HISTORICAL REVIEW

Hugh Cairns and the origin of British neurosurgery

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Abstract

Sir Hugh Cairns, the first Nuffield Professor of Surgery in Oxford and consultant neurosurgeon to the Royal Army Medical Corps during World War II, was a leader in helping to establish neurosurgery as a speciality in Britain. After learning the craft from Dr Harvey Cushing in Boston, Cairns fought against the general surgical orthodoxy in London to establish the first specialised neurosurgical unit in a teaching hospital. We review his early life, training with Cushing, his inspiring character and administrative prowess which not only helped to win the battle for neurosurgery in London but also helped to establish the Oxford Clinical School and to save thousands of lives during the Second World War.

Key words: Hugh Cairns, British neurosurgery, Harvey Cushing, historical review.

Introduction

In early twentieth-century Britain, neurosurgery was performed by general surgeons with an interest in the nervous system. As Geoffrey Jefferson had written so eloquently, ‘No surgeon had thought they could make a living out of so recondite a pursuit – nobody, that is, since Victor Horsley and he had done a little general surgery’. Surgeons at the time were hampered by inadequate knowledge of neurology and neurophysiology, and underdeveloped surgical technique. A rather conservative view prevailed that neurosurgical operations should be performed in addition to general surgery by those who had a serious desire to explore the possibilities of surgical treatment for diseases of the nervous system.

Three inspirational figures formed the pillars of modern British neurosurgery – Hugh Cairns in London, Norman Dott in Edinburgh, and Geoffrey Jefferson in Manchester. All three shared the vision of creating specialised units for surgeons dedicated to neurosurgery alone. Jeffreys, who of necessity was a self-taught neurosurgeon and the most senior of the three, was the leading light in the formation of the Society of British Neurological Surgeons in 1926. This society, modelled on The Society of Neurological Surgeons organised by Cushing and Sachs in 1920, was pivotal to the development of the subject in Britain. It formed a meeting place for the discussion of cases, the exchange of scientific ideas, and created opportunities for foreign visits to neurosurgical clinics. Dott and Cairns had both spent a year learning the craft with Dr Harvey Cushing, the then undisputed leader of neurosurgery in the world, practising at the Peter Bent Brigham Hospital in Boston. All were heavily influenced by his specialist approach and surgical technique. Hugh Cairns, a young man with purpose, drive and vision, was a firm believer in Cushing’s methods. He fought with immense courage and energy against the general surgical orthodoxy to establish the first specialised neurosurgical unit in a teaching hospital along ‘Cushing lines’. This marked the birth of neurosurgery as a distinct speciality in London.

This article examines the factors that contributed to the success of Cairns in helping to establish neurosurgery in Britain. Specific points covered include: his early achievements, his training with Dr Cushing and the surgical principles he adopted, and his inspiring character which helped to bring the banner of neurosurgery to the South of Britain.

Method

A literature search was performed on MEDLINE with the words: Hugh Cairns, Harvey Cushing,
and Neurosurgery, Britain. Primary and secondary evidence was retrieved from the biography of Hugh Cairns and Harvey Cushing, and the publications of Cairns, his colleagues and pupils, located in the archives of the Wellcome Library for the History of Medicine, London.

The early years
Hugh Cairns was born in Port Pirie, South Australia on 26 June 1896 to an Australian mother and Scottish father. An exhibition enabled him to start his medical studies at the University of Adelaide at the age of fifteen. Fired with idealism, Cairns interrupted his studies in the penultimate year to serve the Australian Army Medical Corps (AAMC). He worked in the X-ray department of a hospital in the Greek Island of Lemnos, off the Dardanelles, which provided medical support for the Gallipoli peninsula. He returned to complete his studies in 1916 and won the South Australian Rhodes Scholarship to study medicine at Oxford University. In August 1917 he was appointed Captain in the AAMC and served in France until the end of the First World War. He went to Oxford in 1919 and never lived in Australia again.

