ANÆSTHESIA IN DISTRICT HOSPITALS

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For a long time now I have noticed correspondence in the *British Medical Journal* under the heading 'Complacency in Anæsthesia'.

In England there is a fairly wide choice of anæsthetics, from gas and oxygen, its combinations with ether cyclopropane, ether and chloroform alone or mixed, to all the varieties of local, regional, and spinal anæsthesia, intravenous, tracheal, rectal and so on. In England, again, most serious surgery is done by a team, and an anæsthetic specialist is part of that team. He, to a great extent, shoulders the responsibility and anxiety of anæsthesia. Yet there appears to be but little 'complacency' about anæsthesia in the United Kingdom, although so far advanced over the conditions that obtain in the districts of South India. It would therefore be foolish even to suppose that we in India are complacent about anæsthesia. No, we are far from complacent as every office can show from its files. Anæsthesia in South India outside the city hospitals is one long anxiety, and few escape disaster at some time or other; this undermines confidence, and so the efficiency of the staff, and scares away would-be patients in a curable state—so that one disaster may indirectly cause the loss of more than one life. It is, I believe, rare for the actual surgeon to kill. I personally have not known of a 'fatal mistake' being made, and some districts conduct up to forty thousand surgical procedures a year.

What have the district doctors to choose from?

Chloroform or A.C.E., spinal, local and regional, for ether can scarcely be stocked, let alone used, on account of its volatility.

Intravenous anæsthesia is not suitable for prolonged operations, nor does it give sufficient relaxation. Bromethol and avertin are subject to decomposition and so are avoided in a hot place, especially where there is no trained doctor to administer them. Spinal anæsthesia is suitable for the vast majority of cases and I believe is local for all. But here one comes up against the personality of the patient.

With a strong minded patient or with an ignorant trusting patient one can do anything with novocaine or percaine. But what is one to give to the patient who stoutly refuses any anæsthetic that permits of consciousness in any form while undergoing operation?

Such a patient is a fearful one, and a fearful patient is just the type to die under chloroform.

Before the last war, Dr. Strickland Goodall acquired an electric cardiograph, and being keen to practise with his new acquisition, he subpœnaed his physiology class for experiment for the formulation of data of normal hearts. I was one of that class, and, having started to take a clinical interest in hearts at so early a period, it was only natural that I should gravitate to my teacher's clinic at the Westmorland Street Heart Hospital.

There, Dr. Goodall once gave an amazing clinic, in which he likened the nervous mechanism of certain peoples' hearts to those of rabbits. He expounded on the action of emotion and told us the story of a buck rabbit which, having been kept in solitary confinement, was loosed into the cage of a rutting doe. It died suddenly, and post-mortem examination showed an acutely dilated heart! I well remember Dr. Goodall saying that if one wished to induce experimental ventricular fibrillation, one could do so by frightening a rabbit (now, I doubt not we should give adrenalin) and by giving it chloroform; death is certain and the electric cardiograph will be that of ventricular fibrillation.

Now this knowledge is hardly calculated to give the physician doomed to surgery confidence in chloroform as an anæsthetic, and confidence in any walk of life is essential, if any degree of success is to be achieved; but chloroform is at the present time, in South India, indispensable.

Recently this hospital has suffered a tragic loss.

The patient was a physically fit man of 45 with a sub-acute surgical condition.

Knowing the truth underlying Dr. Goodall's rabbit experiment, I refused to give chloroform. The night before operation, the patient wandered from room to room asking others what they thought of spinal, and went to sleep on allonal with the firm determination to refuse any anæsthetic other than general.

The morning of the operation, he brought forward all his eloquence in firm refusal of a spinal or local anæsthetic, and won the battle only by the threat of a recrudescence of shell shock suffered in the last war. Faced with this situation and realizing that the patient was not in a position to pick and choose his time, I capitulated, and endeavoured to soothe him with promises of cure under complete anæsthesia.

But in a District Civil Hospital there is no choice of general anæsthesia, and chloroform was used. The surgeon stands by reminding himself that adrenalin, whether injected or poured out by fear, plus chloroform produce ventricular fibrillation: and 75 per cent of his attention is diverted towards the course of anæsthesia.

(*Continued from previous page*)

Rogers, L. (1897) .. *Report of an Investigation of the Epidemic of Malarial Fever in Assam, or Kala-azar.* Shillong.

Sinton, J. A. (1938) .. *Proc. Roy. Soc. Med.*, **31**, 1298.

