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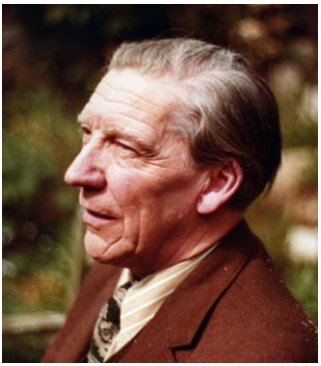 [ii]

After working as a consultant anaesthetist in Lincoln (1943-52) and Birmingham (1952-3) John Clutton-Brock became a lecturer at the University College of Bristol and had consultant status there from 1953. He became head of department in August 1958, and professor in August 1966[i].

Collaborative research links were established with the Veterinary School (1967), and also with the Burden Neurological Institute (at Frenchay Hospital). John Clutton-Brock retired in 1975. Much of his work was associated with pain/clinical topics or equipment. The first two publications preceded 1950, one in 1947 [1] on skin temperature during anaesthesia as an aid to diagnosing shock, and in 1949[2] on the position of electrical anaesthesia.

A low blood pressure without a falling forehead skin temperature was considered of little significance but a falling temperature was of great note and could indicate compensation for shock [1]. The short review of electrical anaesthesia [2] is interesting in that it suggest that J C-B was involved with animal work which the present author has not found (possibly studying fish – personal communication from T C-B). In brief he describes electrical anaesthesia (which had been studied for the previous eighty years) as best with AC current (20-80ma at 2000-800cps) with electrodes in the fronto-parietal position. In primates and man paralysis, airway control and IPPV were necessary. In animal work it had been shown that unless a convulsion had occurred reversal of the anaesthesia was

[i] J F Nunn. British Journal of Anaesthesia. 1999; 83(6): 916
[ii] Photographs courtesy of Tom Clutton-Brock, University of Birmingham

instantaneous on switching off the current with no tissue damage, even after 24h of anaesthesia.

Equipment

There are a variety of equipment related topics, some of great simplicity and some of complexity; from bathroom hooks to hold gas pipes above head height [3], a cradle to hold the transfusion bottle [4] and a perforated face mask to accommodate a stomach tube [5], to custom made ventilators with different respiratory patterns [6,7], phonocardiography[8] and electroencephalography [9].

The custom made (in-house) ventilator had the ability to produce any respiratory pattern including negative phase. The ability to have a negative phase at this time was considered good as it increased venous blood flow and hence augmented the cardiac output, advocated by Hubay and Moloney[iii]. The different patterns of respiration were generated by cams acting on levers acting on a concertina bellow, a very Victorian type of engineering which was still prevalent at that time. A sample of gas could be extracted at any point in the respiratory cycle. The electric motor was controlled with a thyratron, a form of thermionic valve. The second ventilating device was a modified hand ventilator that would also allow negative pressure which was previously impossible using standard systems.

The phonocardiography paper [8], a presentation at the Association of Anaesthetists' Annual Meeting 1969, was an attempt to relate the power of the first heart sound to the blood pressure. A filter was used to isolate the study to a sound frequency of 40cps, the signal being integrated with a time constant of 0.1s. It was thought to be a qualitative measure of stroke work during isometric contraction. This work does not seem to have been followed up.

[iii] Moloney JV jr. Et al. J Amer med ass 1953;152: 212
Hubay CA et al. Anesthesiology 1954;15;445

The work on electroencephalography is largely occult. An overview of the EEG [9] is published in 1961 and includes information about the flicker test and the use of 'scanning' cathode ray tubes to highlight whether the EEG is in synchrony with the flicker. There is a referral to work with W Walter, which is unpublished, but referred to in Trends in Anaesthesia by Evans and Gray, 1958. Referral to unpublished work has diminished over the last few decades. Another paper describes a new display system for display of the EEG [10].

The impression is that J C-B did much more than is obvious from the literature.

The remaining equipment related publications refer to static in and outside rotameters [11], the bottom line being that an inaccuracy in gas flow was never seen if the rotameter was rotating, and a plea, in a letter, for simplicity in the design of anaesthetic machines[12].

Pain

Apart from a paper on the use of xylocaine for caudal anaesthesia in 1951 [13] the three papers of note are those on pain assessment and pain and barbiturates[14-16]. The first paper's main subject is overventilation, but the topic is centred on the measurement of pain during normal breathing and during hyperventilation. At this time many anaesthetics involved minimal anaesthetic agents and a lot of ventilation. It was thought that overventilation increased the depth of anaesthesia. This was studied in volunteers, including the author (and his son).