At Oxford University he studied physiology at Balliol College, and was taught by Sir Charles Sherrington. In his first year he passed his primary FRCS, rowed for the Oxford Blue boat, and met the woman who was to become his wife, the daughter of the master of Balliol College. His successes, particularly the rowing ‘Blue’, won him clinical posts at the Radcliffe Infirmary for one year, and subsequently the role of First Assistant to the Surgical Unit at the London Hospital, under Sir Henry Souttar. Cairns had a desire to carry out scientific research in surgery, of which there was little at the Radcliffe Infirmary at the time. Cairns worked for Professor Turnbull in his prolific pathology department and shortly after became first assistant to a number of consultants, predominantly in urology. By 1925, Cairns had made himself known as a competent and reliable academic surgeon. He was later appointed Honorary Assistant Surgeon to The London Hospital in June 1926.

Despite his achievements, Cairns may have struggled to establish himself in general surgery in London, due to strong competition from men with a more orthodox London background. Around this time, his neurological colleagues: George Riddoch and Russell Brain, were very keen to make Cushing’s surgical methods available to their patients. They had suggested Cairns would be the ideal candidate. Cairns had always been interested in neurology, possibly because Souttar occasionally performed neurosurgical procedures, or because he was inspired by the writings of Dr Harvey Cushing whom he had met at Lady Osler’s residence in 1922. Sir William Osler, probably the best-known physician in the English-speaking world at the turn of the century, had been Cushing’s mentor and close friend. When Cushing came back to England for the Cameron Lectures in 1925, Lady Osler had recommended Cairns to Cushing. These connections won him the Rockefeller Travelling Fellowship to spend a year as Assistant Surgeon to Dr Harvey Cushing at the Peter Bent Brigham Hospital in Boston in 1926; an opportunity that determined the future course of his work and fame.

Training with Cushing
Cairns’s initial assignment at the Brigham was the patient on whom Harvey Cushing first used the electro-surgical cutting knife. The hurly-burly of that operation gave Cairns a taste of what the rest of the year was going to be like. In the operative note, Dr Cushing wrote:

The operation was a perfect circus – many ringed. The New England Surgical Association was here and almost every hand was occupied with them. I had persuaded Dr Bovie to bring his electrosurgical unit over here to let me see what I could do with his cutting loop. This had necessitated re-electrifying the operating room. Dr Greenough appeared with four or five coughing Frenchmen with colds in their heads, the student who was acting as possible donor fainted and fell off the seat. It was a little too much for Davidoff’s successor [Cairns] who has been here only 2 – 3 days so that I finally had to call in Horrax. (p537)

Cairns found himself in a dynamic, innovative, and well-organised unit. It was probably one of the hardest-driven surgical teams in the English-speaking world, largely due to its great demand for advancement and thoroughness. In a long letter to his wife, Barbara, on 12 October 1926, Cairns illustrated the orderly and meticulous fashion in which he trained:

I am called by telephone, almost every room in America has a telephone I should think [resident staff at the Radcliffe Infirmary in 1943 were still called to the wards by the Porter with a message from the night sister]... There is breakfast at 7 – 8:30am instead of 8:30 – 10am at The London... After breakfast I bust around my staff at the Radcliffe Infirmary in 1943 were still called to the wards by the Porter with a message from the night sister]... There is breakfast at 7 – 8:30am instead of 8:30 – 10am at The London... After breakfast I bust around my patients – at the moment I have 30... Each day we operate on one cerebral tumour, usually at 11 o’clock and this means that I begin at 10:30 and clip off the hair and shave the patient’s head. This sort of thing is done in English hospitals by a barber and it is an indication of their great thoroughness and attention to detail over here that it is done by the surgeon... The operation is done very slowly and carefully... By the time we are finished operating it is usually 2 o’clock. We do a...
few dressings then on our cases . . . In the afternoon I take histories of cases and test eyes in a rather complicated but very valuable way they have of doing it here until 5pm and then I go around the wards with the Chief until 6:30pm, we decide what to do next day . . . After supper I do a night round and take more histories. Then I go down and dictate them all on to a gramophone record in great detail and a stenographer copies them out the next day. I am usually through by about 10:30pm . . . (p49)8