The abdomen is not relaxed, the patient is large and powerful, there are long moments of painful suspense, the anæsthetist nods, the surgeon feels the rigid abdomen, and waits again. There is softening of the rigid abdominal wall and the surgeon makes an incision, the blood looks dark, the surgeon stops—looks—listens—no breathing—no heart beat—all is still. Then all the orders laid down by Hamilton Bailey, which are already framed and suspended in the theatre, are carried out, but there is one point that baffles some of us, and it is that the heart is like a uterus, fairly hard and empty, and massage 'feels' useless, and when it does relax, it is the relaxation of death. So chloroform claims one more victim. The hospital and its staff share the responsibility, the public share the fear, and we go on from year to year, from war to peace and to war again, content to give chloroform to all those patients who are too imaginative for local or spinal, just the type of patient for whom chloroform is the greatest danger.

The present is hardly the time to try and obtain expensive apparatus so urgently required for the defence services. Nor can we expect easy and cheap refills of nitrous oxide, oxygen and carbon dioxide or ether in glass capsules. But the world is alive to the necessity for re-planning for a victorious post-war period, and in India no doubt the medical department and colleges will be eager for improvement. Let us make sure that surgical anæsthesia comes in for more than its share of attention to compensate for the neglect of the past, and that a safe general anæsthetic skilfully administered is placed within the reach of all in the post-war world.

What do we jacks of all trades in the districts know about hearts? Just the bare facts of anatomy, physiology, innervation, and a smattering of embryology, and these bare facts are as follows :—

The heart and vascular system are essential to life; disease of the heart impairs the vascular system, and disease of the vascular system impairs the heart. The heart, like all the other organs, has a one hundred per cent reserve to call upon and so takes a lot of knocking out so long as the innervation remains undamaged. And what an important point this latter is!

Anatomically speaking there are two separate hearts, one to pump blood through the general circulation, and the other to pump blood through the lungs. To economize in space, the two are moulded together.

In the primitive reptilian heart, the primitive cardiac tube is differentiated into four primary chambers in this order : sinus venosus, atrium, ventricle, and conus. These contract consecutively, driving the blood through the skin or gills for oxygenation. Later the conus becomes non-contractile (*i.e.* the first part of the aorta, or bulbus arteriosus) as it is unnecessary to waste effort.

The lumen of the heart then begins to subdivide longitudinally into right venous and left arterial channels by means of longitudinal ridges and septa ; the atrio-ventricular opening becomes divided by the junction across of the endocardial cushions and inter-auricular septum; the inter-ventricular septum then becomes established, and the bulbus cordis (conus) completely divided into pulmonary and carotid channels. An alternative observation is that the heart of vertebrates is formed by the fusion of two symmetrically developing tubes, but in any case the fusion and direction of function is from the bulbar, sinus venosus end, caudally.

Now, it is mechanically obvious to any plumber that a pump must have a certain direction of flow, so he puts in valves to control this. So does nature, but nature does not work by a simple matter of *vis a tergo*, but a matter of co-ordinated muscular contractions, so these muscular contractions must be in a definite order to ensure the onward flow of the blood stream.

To ensure this orderly rotation of contraction and relaxation, heart muscle has evolved a state in which it can be refractory or contractile according to its state of nutrition, for after recent contraction, it must relax and is refractory.

Heart muscle is not like the biceps, just a bundle of separate striated muscle fibres each requiring individual stimulation; its muscle fibres branch, each branch uniting with other branches of adjacent fibres, forming as it were, a cyncytium; there is no cell limiting membrane such as one sees in the muscle cells of the biceps, and so stimulation of one cell spreads to all (all or nothing rule of Starling).

That is why the heart responds to a needle stuck into it, when, in desperation, the surgeon drives a needle through the fourth intercostal space to inject the heart. It does not matter much, so far as I can see, what the surgeon injects so long as he sticks the needle into the heart, for if the heart is going to react at all, it does so immediately, and not after the injected drug has had time to work. The needle has stimulated a few fibres and the stimulus spreads in a way that it could never do in the biceps.

About auricular fibrillation one knows quite a lot, for it does not kill and we have time to stop and think; Lewis has described the circus waves, and Samson Wright gives all the details worked out for the benefit of the student.

Now the muscle of the ventricle is exactly the same. It has two kinds of fibres, as has the auricle. There are true heart muscle fibres transversely striated and branched, and junctional tissue fibres longitudinally striated. It is these latter fibres that are linked up with accelerator (sympathetic) and decelerator (vagus, para-sympathetic); it is indeed these latter that are all-important in the order of muscular contraction.

