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History

Professor Edgar Alexander Pask

A. Taylor

Introduction

This year sees the fiftieth anniversary not only of the National Health Service (NHS), but also of the effective establishment of the Academic Department of Anaesthesia in Newcastle upon Tyne. It is appropriate, therefore, to review the life and considerable achievements of its first professor, Edgar Alexander (Gar) Pask.

Early life

Pask was born on 4 September 1912, the second son of a Cheshire businessman. Educated at Rydal School, he won an open scholarship to Downing College, Cambridge, from where he graduated with first class honours in natural sciences, in 1933. He proceeded to clinical studies at the London Hospital, graduating MB BChir in 1937. After 2 years in junior posts at the London, he moved to the Nuffield Department at Oxford, becoming first assistant to Professor R. R. Macintosh.

RAF years (1939–1946)

War was declared shortly after Pask's arrival in Oxford. He promptly volunteered for the Royal Air Force (RAF).[1] In 1940, he was posted to its Physiological Laboratory in Farnborough, the forerunner of the present-day RAF Institute of Aviation Medicine. During the early war years, the Laboratory's research efforts were concentrated on the prevention of hypoxia and the protection of aircrew against g forces.[2] Pask involved himself in this work, acting as the subject for a simulated parachute descent without oxygen from 40 000 feet (12 308 m). It had already been determined that a man could remain unconscious, and yet survive, for a period of 7½ minutes, and that descent with a standard parachute from 35 000 to 20 000 feet (10 770 to 6154 m) took that length of time.[3] In a decompression chamber, and suspended in a standard parachute harness, Pask showed that 30 000 feet (9230 m) was the greatest altitude from which a 'bale-out' could be made without supplementary oxygen.[4]

A somewhat more frivolous enterprise at the time was his development of a device to enable Winston Churchill to smoke his cigars whilst wearing an oxygen mask (Fig. 1). Unfortunately for Churchill, the device did not work as intended, and quickly reduced a premium cigar to expensive ash.[5]

In 1942, Pask undertook his first series of experiments on resuscitation, or as he termed it, 'artificial respiration'.[6] Since the first written description by Silvester in 1858,[7] 74 methods had been documented, but around 100 techniques were probably in use by the outbreak of war in 1939. For these experiments, Pask had himself anaesthetized with ether to the point of apnoea, without

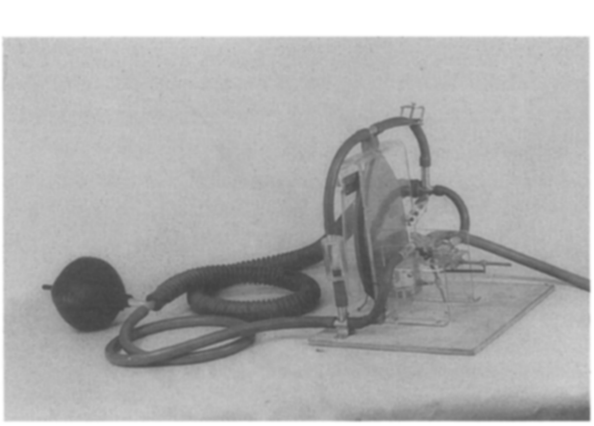

Fig. 1 Cigar-smoking attachment.

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hyperventilation being employed. Using a spirometer to record tracings for 1–2 minutes each time, he and his team tested 13 resuscitation techniques, allowing for prone and supine positions. The duration of 'artificial respiration' was considerably longer in each case than recorded on the tracings.[6] He repeated these experiments in 1945, but this time using 'a considerable quantity' of d-tubocurarine, 'sufficient completely to paralyse spontaneous respiration for about two hours'. Again, he was the subject in all the experiments.[6]

Between 1943 and 1945, he devoted his talents to the development of effective and reliable protective clothing and life jackets. The quality of flying clothing at the outbreak of the Second World War was extremely poor, having changed little since the end of the First World War.[2] There had been no 'in-house' testing facility available to the armed forces until the establishment of the Physiological Laboratory. Much wartime flying was over water, particularly the cold waters of the North Sea and Atlantic Ocean, and so research into the problems of survival at sea was given high priority. Pask's first major task was the development of an immersion suit for the pilots of the Merchant Ship Fighter Unit (MSFU). One ship in each convoy would be equipped with a catapult-launched Hurricane fighter. Once launched, the aircraft obviously could not land back on board, and so had to ditch in water if land was too distant. A suit was therefore needed which would enable a pilot to withstand prolonged immersion in cold water. It had to be watertight and yet comfortable enough for prolonged wear during standby aboard ship. Finding a material which was water- (but not air- or vapour-) tight presented a major challenge: one physiologist had suggested that the only solution was to use the skin and feathers of a sea bird![2]