Although he did not have publication on his mind at the time, Cairns compared the physical stress of being Cushing’s resident to that of his experience of serving in the Gallipoli peninsula.10 By the end of the year he had learnt to take detailed histories and examine the neurological system thoroughly, to assess perimetric visual fields, to interpret skull X-rays and ventriculograms, and to perform operations for intracranial tumours on his own in the way Cushing had taught him. In addition, Cairns became convinced by Cushing’s principles of surgical practice and adopted them in almost slavish fashion for the rest of his career.3

Cushing’s principles

The first of these principles was to dedicate oneself to surgical neurology. In 1900 Cushing had decided to limit himself to what was at the time considered a narrow field of surgery, and he proceeded to attack it by all the available methods of science. He taught himself the relevant parts of neurology and ophthalmology. He did his own experimental work, and to the end of his career worked in a histological laboratory. He used his artistic talent to capture his operative findings and develop his operative technique. In 1929 Cairns published a substantial report on his experiences of working in Dr Cushing’s clinic.11 In the introduction of the report, he wrote:

Devoted as it is solely to the study of neurological surgery, and in particular to the study of intracranial tumours, the clinic is in the truest sense a surgical unit. The methods used both for diagnosis and treatments have been drawn with catholic spirit from widely divergent fields of medicine. All members of the clinic are trained to use all these methods: for example to make neurological, perimetric and ophthalmoscopic examinations, as well as to perform intracranial operations. They are thus in no sense a group of expert specialists, each supplying the deficiencies of the other: all are trained in the broad field of neurological surgery. (p6)11

Second, Cushing believed that the neurological surgeon should always attempt to make his own diagnosis by careful preoperative studies. An illustrative example was seen in Cushing’s clinic by Cairns himself.11 A 40-year-old woman presented with dysphasia, right sided facial weakness, and papilloedema without visual field defects. The skull X-ray revealed ‘unusual vascularity of the skull, all channels of the left middle meningeal artery being unusually large and tortuous’. Cairns explained that a clinician without any surgical experience would probably have formulated the diagnosis of tumour in the lower part of left motor strip and would have plainly advised operative treatment. However, Dr Cushing with his extensive surgical experience had noted a previous case with almost identical clinical features and the same ‘tell-tale vascularity’. This was a patient with meningioma of the sylvian cleft who died intrapertively from profuse haemorrhage. His own assessment of the clinical and radiological findings prompted the appropriate preparations for blood transfusion and haemostasis. The tumour was removed with electro-thermic methods, and the patient recovered well with only slight asymmetry of her face.12 Cushing taught his students not to be the ‘handmaiden’ of the physician, but to ‘be one’s own neurologist and radiologist’ so that one can understand the clinical problem and predict the likely surgical complications. Cairns followed this principle throughout his career, and greatly benefited from it. Joe Pennybacker, one of Cairns’s fine pupils, wrote:

Not least in Cairns’s achievements was his success in integrating medical and surgical neurology . . . Cairns was soon speaking to the physicians on equal terms and in their own language . . . this helped to develop a strong bond of mutual respect and affection between him and his contemporaries among the neurologists.3

A third principle Cairns adopted is evident in his letter to Barbara:

If I could introduce into English surgery the meticulous care and technical efficiency that obtains in America, why, I would be doing a very big thing. (p49)8

Before Cushing was appointed to the chair at the Peter Bent Brigham Hospital in 1910, he had spent a number of years as assistant resident to William Halsted at the Johns Hopkins Hospital in Baltimore. Sir William Osler was professor of medicine at Hopkins at the time, and greatly influenced Cushing. His emphasis on patient care, careful observation, new knowledge, teaching and writing were critical in Cushing’s development.12 Cushing brought these principles to neurosurgery, and taught his pupils to be thorough and complete in their assessment, and to fully document their findings as if it were being prepared for publication. Cushing argued that it is impossible to tell during the stage of investigation whether a case would subsequently prove to be of
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unusual interest. Cairns developed vivid and personal records of his patients for the rest of his life. Peter Schurr, one of Cairns’s trainees at the Radcliffe Infirmary, said in the 1988 Cairns’s memorial lecture:

