravenous method five were evacuated as walking and two as sitting cases, and in one only was there oedema present on discharge; in the oral series of ten cases, only five were evacuated as walking and three as sitting cases, while two had to be sent to England as stretcher cases, and in no fewer than five cases there was a considerable amount of oedema present on discharge.

The known facts concerning the action of citrates on the blood as worked out by Sir Almroth Wright would lead one to expect that it would lengthen the coagulation time, and in my own series this is confirmed by the experiments in the coagulation time before and after the administration of sodium citrate in the course of treatment recorded above.

Moreover, not only is the coagulation time increased, but the tendency of the blood to coagulate is diminished. This, as is commonly known, can be demonstrated *in vitro*. With the application of citrate to the blood in circulation, in which as in the case of thrombosis a clot has formed, the formation of further clot is apparently prevented, and such clot as is already formed would then seem to behave in the same way as a clot may be seen to behave outside the body—that is to say, it rapidly shrinks, with the expression of serum, and so opens up the venous channels.

The circulation is then speedily restored, the clot being ultimately absorbed. The better results obtained by the administration of the citrate intravenously than orally would seem to be dependent upon the more immediate and intimate manner in which the drug is brought into relation with the blood by the former than by the latter method.

Lectures

ON

THE ANATOMICAL AND PHYSIOLOGICAL PRINCIPLES UNDERLYING THE TREATMENT OF INJURIES TO MUSCLES, BONES, AND JOINTS.

GIVEN AT THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,
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BY

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**III. THE PRINCIPLES AND PRACTICE OF
HUGH OWEN THOMAS.**

MEN could not have approached a common objective by more diverse routes than did Hunter and Hilton on the one hand and H. O. Thomas on the other. Hunter and Hilton worked long and hard in the dissecting and *post-mortem* rooms in the search of facts to guide them in formulating rational means of treatment; they observed the efficacy of their methods in regulated hospital wards and on closely tended private patients. The circumstances amidst which Thomas matured his experience were very different: his field of observation was the steady stream of accident cases drawn from the dockland of Liverpool, which passed through his surgery; his field of experiment lay in his workroom, where, in workman's

attire, and with the hand of an expert, he wrought the exact form of splint or machine which he desired for the treatment of each particular case that came under his care. Here, then, is a surgeon of a new kind, one who could and did use his knife, but it was his final and fixed opinion, founded on thirty-three years crowded with experiments on orthopaedic cases, that the blacksmith's hammer, deftly used, was, in most cases, a more powerful reparative instrument than the surgeon's knife.

Thomas was born and bred an orthopaedic surgeon. His father, Evan Thomas, had his home and surgery, so Professor Rushton Parker has informed me, at 72, Great Crosshall Street, Liverpool, where, although unqualified, he was the referee of certain workmen's clubs—dock gatesmen, ship's carpenters, boilermakers, and several others. He had five sons: Hugh Owen was the eldest; two others besides him—Richard and Evan—studied and qualified in medicine; as the boys grew up they had to help in the surgery and could not fail to gain a first-hand knowledge of injury and disease. Indeed, it was proposed at one time that Hugh should become his father's apprentice, but the ill state of his health—he never at any period of his life was robust—led to a change of plan. In 1851, at the age of 17, he was apprenticed to his maternal uncle, Dr. Owen Roberts of St. Asaph. In 1855, at the age of 21, he went to Edinburgh to study medicine. Syme and Spence and Simpson were in the heyday of their fame; Goodsir was teaching anatomy; there was then a demonstrator of anatomy newly arrived from London—William Turner. Lister was also there commencing the Edinburgh phase of his great career. But in Thomas's writings there is never an allusion to his life in Edinburgh; only one man seems to have impressed him there, Hughes Bennett. He apparently spent little more than a year in Edinburgh, for in 1857 he was studying at University College, London; of his life and experience in London he never gives us the slightest hint. In 1857, in his 23rd year, he became a Member of this College, and in the following year, still in poor health, he returned to Liverpool, where he spent the thirty-three years of his professional life amongst the accident cases of Liverpool dockland. He began in easy circumstances so far as finance was concerned. Professor Rushton Parker informs me that he had at first a very hard struggle, but ultimately acquired the surgeonships of the various clubs which had been held by his father, and that thus an annual income of at least £500 was assured him. His cases supplied him with all his interests—his cases and his workroom where he designed, modified, and perfected the methods he applied for treatment. He knew and sympathized with the working people; there were many poor and ailing men round him who could ill afford to leave their work and seek treatment on week-days; Thomas established a Sunday clinic for them—he eased his poor patients and enriched his own store of knowledge.

