

## ORIGINAL PAPERS

## HUGH CAIRNS – NEUROSURGICAL INNOVATOR

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## Abstract

**Following in the footsteps of Victor Horsley, the ‘father of British neurosurgery’, Hugh Cairns continued the tradition of great neurosurgeons associated with the Royal Army Medical Corps. He was a central figure in the acceptance of neurosurgery as a specialty in its own right in Britain, was instrumental in the foundation of Oxford University Medical School, and can legitimately claim to have significantly improved mortality figures in neurosurgical casualties in the Second World War. He was also the driving force in the acceptance of crash helmets for motorcyclists, which have substantially reduced the mortality rates of motorcyclists in those countries in which they have been introduced.**



Hugh Cairns

Hugh Cairns was born at Port Pirie, South Australia in 1896, the only son of a Scottish father and an Australian mother. The ‘dux’ of his High School, Cairns won a bursary to Adelaide University medical school aged just 15. His studies were, however, soon interrupted by the Great War, and in 1915 Cairns signed up. Enlisted into the Australian Army Medical Corps (AAMC) as a private, Cairns served in the ill-fated Gallipoli campaign of that year. After contracting typhoid

in 1916, he was released from the army to continue his studies, qualifying the following year. Now a doctor, he resumed his military service as a Captain in the AAMC, and was deployed to France for the rest of the war.

On his return, Cairns successfully applied for the South Australian Rhodes scholarship to Oxford, where he was to meet Harvey Cushing-later to have a profound influence on his career. He was accepted by Balliol College to read physiology in 1919, and demonstrated his all-round talents by rowing for Oxford in the boat race of 1920, although that year Cambridge was triumphant. Cairns clearly took full advantage of the opportunities Balliol offered, marrying Barbara, daughter of A L Smith, the master of Balliol, in 1921. The same year, he obtained his FRCS and left Oxford for the London Hospital to start his surgical career in earnest. Initially attracted to a career in genito-urinary surgery, Cairns entered the post of first surgical assistant at The London, where he published on congenital cystic kidneys and tumours of the testicle. He was soon invited to give a lecture on his research, as Hunterian professor at the Royal College of Surgeons of England.

Around this time, Harvey Cushing was achieving great fame in Boston as a pioneer in the evolving specialty of neurosurgery, and Cairns was persuaded by George Riddoch, the neurologist at The London, of the opportunities for a neurosurgeon in London trained in Cushing’s methods. In 1926, Cairns was awarded another fellowship, this time by the Rockefeller Foundation, and travelled to Boston to work with the great man. After a year apprenticed to Cushing, Cairns returned to England, creating the first neurosurgical department in a British teaching hospital. By now, he considered himself a specialist neurological surgeon, but as a relative unknown, he found the early years difficult. Indeed the general surgeons, who considered neurosurgery to be merely a part of a standard workload, were initially opposed to the level of specialisation Cairns envisaged. He was certainly advised against limiting his practice to such a narrow field. Cairns was able to point to his superior results to convince the sceptics; at a time when average neurosurgical operative mortality was around 50%, Cairns reported a death rate of 12.2% from his year in Boston [1]. Emboldened by his success rate Cairns, together with Geoffrey Jefferson in Manchester and Norman Dott in Edinburgh, established the specialty in Britain [2].

Still on the staff of The London, Cairns was appointed consultant at the two principal neurological hospitals in London, first Maida Vale (1931-1934) and later at Queen Square (1934-1937), indicating his acceptance by the neurologists of the time. This appointment to Queen Square was a significant achievement, as previously surgeons were considered to be mere technicians by the physicians. Cushing taught his trainees not to be mere ‘handmaidens’ of physicians, but to ‘be one’s own neurologist and radiologist’, a message absorbed by Cairns; thanks to Cairns, neurosurgeons were able to command increasing respect.

Cairns wanted to establish a Department of Neurosurgery, and found willing backers in the Rockefeller foundation. The neurologists of Queen Square were less enamoured with the idea, and with the development stalled, Cairns soon became frustrated by the delay. In 1935 he wrote a memorandum to Farquhar Buzzard, Regius Professor of Medicine at Oxford, suggesting the creation of medical school based at the Radcliffe infirmary-no doubt with the prospect of his own neurosurgical institute in mind. After three years of negotiations between the University, the Radcliffe Infirmary and Lord Nuffield, Oxford University Medical School was founded, initially only for postgraduates. Due to the disruption London suffered throughout the War, a clinical school was later established, and undergraduates admitted. Although the exact level of Cairns’ involvement in the negotiations is unclear, contemporary reports

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leave little doubt that it was significant [3].