On reading them [Cairns’s records] one can imagine the thoughts behind the actions, and drop into the situation as it existed at the time.13

Cairns demanded nothing less from his trainees. Case histories and operation notes were reviewed by Cairns with great scrutiny and criticism, and copies of all records were carefully filed in a cabinet next to the wards for future reference and learning.13 Cairns had a passion for teaching and took his responsibilities as a trainer of future neurosurgeons very seriously. On his ward round, cases had to be presented from memory and a competition to recall similar cases to the one being seen would be instigated, with a view to elucidating a problem.

One of his pupils wrote in his obituary:

Cairns had a gift of investing every case with a particular interest and his system of records made the material easily available for future reference. Each patient was ‘followed up’ and over the years a useful body of information about the natural history of neurological diseases has accumulated.14

Cushing’s second strong influence at Hopkins was William Halsted, who inspired Cushing with his gentle tissue handling and details of haemostasis. At a time when it was still the fashion to operate ‘against the clock’ Cushing would take from three to ten hours to remove a tumour, ensuring that he caused minimal damage to the brain. Cairns was taught by Cushing to ‘do no harm where you cannot do good’.11 He aimed to open the skull without the slightest laceration to the dura, protected the brain with ‘slabs’ of cotton wool, and retracted the brain with sterile retractors. He introduced new methods of haemostasis, including silver clips and electrocautery, and emphasised the need to close the galea to prevent wound infection. Cushing noticed that some tumours were extremely slow growing and benign, so that a complete removal was not required to improve symptoms. He demonstrated a better outcome could be achieved when vital structures of the brain, such as the optic nerve and brainstem were untouched.11 These principles were passed on to Cairns as well as his numerous other assistants, and are currently practised routinely in neurosurgery.

A final principle, which Cairns took from Cushing, has been highlighted by Geoffrey Jefferson. In 1959, he wrote:

Cairns brought back to this country a characteristic of Cushing, the continual appraisal and periodic publication of his surgical mortality and something

else - the forging of bonds between the patient and his surgeon so that after-histories were known.2

Cairns reported 28 operative deaths out of the 284 major intracranial operations that were carried out on 229 patients during his year with Cushing. This gave an operative mortality rate of 9.8% and a case mortality of 12.2%.11 at a time when the average mortality in neurosurgery was 50%.12 Cairns used these results and the results of his long-term follow-up in 1935,16 to convince the surgical world that a significant amount could be achieved by neurosurgery in the hands of a specialised team.

At the end of the year, Cushing was extremely impressed with Cairns’s work and gave him a spirited letter of counsel, which illustrates Cushing’s inspiring personality, his mentorship and genuine interest in Cairns’s future career:

Herewith my parting advice. Don’t imagine that you can learn everything about the surgery of intracranial tumours in a twelve-month, and from having had a hand in dealing with one or two hundred cases. I have been in this business myself for a long time. After my first year or two, I thought I knew much more about the subject than I now do after twenty-five years. Each year the character of the work changes more than you can possibly imagine. Almost every case brings up new problems or modifies one’s impressions of old ones presumably solved. Few things are so permanently settled that one can speak about them with any degree of finality. That of course is one reason why the work is so engrossing. (p540)10

Cairns’s battle in Britain

Cairns’s newly adopted methods were heavily criticised on his return. Some of the high-ranking London surgeons and neurologists could see little point in the slow, painstaking methods of Dr Cushing which they saw as ‘the triumph of technique over reason’.3 Cairns had to convince them, as well as the anaesthetists, assistants and nurses who helped with the long procedures. He also had to deal with the administrative problems of beds, access to theatres and special equipment. Only a person possessed of considerable energy, determination and dedication could have succeeded.