Pask pursued two approaches. The first was to use a waterproofed leather garment, with a thermal lining of 'Tropal.' This fabric, newly developed during the Second World War, provided both insulation and buoyancy. It was five times more buoyant than cork, and able to support 30 times its own weight.[2] This so-called 'flying coverall' received extensive laboratory and field testing, mostly by Pask himself. Its effectiveness was shown one bitterly cold winter day, when Pask was swimming in the loch at Sullom Voe, Shetland. The test had to be curtailed because the accompanying observers (in a boat) became too cold to continue. Pask, however, was uncomfortably hot when he emerged from the water. As a further test of the garment, Pask had himself parachuted into the sea off the coast of Iceland.[4]

His second approach was to produce cotton fabrics of small pore size and high water repellence. Whilst not as waterproof as the 'flying coveralls,' the resulting garments were sufficient to keep a ditched airman dry for long enough to inflate and board his survival dinghy, besides being lighter and less bulky. They were widely used by the Fleet Air Arm and the Air–Sea Rescue Service. A third type of suit, again Pask's idea, was the exposure suit, but the War was practically over before it entered service.

Pask's work on life jackets was truly pioneering. Like immersion suits, life jackets had received scant scientific attention since the end of the First World War, reliance being placed instead on the flotation properties of kapok-lined flying suits. An inflatable life jacket, the Perrin Arm Brace, had been produced during the First World War, but the RAF traditionally considers the Life-preserver Mark I to be its first.[2] This jacket is better known as the 'Mae West' on account of its supposed resemblance to the contours of that actress. The chief concern was to determine whether the 'Mae West' was actually preventing unconscious survivors from drowning. Experiments were conducted in a swimming pool which had the facility to create artificial waves up to 3 feet (1 m) high, trough-to-crest. Pask knew that a conscious subject could never accurately simulate the behaviour of an unconscious one, so he had himself anaesthetized yet again. His anaesthetist was the RAF Consultant in Anaesthetics, Air Commodore (as he became) R. R. Macintosh.

Following induction, intubation and pharyngeal packing, anaesthesia was maintained with ether in air via a double-lumen, corrugated, non-kinking tube, weighted to neutral buoyancy by wrapping solder wire round it. It was, in principle, the first Mapleson D system, anticipating Bain by 30 years.[8] After proving conclusively that an unconscious subject without a life jacket sank to the bottom of the pool, Pask and Macintosh carried out a full evaluation of the Mae West, plus 19 other 'flotation garments'. In each case, Pask would be allowed to languish while photographs were taken.[9] The Mae West provided satisfactory floating position and self-righting characteristics. However, the Royal Navy's tubular inflatable life belt repeatedly failed to turn Pask from a face-down position, and the Board of Trade life jacket (widely used, and in great numbers) failed to keep a survivor's head out of the water. Pask and Macintosh concluded that a face-up posture at an angle of approximately 45° was most likely to ensure a clear airway and minimize wave-splash onto the face.

Pask's bravery, coupled with his meticulous approach to experimental method, ensured that these experiments became classics of their kind. They were also the basis for his MD, awarded in 1947, and for all future research, much of which he carried out after the War ended. Although details of the wartime experiments were not published in civilian scientific literature until 1957, Pask dryly observed that he and Macintosh did not 'know of any similar work reported more recently'.[9] As it was unlikely that such experiments would be allowed to be repeated in the post-war world, sensitized as it was by the knowledge of Nazi experiments at Dachau, Pask set about creating a suitable dummy. The dummy, named Seaworthy Sierra Sam, eventually had electronics, which Pask designed, enabling the frequency and duration of facial immersion to be recorded.[2] Sierra Sam also had the advantage that it could be used in seas too rough to be safe for a human subject, but Pask still went out in small boats to film its behaviour.[10] This was all the more remarkable because he was particularly prone to sea-sickness.[2] Data from the Sierra Sam experiments were used in the preparation of improved life jackets for merchant seamen and the crews of lifeboats.