The Radcliffe had previously been a small provincial general hospital. Benefaction from Lord Nuffield, and the newly founded Nuffield Chairs of Anaesthetics, Medicine, Obstetrics and Gynaecology, Orthopaedic Surgery and Surgery were to transform it into a medical centre of international importance and fame. Cairns returned to Oxford as the first Nuffield Professor of Surgery, now elected a fellow of Balliol. The idyllic life Cairns fashioned for himself at Oxford was not to last long. Within eighteen months, the possibility of another war became reality, and Cairns found himself increasingly involved.

## World War Two and Cairns' Mobile Neurosurgical Units

In 1938 Cairns was appointed advisor on head injuries to the Ministry of Health, and subsequently consultant neurosurgeon to the Army, with the rank of Brigadier. In his new role, Cairns established a 300-bedded Military Hospital for Head Injuries at St Hugh's College in Oxford. 13 000 servicemen and women would be treated at St Hugh's before the end of the War. In addition, he created two convalescent homes for the rehabilitation of Army and Air Force head injuries. The Navy made separate arrangements. Medical facilities in the UK were, in effect, nationalised to form the Emergency Medical Service; Cairns and Jefferson organised the neurosurgical element. Finally, in the same year, 1938, and envisaging a steel shortage, Cairns had the foresight to order sufficient quantities of instruments, which would be required by Army neurosurgical units in the event of war. As a result neurosurgeons did not want for medical supplies throughout the war, in contrast with other specialties who struggled for equipment after hostilities began.

The experiences of the Great War had illustrated the benefits of early surgery for head injured patients. The result was the creation of Field Hospitals, situated a few miles behind the front, designed to take these patients. The Second World War provided a new challenge; with evolution away from the static trench warfare of twenty years previously, a new doctrine was required. Cairns advocated the formation of mobile field neurosurgical units (MNSUs), able to deploy where needed. Designed by Cairns himself, each unit would be attached to a field hospital, CCS or field ambulance and carry equipment sufficient for 200 operations without resupply. Postoperative patients would then be passed up the chain to the parent unit. Almost all the staff of the MNSUs had trained at St Hugh's military hospital.

The first MNSU deployed to France in 1940, but was soon captured by the German Army, and took no further part in the war. Its replacement as Number 1 MNSU was sent to North Africa where initially it was used to provide general surgical capacity. Of the 238 operations Number 1 MNSU carried out leading up to Alamein, only 27 were for head injuries. The Army kept faith with the MNSU system however, and was rewarded with impressive results.

In 1943, accompanied by Howard Florey (Cairns' successor as South Australian Rhodes Scholar), Cairns toured the North African front to conduct the first clinical trials of Florey's new drug, penicillin. Later that year, penicillin was utilised for head wounds by MNSUs in Sicily and mainland Italy, with great success. The MNSUs soon developed a regime for the management of pyogenic meningitis, previously one of the great dangers of penetrating head wounds.

The faith of the medical hierarchy in Cairns' concept was vindicated by the huge numbers of head injuries successfully treated by the MNSUs. After Alamein, number 1 MNSU relocated to the 15th Scottish Hospital near Cairo, where it managed 3804 neurosurgical patients; number 4 MNSU admitted 6063 head cases from the Yugoslavian campaign alone; number 5 treated 4600 casualties in Italy. MNSUs also saw service in the Far

East where more valuable work was performed, often under very trying operating conditions. In total, seven MNSUs were active; between them they dealt with over 20 000 patients, including over 80% of all head injuries. The benefit of specialist neurosurgical teams is illustrated by comparing figures from MNSUs to units staffed by general surgeons. MNSU 4, while accompanying the 8th Army, achieved primary healing in 97% of scalp wounds, 84% of wounds with an intact dura and 71% for wounds involving the brain; the rates for general surgeons treating Alamein casualties were 50%, 12% and 25% respectively [4]. The concept of MNSUs was imitated by other Armies, with both the Canadians and Americans borrowing some or all of the original ideas.