His biggest problem was financial hardship. The major source of income for surgeons at the time was private patients. However, they were not permitted in the voluntary hospitals. Cairns was forced to run around to private nursing homes for income, which distracted him from his primary task. His proposal of establishing a ‘private ward’ at The London was rejected, and Sir Walter Morley Fletcher (Secretary of the Medical Research Council), Abraham Flexner
through Cushing. In 1975, Pennybacker wrote: "teach, a gift that was passed on to him from Osler"

Cairns helped to deliver the message that surgical diseases of the nervous system should be treated in the United Kingdom with the support of the Rockefeller Foundation. Cairns managed to persuade the Rockefeller Foundation to send Dorothy Russell to study neuropathology in Montreal. He helped to find funds for Audrey Arnott, a fully trained artist who had exhibited at the Royal Academy, to learn surgical illustration from Max Brödel, Halsted's artist at John Hopkins Hospital in Baltimore. He also recruited his own full-time anaesthetist, Olive Jones, who stayed with him for the rest of his life.  

One of Cairns's greatest assets was his administrative prowess and ability to organise teams. He was a natural leader that had the talent 'to enlist advice and to get the right people on his side, people with different knowledge and different influences, people who could help'. To promote further specialisation of neurosurgery, Cairns managed to persuade the Rockefeller Foundation to send Dorothy Russell to study neuropathology in Montreal. He helped to find funds for Audrey Arnott, a fully trained artist who had exhibited at the Royal Academy, to learn surgical illustration from Max Brödel, Halsted's artist at John Hopkins Hospital in Baltimore. He also recruited his own full-time anaesthetist, Olive Jones, who stayed with him for the rest of his life.  

Cairns imparted his surgical dogma to the nation with immense enthusiasm. In the autumn of 1927 Cairns was admitted an Associate Member of the Society of British Neurological Surgeons. He gave the first of many papers in the following meeting in Edinburgh, and became a full member in 1930. In March 1928 Cairns published his first neurosurgical paper in The Lancet, titled: ‘The treatment of head injuries’ and described the observations which enabled patients to be classified. Cairns’s surgical principles, adopted from Cushing, were laid down in his 83-page report published by the Medical Research Council as ‘Special Report No. 125’ in 1929. This landmark paper titled ‘A study of intracranial surgery’ was distributed to hospitals worldwide, with the support of the Rockefeller Foundation, and helped to push Cairns under the public eye. His research flourished, and with his meticulous technique he became the first surgeon to remove an acoustic neuroma with sparing of the facial nerve. His publications and lectures attracted visitors from afar and skilled assistants who came to him to be trained, notably Douglas Northfield, who succeeded Cairns at the London, and Joseph Pennybacker who went to The Oxford Radcliffe Infirmary with Cairns in 1938 and succeeded him after he died. Through each of these advances, Cairns helped to deliver the message that surgical diseases of the nervous system should be treated by specialists.  

One of Cairns’s great advantages was his ability to teach, a gift that was passed on to him from Osler through Cushing. In 1975, Pennybacker wrote: "Dott was probably the best technical surgeon; Jefferson had the most genial personality and philosophical turn of mind; but Cairns was the great teacher, as Dr Cushing had been before him. He had the qualities which inspire young men and make them want to be as good as the master."

Although Cushing was an admirable teacher, he was also a very irritable and difficult person. He was nicknamed ‘pepper-pot’ by his pupils. Cairns absorbed much of Cushing’s petty traits during his year in Boston, but modified it with innate kindness and generosity afterwards. Cairns set exceedingly high standards for his students and could be particularly cruel if he considered that one had failed him. Once the lesson was learnt, the harsh words were followed up with inspiring comments or compassionate gestures. He once said to his trainee: ‘remember that I am doing this not only for your own good, but for the good of those that you are going to have to train’. This is one of many great examples of Cairns’s incredible way of thinking, always with an eye on the future. His vision inspired young men from Britain, Europe and the Commonwealth. His legacy spread through his disciples, such as Douglas Northfield at The London Hospital, Joseph Pennybacker at Oxford Radcliffe Infirmary; Peter Ascroft at Middlesex Hospital; Gilbert Phillips in Sydney, Frank Morgan in Melbourne, Almeida Lima in Portugal, and Hugo Krayenbuhl in Zurich.  