There is no doubt that the results of Pask's efforts saved many lives, and this was recognized during the War by the award of the OBE (Military Division) to him in the New Year of 1944. He was also honoured by the Association of Anaesthetists of Great Britain and Ireland (AAGBI), who in 1946 awarded him one of the first three John Snow Medals.[11]

Life after the War

The medical school in Newcastle upon Tyne was a component of the University of Durham until 1963, when it became part of the University of Newcastle. Its principal teaching hospital was the Royal Victoria Infirmary (RVI). The Yearbook of the RVI for 1948 records Pask's proleptic appointment in 1946 as Reader in Anaesthetics, thereby setting the foundation of an academic department, but he did not take up the post immediately. In the interim, and still relatively undecided about his future career path, he worked with Penfield in Montreal and with Waters in Wisconsin. It was Waters who persuaded Pask to return to the UK as an academic anaesthetist, rather than remaining in North America as a physiologist.[12] Pask took up his reader's post in 1947, and was appointed to a personal chair a year later, making him only the second professor of anaesthesia in the British Isles. In due course, the chair was established by the University.

With the inauguration of the NHS in 1948, it had been agreed in Newcastle that the academic head of any department of the medical school would become the chief authority in that specialty. Pask thereby assumed a degree of control over anaesthesia in the RVI and turned his prodigious energies to the organization of his new department. Following the lead of his mentor, Macintosh, Pask's priority was to find a suitable chief technician. He found his ideal candidate in Flight Sergeant Norman Burn, recently demobilized from the RAF. Burn, a trained flight engineer, had volunteered for aircrew duties, but had been rostered instead to serve aboard the launches of the Air–Sea Rescue Service. This work was dangerous and technically demanding, although considered 'a fairly safe job' by the RAF![12] Burn's contribution to Pask's research was vital because Pask's manual skills were not commensurate with his formidable intellect.[12] Laboratory notebooks surviving from this period and later show that actual practical observations and many suggestions for improvement came from Burn. Despite the arrival of the NHS, supplies and funding were in very short supply, a situation to which Pask and Burn were accustomed. Their only ready source of equipment and material was war surplus stock, which they bought at knock-down rates.

Macintosh's influence on Pask had left him with a strong interest in the precise clinical measurement of physiological variables. In the first years of the Newcastle department, Pask and Burn built hardware for these measurements, including a radiometer, capacitance blood pressure monitor, and Britain's first microanalysis blood gas device. Their main clinical impact outside Newcastle, however, was in a field well suited to both Pask's interests and Burn's mechanical skills. The late 1940s and early 1950s saw widespread epidemics of poliomyelitis in the developed world, and the only apparatus available to keep alive large numbers of previously healthy young people was the Tank ventilator, which was labour-intensive and inefficient.

The first 'Newcastle' ventilator was constructed in 1948 (Fig. 2). Powered by compressed air, with electrical switching, it was described by Mushin in somewhat dismissive terms as a 'modification of the Bang ventilator'.[13] It was, however, no secret that Mushin and Pask disliked each other.[12] While true in principle, Mushin's statement overlooks the fact that the 'Newcastle' was the first intermittent positive pressure ventilator to be made in the UK. Pask considered that his ventilator performed 'a function substantially similar to that of Bang's device, but which could be made in a short time from components which are easy to get'.[14] Such a ventilator could be built from scratch in 8 hours by one person, and 'no precision work [was] involved'.[14] From the few surviving parts, it was obviously constructed from war surplus stock. Following successful trials on anaesthetized patients, it was used in the RVI in what would nowadays be termed 'intensive-care' circumstances. Despite needing frequent attention from Pask and Burn,

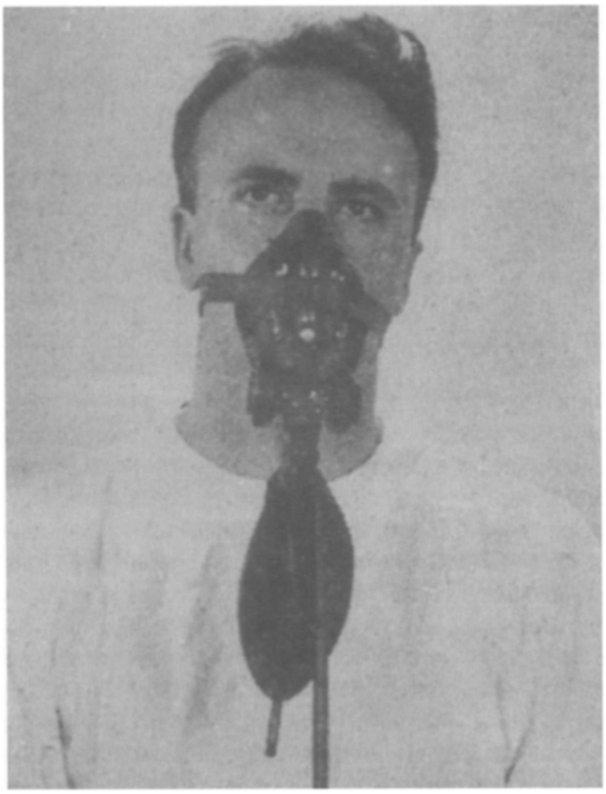

Fig. 2 An early 'Newcastle' ventilator.

it worked. Its main drawback was the intensity of labour needed to keep it going.