What an important thing is this order of muscular contraction; it is the whole point at issue that I have in mind at the present time. If the order of contraction is orderly, we go on happily, but if it is upset, it is like a rowing boat in which each oarsman dips his oar at a different time, and pulls in a different direction, some 'catching a crab'. Such a boat will not only stop, but will be in imminent danger of capsizing.

In auricular fibrillation, the auricle is useless; its impulses are so frequent and to the ventricle so obviously silly, that the ventricle ignores them, and by virtue of its own *junctional tissue,* functions independently.

But what happens when the ventricle suffers the same misfortune ?

The circus movement described by Lewis puts three-quarters of the muscle into spasm, the remaining one-quarter being refractory. The heart ceases to function as a pump, and the circulation stops. Death must result.

Samson Wright on page 439 of the 1940 edition says : 'Ventricular fibrillation' may be produced as follows :—

(1)
(2) (All experimental and of no interest to the practising doctors.)
(3)

(4) When low percentages of chloroform vapour are inhaled, the irritability of the ventricles is enhanced to a precarious degree. Injection of minute doses of adrenalin, stimulation of a sensory nerve (*e.g.* the skin incision), etc., may precipitate fibrillation of the ventricle.

Sequence of events :—

(1) Ventricular extra-systoles arise in one or many foci.

(2) Rapid, almost regular, small undulations of the ventricles occur.

(3) Fibrillation sets in, and co-ordinated contraction of the heart fibres ceases. The heart dilates and the blood pressure falls to zero. Inspection shows that the ventricles are convulsed by minute quiverings; one area is contracted, and the adjacent one is relaxed, etc. 'Clinically, fibrillation of the ventricles has been recorded in the *dying* heart.'

'The earlier stages (1) and (2) have been recovered from. Ventricular fibrillation is the mechanism of sudden and unexpected death, with loss of pulses, pallor passing to cyanosis, and a few gasping respirations.'

It is the fate of the physician doomed to surgery to know the danger, and to experience this very vivid description of the facts. If most of the heart is quivering, it feels like a uterus; the fact that it is taught that a heart never goes into spasm is poor satisfaction, for the very obvious fact remains that a three-quarter contracted heart can contract but little further, and so cardiac massage, although considered a wonderful procedure, is of but little value in ventricular fibrillation of chloroform origin.

How long are we to be complacent in the use of chloroform ?

THE NATURAL HISTORY OF A LARGE CYSTIC TUMOUR OF A LONG BONE

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IN October 1936 I was consulted regarding the painful condition of the thigh of the son of a government servant in the employ of the Military Engineering Service. For over six months the boy had been complaining of increasing pain and difficulty in the right thigh on walking. The father thought that his son had always been weak on the right leg, but that recently the boy had been quite lame, and complained that even walking hurt him. He often cried in bed at night.

Clinical examination of the small boy, aged nearly four years, revealed no abnormality, except that he limped badly to the left to take the weight off the right leg. All movements of the joints of the lower limb were free and painless when carried out slowly and deliberately. If any movement, active or passive, was carried out suddenly, yet well within the limits of its range, pain was caused. The right thigh at the upper limits was warmer than the left at a corresponding level. The skin at the same level presented a few visible veins. There was no redness or œdema. There was no increase in the circumference of the affected limb. Deep pressure applied to the right upper thigh was painful and caused the boy to cry out. No other signs could be elicited, although time was spent searching for rarer diagnostic signs. The urine was normal in every way. Blood counts were normal in all respects. *X*-ray examination of the two thighs, the pelvis and hips showed a very clearly demarcated cystic expansion of the upper part of the shaft of the right femur. Plate XIX, figure 1, is a print of this skiagram. A diagnosis of solitary bone cyst was made, after screening the other long bones and spine to confirm the absence of any other tumours. The position was explained to the father, who refused operative treatment. He was advised of the possibility that spontaneous fracture might occur. He agreed to allow me to see the child once a year as far as that might be possible, considering the liability of government officers to frequent moves. I was able to see this case again in 1937, and in 1938; then after a gap of two years I came across the child again in 1941, and in 1942. At each examination up to 1938, the clinical condition was almost unchanged, the limp and pain persisting. The skiagrams of these examinations (1937 and 1938) are shown in plate XIX, figures 2 and 3. During this time the father, as is the custom in India, had consulted many other doctors, homœopaths, herbalists, ayurvedics, etc. Most of these had simply looked at the old skiagrams and advised various vitamin preparations together with calcium. One had given a course of calcium and parathyroid—I could not