Dream come true

By 1933, London became convinced of Cairns’s ideas. He became the first full-time British neurosurgeon to be in charge of a Department of Neurosurgery at The London Hospital in June 1933. That marked the birth of the specialty in London and indeed in England. Cairns was later appointed Honorary Neurological Surgeon to The Maida Vale Hospital, and The National Hospital, Queen Square in 1935. When the Rockefeller foundation agreed to fund a new neurosurgical unit at Queen Square in 1935, Cairns had plans for something bigger – a neurosurgical unit within a centre of clinical and academic excellence in Oxford. He put forward his ideas in a three-page memorandum to the then Regius Professor of Medicine, Sir Farquhar Buzzard in 1935. His plans consisted of a largely post-graduate medical school of no more than 20 students that would be centred on the Radcliffe Infirmary, its associated hospitals and the Basic Medical Science Departments of the University (Medicine, Surgery, Pathology etc.) He was the driving force in the meetings held in 1936 with Buzzard, Douglas Veale (Registrar of the University) and Lord Nuffield at the dinner of the Oxford Graduates Medical Club and at the 1936 Annual BMA conference. With his vision and determination, this dream became a reality in 1938. Lord Nuffield's...
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By 1943, penicillin had been given preliminary trials and was ready to use in the field. Cairns collaborated with Sir Howard Florey in Oxford to introduce penicillin into the treatment of war wounds and cranial infections. He set up a programme for its use by the Mobile Neurosurgical Units in Sicily and North Africa. Despite the impurity of the early samples of penicillin the results were dramatic and meticulously recorded in the battle zone. A striking result was achieved in the treatment of pyogenic meningitis and prophylaxis of brain abscess. It was characteristic of Cairns to be involved in many projects at any one time, and he continued his research on the treatment of pyogenic and tuberculous meningitis after the war. For his dedication to neurosurgery during the war he was awarded a knighthood in 1946.

Conclusion

Hugh Cairns was a leading figure in the development of British neurosurgery. He fought against the general surgical orthodoxy in London and came out victorious due to the combination of: a promising start, an ideal master, a defined set of principles, and an inspiring character. It was Cushing that opened the doors in neurosurgery for Cairns. In 1935, at the end of Cairns’s visit to Boston, Cushing wrote a letter to Barbara. She treasured it for the rest of her life, believing it to be the ultimate accolade of Hugh as a neurological surgeon:

I hope this note will reach you before he returns. It is merely to let you know how greatly we have enjoyed having him here and how warmly every one felt toward him. I of course take the greatest pride in his career, for of all my many pupils he is facile princeps. (p100)

The bond between Cairns and Cushing maybe one of the most inspiring relationships between student and teacher in the history of British neurosurgery (Fig. 1). After learning the craft from Cushing in 1927, Cairns created his own destiny with his inexhaustible energy which was the result of his self discipline and demand for achievement. He established the first specialised neurosurgical unit in London and laid down the principles of neurosurgery that are still practised to the present day. His determination, vision and genius for organisation led to the establishment of the Oxford Clinical School. His leadership saved thousands of lives during the Second World War. His passion for teaching trained a generation of neurosurgeons...
throughout the world. As a tribute to the wealth of surgical knowledge that Cairns gave to the world, medical students at Oxford University have established an independent charity, called the Hugh Cairns Surgical Foundation, to provide financially stricken surgical students in the developing world access to electives in Oxford. The first academic chair in neurosurgery that is currently being sought by the University of Oxford will also be in his honour. Sir Hugh Cairns was a great man who continues to inspire students and doctors of this generation that have read about, but never met him.

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Contribution of authors

Jignesh Tailor was the primary researcher and writer of the article. Ashok Handa contributed to the original idea, editing and its final appraisal.

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