Thus he lived from his twenty-fourth to his fortieth years, his fame during that period being still confined to dockland. In 1874 an event occurred which led to his labours becoming better known. Mr. Parker, police surgeon, had reason to visit Mr. Thomas, who then had his surgery and hospital in Greta Street, in connexion with a case—that of an inspector of police—who was then under Mr. Thomas's care on account of a compound fracture of the leg. Mr. Parker had taken with him his son, Rushton, a young surgeon of 28, with an assured future in the Liverpool School of Medicine. We can learn the effect of that visit from the preface which Thomas wrote for his first important publication on *Diseases of the Hip, Knee, and Ankle Joints, with their Deformities: Treated by a New and Efficient Method* (London: H. K. Lewis. First edition 1875; third edition 1878). It was not actually his first publication, for in 1873 he described a method of using silver wire ligatures for the treatment of compound fractures of the mandible. The ligatures were fixed by a terminal spiral which could be conveniently tightened as the mandibular fragments yielded. He also advocated then a practice adopted in the present war, of removing any tooth situated on the line of fracture, as its presence there always retarded union. Once started as a writer he continued to issue *Contributions to Surgery and Medicine* almost annually until death brought an end to a laborious career, handicapped by indifferent health. He died in 1891 at the age of 57. Even in the manner of publication he emphasized his individuality. His writings

were issued in pamphlet form, designed, one would almost think, for only private circulation. It is because of the means he adopted for publication that his numerous writings are so little known; it is very difficult now to obtain a complete set of Hugh Owen Thomas's works.*

He based his methods of treatment on the axiomatic belief which had served to guide Hunter and Hilton—namely, that the power of repair lies in the living tissues of the body. "The crying evil of our art in these times (1883)," he writes, "is the fact that much of our surgery is too mechanical, our medical practice too chemical, and there is a hankering to interfere, which thwarts the inherent tendency to recovery possessed by all persons not actually dying." Further on, in another passage, he adds: "There are actions which Nature cannot do so well as the artist in charge." Spence, whom he must have listened to in Edinburgh, proclaimed that excision of joints opened up a new world in surgery. In Thomas's opinion the world which excision opened up was one of unnecessarily maimed limbs—limbs which could have been saved, or at least cured equally well, had the surgeon been content to play the patient part of Nature's assistant.

It has been said that Thomas's methods of treatment are not founded on a knowledge of anatomy, physiology, and pathology—the only sure basis for a means of cure. That, in one sense, is true. "Surgery is an experimental science," he states. All his life long he kept making experiments in his methods of treatment, closely observing and carefully recording the results night by night. The conclusion he drew from these years of toil was that the more strictly he observed the principle of rest in the methods of treatment he applied to his cases the better were his results. But it would be a complete misrepresentation of the case were it to be said that his methods were not based on a knowledge of the anatomy and physiology of the human body. "Men admired my splints as if I were a blacksmith," he wrote, "but the principles on which they were framed they never could see." We shall examine those principles in connexion with the hip-joint. Thomas never thought in terms of muscles, but of parts. When in ordinary-day life we excite movements, however perfect our knowledge of anatomy may be, we do not think of the muscles which produce them, but only of the segments of the limb we wish to move. That was the nature of his working knowledge of anatomy. He observed that in all movements of the lower part of the body—in walking, turning, or bending—two joints were correlated in their action, the hip and lumbar dorsal joints of the spine. He saw that a limitation in the movement of the hip could be compensated by an increased action in the lower part of the spine, and on that observation he founded his test for demonstrating and estimating the degree of limitation in the movements of the hip-joint. He realized that the hip-joint could not be fixed, could not be given rest, unless the dorso-lumbar region of the spine were also fixed. Movements of the knee also affected the hip; the knee had also to be fixed to give the hip rest. To fix these joints he invented his hip splint—and fashioned it in such a way that it could be fitted and attached to sound parts of the body and could be so placed that it would assist the weaker groups of contracting muscles against their stronger antagonists. He therefore placed the main supporting bar of his hip splint along the back and prolonged it to fit the flexor aspect of the thigh and leg, bent so as to support these parts and relieve the flexor muscles of the hip from those burdens which disease had thrust upon them. He did not know why but he did know that these muscles would begin to relax so soon as they found they were relieved of their involuntary burden. But he did much more: he saw that the splint must be perfect in its fit and its effectiveness; he saw that that day after day and week after week, moulding the splint as the muscles relaxed, thus leading the parts down the ladder in ease which they had slowly climbed in pain. He carried out, as it never had been carried out before, in cases of diseased hip-joint, a system of "enforced, uninterrupted, and prolonged rest." "A man," he said, "who understood his principles, would do better with a bandage and broomstick than another could do with an instrument maker's arsenal."