The poliomyelitis epidemic in Copenhagen in 1952 showed the potential need for such devices. Here, the successful application of (manual!) intermittent positive pressure ventilation by relays of medical students, plus blood gas analysis, was a landmark in medical history, but the numbers involved would have overwhelmed the resources available for mechanical ventilation, given the equipment generally available at the time.

Over the next few years, the Newcastle team produced a series of ventilators incorporating simple mechanisms and cheap materials, which would do the job at least as well as medical students. Most of these ventilators bore a distinct resemblance to the Oxygen Economiser, developed at Farnborough during the Second World War, and with which Burn, as a flight engineer, would have been familiar. The expected epidemic crisis did not occur, but the simple and effective mechanisms developed for these devices were elaborated into an efficient pressure-cycled ventilator powered by high-pressure air or oxygen. The final form of the Newcastle ventilator was much neater and more sophisticated than the early prototypes, but the series as a whole was characterized by the cheapness, ease and speed with which a ventilator could be constructed.

But what of the man himself? Pask was described by his mentor, Macintosh, as an enigma,[4] presumably because despite achieving so much, he remained shy[12] and modest: in none of the papers relating to his wartime experiments does he mention that he was the experimental subject. Russell, one of his political allies at the RVI, noted him to be a formidable opponent in arguments, 'always ready to pounce on the unwary, but without introducing acrimony or bitterness to a discussion'.[10] Trainee anaesthetists would quite often find Pask walking into the operating theatre at any hour of the night. If he disapproved of their conduct of a case, he was known to turn off temporarily the oxygen supply to the patient, which was somewhat unnerving for an unsuspecting trainee![12]

During Pask's reign, many passed through his department who would subsequently become prominent figures, including Professors Sir Gordon Robson, M. D. Vickers and M. Rosen, and Dr J. N. Lunn. Clinical training and direction were left under the aegis of Dr M. H. Armstrong Davidson, one of the few people formidable enough to hold his own with Pask. Armstrong Davidson had gained considerable front-line experience of anaesthesia during the War, and supplied the clinical expertise that Pask lacked. Despite their differences, they founded the North of England Society of Anaesthetists in 1951.

His organizational abilities made him a valuable and effective committee member: he chaired the medical advisory and planning committees of the RIV, as well as becoming one of its governors. Pask's administrative and argumentative talents were also employed widely outside Newcastle. He was a member of the Board of the Faculty of Anaesthetists from its inception in 1948, until 1962, serving a term as Vice-Dean. For 8 years, he examined for the Final Fellowship, before turning his attention to physiology in the Primary. Pask also acted as an examiner for the Royal College of Surgeons in Ireland, and was due to have received an honorary fellowship only days after his death.[15]

He was President of the Section of Anaesthesia of the Royal Society of Medicine (1964–1965), as well as being a Member of Council and Honorary Treasurer of the AAGBI. For a time, he was a member of the Medical Research Council, and repeatedly emphasized that research should have a practical endpoint, and not be a means solely of achieving publicity for individuals.

Even in the post-war period, Pask remained committed to saving lives at sea, not only continuing his life jacket work, but also serving on the Committee of Management of the Royal National Lifeboat Institution, and acting as honorary medical adviser to the Tynemouth lifeboat station.[15] His interest in the safe practice of his specialty was not confined to developing monitoring equipment, for he was an original member of the central committee established to investigate deaths associated with anaesthesia.[10]

Pask's death and commemoration

As a result of his wartime experiments, Pask was troubled with poor health, but this did not impede his

Fig. 3 Professor E. A. Pask.

work. On 30 May 1966, however, he became acutely ill at home and was admitted to the RVI, where he died shortly afterwards. The memorial service a few weeks later was presided over in part by the Reverend Alfred Pask, his elder brother and Methodist chaplain to the University. In 1977, following the Moorgate Underground disaster, the Council of the AAGBI instituted the Pask Certificate of Honour, to be awarded to 'those who have rendered distinguished service, either with gallantry in the performance of their clinical duties, in a single meritorious act, or consistently and faithfully over a long period'.[11] It is an entirely fitting tribute to a man of such stature in British medicine. It is appropriate also that Burn is a holder of this award, for his assistance in Pask's post-war research proved invaluable. Part of the citation for his Honorary FFARCSI comes to the only possible assessment of his life and work, when it styles him as 'This truly remarkable man, Professor Edgar Alexander Pask'.

Acknowledgements

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