A household spring balance (kitchen scales) was modified so that when (after removing the pan) the top of the scales could be pressed onto the tibia. The pressure exerted on the tibia could be read of the scale. Using this technique the pain threshold was between 3 and 4kg. During forced breathing it rose to 6-8kg. It was considered that this might be due to cerebral hypoxia induced by the

overventilation[iv]. To clarify the physiology the experiments were repeated and the participants on achieving hypocarbia were given extra oxygen (to relieve any cerebral hypoxia) or amyl nitrate to relieve cerebral vasoconstriction. Pain thresholds returned towards 'normal'. The conclusion was that "cerebral vasoconstriction produced by overventilation may cause hypoxia and should be avoided." This is a significant paper.

The second publication is of the style of an abstract and is a preliminary communication about pain thresholds and premedication (referring to a previous publication [14]) but then goes on to describe the abolition of this effect by small doses of thiopentone (25-100mg). This was described as a transient phenomenon except in the situation where an induction dose of thiopentone had been given which then results in prolonged anti-analgesia because the blood barbiturate levels would be raised for at least two hours. The full version was published in 1961; "...it seems most likely that the explanation [*for the anti-analgesia effect*] will be found in the effects of the barbiturates on the reticular system of the brain stem[v]."

The device used for measuring pain thresholds was improved in 1964 [17]; the scale to be read was linear rather than circular and there was a modification that allowed the pressure to be recorded after the pressure was taken off.

Miscellaneous others

There is a letter about hiccup during anaesthesia [18] in 1952 that demonstrates J C-B's early thoughts on hyperventilation as described above, a paper on the technique to achieve hypothermia, by surface cooling, for cardiac surgery [19]. There is some historical interest for clinicians in this paper, firstly the use of both

[iv] Kety, S. S., and Schmidt, C. F. (1946). The effects of active and passive hyperventilation on cerebral blood flow, cerebral oxygen consumption, cardiac output and blood pressure of normal young men. J. Clin. Invest., 25, 107.
[v] Brazier, M. A. B. (1954). Brain Mechanisms and Consciousness. 163. Oxford.

the drug doses in grains and mgs, the use of only nitrous oxide and oxygen and muscle relaxant (with small doses of opiate) for the anaesthetic, and the use of the EEG to assure the anaesthetist of a light anaesthetic and "The electro-encephalogram has been found to be of more use than the electrocardiogram; changes in the electrocardiogram are not necessarily reflected in changes of the circulation to vital organs, whereas the electro-encephalogram is a most sensitive indicator of cerebral hypoxia."

An overview of the central nervous effects of anaesthetic agents [20] was published in 1961. Some comments may seem cavalier to modern anaesthetists.

> *"It can probably be agreed that the patient should be perfectly comfortable and must not be sufficiently aware of his surroundings to be frightened or upset by them. This upset may be caused by his overhearing what the surgeon has to say—for example, "Let's sew the old bag up now"—or by feeling the surgeon at work in his abdomen, even if there is no pain."*

There was discussion on the nature of consciousness, of neural pathways involved in consciousness and referral to his work on pain and anaesthetic agents. The assessment of depth of anaesthesia was a major problem and an example given of a patient conscious enough to respond to a question (during an aortic aneurysm repair) whilst not retaining the memory of this event.

> *"Amnesia surely is not an adequate substitute for anaesthesia!"*

Electroencephalography seemed to be a possible method of monitoring anaesthesia, however....

> *"With nitrous oxide the author has failed to find any constant relationship between the depth of anaesthesia and the e.e.g. pattern."*

The report on the poisoning of patients with the higher oxide of nitrogen is of interest, the appearance of methaemoglobinaemia and the management with methylene blue[21].

The final paper of comment was that of *Scientific Measurements in sociology* [22]. This is an amusing short 'article' first published in 'Anaesthesia Points West'[vi] and reproduced in the Bristol Medico-Chirurgical Journal. It describes a unit of beauty (the Helen [of Troy]), of strength (the Herm [Hermes]) and when you combine these (1 herme / 1 helen) you get 1 Preg! A milli-helen, by the way, only launches one ship.

John Clutton-Brock was working in the first half of this 50 yr epoch; technology was starting to have an influence on anaesthesia and his investigation of the use of the e.e.g. , the effects of hyperventilation and the measurement of pain are of importance[vii].

Clutton-Brock in his workshop in Bristol

[vi] Journal of the Society of Anaesthetists of The South Western Region
[vii] Obituary:http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1342091/pdf/bmjcred00262-0060.pdf

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