When he came to design his knee splint he utilized his

intimate knowledge of the living human body. Nature has two methods of providing limbs with the degree of rigidity necessary for movement: In vertebrate animals she utilizes an internal or central support; in crustacea and insects a peripheral or ensheathing support. We have no reason to suppose that Thomas borrowed any suggestion from the crab or lobster, yet his knee splint is based on the ensheathing principle exemplified by their limbs. He simplified the sheath design by cutting away all unnecessary parts, leaving only a basal ring, with inner and outer bars to represent the complete sheath. He saw that he had to utilize the natural base of the limb—the prominent and fixed parts of the hip bone—as a fixed foundation for the new skeleton with which he was to supply support to the damaged limb. He therefore left intact the basal ring of the sheath, and, by an exact study of the living parts, moulded the basal ring to the supporting points of the pelvis—the ischial tuberosity and projecting iliac parts of the pelvic basin. He gave his sheath rigidity at its distal or pedal end by uniting the lateral supports. He thus furnished the lower limb with a new temporary external skeleton which relieved all its bones of work and stress, and gave the muscular engines complete rest.

We see him again bring his anatomical knowledge to bear on the shoulder-joint. As at the hip, he realized that in all shoulder movements two joints were involved—the scapulo-thoracic and the scapulo-humeral. It was his recognition of this fact which led him to plan a new means for the treatment of dislocations of the scapulo-humeral or shoulder joint. That joint could not be manipulated with precision until the scapula was fixed. He again utilized a basal ring—a fixed basal ring—against which the scapula could be fixed when the arm was drawn through the ring for the purpose of reducing a dislocation of the shoulder-joint.

His knowledge of the physiology of the human body, like his knowledge of its anatomy, was founded on observations made on his patients. Let me cite one of his statements regarding the behaviour of muscles: "The intelligent muscles, finding their labours no longer needed (after application of hip splint), take a rest until invited to enter again on duty." It is a figurative statement, but, as we shall see when we come to deal with recent discoveries of neurologists, it is essentially true. He observed that whenever a joint became diseased, the muscles round that joint became limited in their range of action; the longer the duration of the disease the greater the limitation; if the range began to increase, then that was a sure sign that repair had commenced. He observed these physiological facts; he did not seek to explain them. He also drew an extremely important deduction from these observations: When a patient is able, voluntarily and without pain, to bring a limb or moving part, which has just been released from enforced rest, back to the point or position in which it had been fixed, then that part is cured; the volitional efforts of the patient will, when that stage is reached, effect a full cure. That is surely applied physiology. "If a muscle manifests a flicker of movement under volition, it will recover its full power," is another instance of physiological observation. He treated muscles as he treated his patients. He relieved the weak and oppressed, and restrained the strong. If the flexors of the elbow were paralysed, he saved them from their overstrong antagonists by keeping the elbow partially flexed; he dorsiflexed the wrist-joint by a special splint to nurse the paralysed extensor muscles of the forearm.

We shall have occasion to refer at a later date to other aspects of his methods of treatment—his means of stimulating repair by injury and by "damming"; his opposition to operative measures for securing union of newly-fractured bones, and above all to his condemnation of every form of passive movement as a means of treatment, particularly of the kind applied by bonesetters.

I have touched only a fringe of his career. If I were asked to state briefly the chief lesson we can learn from him, I would not place first his discovery of a fuller meaning to the word "rest," nor his genius in designing new means of giving rest; but rather his realization that repair can be fostered only by the patient personal application of the surgeon's head and hand, day after day, week after week, month after month, if necessary, year after year. He knew that it takes over twenty years to build up any part of the body; how could a destroyed joint be rebuilt in a night?

*Colonel Sir Robert Jones has presented a complete set to the library of the Royal College of Surgeons of England