## Motorcycle Helmets

In May 1935, Lieutenant Colonel T E Lawrence (Lawrence of Arabia) was thrown over the handlebars of his motorcycle in a crash near Bovington Camp, Dorset. He was taken to Bovington Camp Military Hospital, where specialists were brought in from around the country to try and save his life, one of whom was Hugh Cairns. Five days later Lawrence succumbed to his injuries and died.

Early in the Second World War, Cairns noticed the high mortality in motorcycle despatch riders as a result of head injuries. Typically, protective headwear was not worn. Cairns felt that many of these deaths were largely attributable to the lack of protective headwear worn at the time of the injury. Cairns published his observations in the BMJ, noting that over 2000 motorcyclists and pillion passengers were killed in Britain in the first 21 months of the war, with head injuries the most common cause of death [5]. He reiterated his belief in the value of crash helmets repeatedly in the British Medical Journal [6,-8]. Alongside the physicist AHS Holbourn, Cairns began to research different types of crash helmet, using as a basis those worn by racing motor cyclists. Between them, they eventually produced a helmet that was adopted by the Army. Cairns used his influence at the War Office, and the wealth of evidence from his research to persuade the Army hierarchy of the benefit of helmets. The wearing of crash helmets became mandatory for Army motorcyclists in 1941, and for pedal cyclists soon after. An immediate reduction in fatalities was the result. In his paper of 1946 Cairns concluded "*From these experiences there can be little doubt that adoption of a crash helmet as standard wear by all civilian motorcyclists would result in considerable saving of life, working time, and the time of hospitals.*" [8]. The compulsory wearing of crash helmets by civilian motorcyclists did not become law in the UK until 1973, but much of the credit lies with this tireless work by Cairns. A recent Cochrane Database systematic review shows that, in motorcycle riders who crash, helmets can reduce the risk of death and head injury by up to 69%, [9].

## After the War was over

The end of the war saw Cairns reduce his clinical commitments to take up more administrative and ambassadorial duties. He retained his passion for science as head of a department engaged in research on pyogenic and tuberculous meningitis. During his career, he wrote over 100 medical papers on neurosurgery. Notable achievements include elucidating the pathology of Ménière's syndrome alongside CS Hallpike; he was the first surgeon to publish an account of removal of an acoustic neuroma with sparing of the facial nerve [10] and, in 1941, he was the first to describe a form of persistent vegetative state, akinetic mutism, in which the patient appears awake and maintains a normal sleep-wake cycle, but does not react to environmental stimuli, and cannot communicate in any way. This condition was named Cairns' Syndrome in his honour [11]. Cairns returned to this subject several years later, from which arose the last work to be published by him in his lifetime. Perhaps appropriately, given their shared association with the RAMC, Cairns presented this paper as the Victor Horsley Lecture at University College Hospital [12].

For his services during the war, Hugh Cairns was made Knight Commander of the Order of the British Empire (KBE) in 1946. He served terms as President of the Royal College of Surgeons of England, the Society of British Neurological Surgeons, the Association of Surgeons of Great Britain and Ireland, and of the neurological section of the Royal Society of Medicine. He was made an honorary lecturer at the University of Adelaide, and by the Society of British Neurological Surgeons. In 1947 he was made the first Sims Commonwealth travelling professor by the Royal College of Surgeons of England, and in this role toured Australasia and Southern Africa. Hugh Cairns was just 56 when he died of lymphosarcoma of the caecum.

## Summary

Hugh Cairns was a seminal figure in the establishment of British neurosurgery as a separate discipline in the face of general surgical orthodoxy. Thanks to his ideas and energy, the survival rates from neurological injuries of servicemen during the Second World War were dramatically improved. The improvements in head injury outcomes in WW2 can largely be attributed to four factors: the development of MNSUs, improved speed of evacuation, the Military Hospital in Oxford, and new antibiotic therapy, for all of which Cairns can claim credit. To this we can add a lower rate of head injuries due to the introduction of crash helmets, again at his insistence. As a result, the death rate for head injuries in the British Army in WW2 was lower than in any other army [13].

A quote from one of his students after his untimely death illustrates why he remains worthy of remembrance: *'He was to the end a student, eager to learn from anyone who knew more about a subject than he did, and his interests were by no means confined to his own specialty. It was these qualities, together with his charming personality, which made him such a good representative of British Medicine'* [13]. The final word, however, goes to his successor at the Radcliffe, Joe Pennybacker, who described him as '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' [2].

## Acknowledgement

The photograph of Hugh Cairns is reproduced by kind permission of the President and Council of the Royal College of Surgeons of England

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