

## A HISTORY OF ANAESTHESIA IN SOUTH AFRICA \*

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When the Dutch East India Company sent out Johan van Riebeeck to the Cape of Good Hope it was with the intention of establishing a half-way station for their ships travelling between Europe and the East, so that the crews could be provided with fresh provisions for the long voyage which lay ahead of them. It took over 3 months for the sailing ships to arrive at the Cape from Holland. The ships' surgeons had a busy time in dealing with the many ailments amongst the passengers and the crew, because disease, especially scurvy, was extremely prevalent because of the poor diet and unhygienic conditions on board.

In 1656, 4 years after van Riebeeck established the settlement at the Cape, a hospital had been built for the treatment and convalescence of patients on the incoming ships. In subsequent years the accommodation in this hospital was found to be inadequate and bigger institutions were erected by van Riebeeck's successors. The Company hospitals admitted only their own employees, people who sailed on their ships or members of the military garrison.

In those days the Cape Colony had no medical men with a university education. The barber surgeons and surgeons, who had received their training by being apprenticed to a qualified man, alone represented the medical profession. Their knowledge, however, was limited. The barber surgeons knew only how to treat wounds, and the surgeons employed mainly bleeding and purgatives for most of the ailments with which they had to deal. Dr. C. P. Thunberg, who visited the Cape between 1772 and 1775, reports: 'Both in the hospital and on board their ships, the Company had, for the greater part, ignorant and unskilled surgeons; when a skilful surgeon was found he was a foreigner.'<sup>1</sup>

Some 30 years later, in a book published by the Batavian Government in 1802, a list of the medicines and surgical equipment issued<sup>2</sup> gives some idea of the operations that could be performed. The list covers amputations, trepanning, herniotomy, excision of fistula-in-ano and extraction of teeth. Opium is the

only item with analgesic properties mentioned in this list, as would be expected from the date of its publication.

Further information can be derived from the records of a medical society which flourished in Cape Town from 1827 (or earlier) to 1847. On 2 November 1830 the members of this society laid down the following fees:

|   | £ s. d. | £ s. d.   |
|---|---------|-----------|
| For introducing bougie, probang, catheter, extracting teeth, cupping, bleeding, and minor operations                    | 0 3 0   | to 0 15 0 |
| For the operations of hare-lip, hydrocele, excision of tumours, tapping, amputation of toes and fingers                 | 0 15 0  | to 2 2 0  |
| For reducing fractures and dislocations   | 1 10 0  | to 4 0 0  |
| For capital operations, viz., hernia, amputation, aneurism, trepanning, lithotomy, extirpation of mamma, cataract, etc. | 3 0 0   | to 15 0 0 |

Other interesting features of medical work at that time are obtained from original papers presented at the meetings of this society, the titles of some being: (1) Rupture of bladder; (2) operation for spina bifida, successful; (3) abscess of liver opened (1829); (4) diffused femoral aneurism successfully treated by ligation of the external iliac artery (1833); (5) a report of a chemical analysis of Cape opium; (6) gangrenous sloughing ulcer, cured by opium, gradually increased up to 125 minims daily of laudanum.<sup>3</sup>

This gives us a glimpse of the events in those early days, but how was the pain associated with certain conditions and operations dealt with in the pre-anaesthetic era?

### PRE-ANAESTHETIC ERA

Some knowledge of this period is taken from the writings published by laymen. Peter Kolben in his book *Caput Bonae Spei Hodiernum* (p. 568) relates that the Hottentots, one of the original tribes inhabiting the Cape, had their own barber surgeons. They were acquainted with the treatment of wounds and other injuries, with cupping and with bleeding. When one of their patients had abdominal pains, epigastric discomfort or chest pain they did not administer internal medicines immediately but first resorted to cupping. A cow or ox horn was cut, levelled and sucked to the area of pain until it caused the skin to become anaesthetic. The

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horn was then forcibly removed and the skin incised with a few cuts about half an inch in length. Subsequently the horn was reapplied over the incised area and kept in this position until it filled with blood and fell off on its own accord. The procedure took 2 or more hours depending on the depth and size of the cuts made.

When confronted with a woman in difficult labour they administered tobacco or dagga mixed with milk to hasten delivery. This probably had its beneficial effect by acting as a narcotic.<sup>4</sup>

This type of medication in obstetrics was not only used by the Hottentots. Kolben (p. 322) describes a case of obstructed labour, in which as a last resort Virginian tobacco was shredded into water and the mixture boiled, strained and cooled. After the patient had taken the fluid-extract by mouth, 'she was delivered of the child and of the violent pains'. One wonders what part the ganglion-stimulating effect of nicotine played.

When medical practitioners saw the need for producing insensibility they resorted to quite drastic methods, such as bleeding their patients or putting them into hot baths until they fell into a state of syncope. In others the same effect was brought about by forcible rectal injections of raw linseed oil. To relieve any muscular spasm they administered alcohol by mouth or, if necessary, by means of an enema.<sup>5</sup>

Opium was used with very much the same object in view as it is today, either as a hypnotic in the form of laudanum or as an enema in the form of opium crutum in cases of dysentery. It was also applied topically for localized painful conditions.

Although these methods and preparations were employed on occasions to alleviate pain, there is no indication of their having been used during operations. This has been pointed out by Dr. P. W. Laidler in his historical articles.<sup>6</sup>

Kolben (p. 636), who witnessed an above-elbow amputation in Cape Town in 1708, describes it as follows: The patient, who had his hand and wrist shattered by a gun shot, was brought to the operation room from the general ward and seated in a chair. The barber-surgeon made his skin incision and with three movements of the saw the operation was over. As the dressings were applied the patient exclaimed his astonishment on being shown the amputated arm. After having received a tonic and a heart stimulant he was returned to the ward but died a few days later from complications.

A very good account of an operation performed in 1845 is given by Dr. Henry Bickersteth in the January number of the *Cape Town Medical Gazette* of 1847, the first medical journal to be published in South Africa. It was a case of an aneurysm, in which the left common carotid artery was ligatured. The day before the operation the patient was bled (10 oz.) by venesection. After the bleeding he felt easier, the throbbing pain in the head had decreased and he appeared calm and prepared for the operation. In his article Dr. Bickersteth writes: 'The patient having been laid on the table with his shoulders raised, neck supported by a firm round pillow, and chin inclined towards the right side, the Operation was commenced. . . . The man bore the operation, which lasted about eighteen minutes, most nobly, scarcely uttering a word or moving at all during its performance. He expressed no suffering when the artery was tied, but said he felt much relieved from the distressing pain in the head, of which he had previously complained.'

In the account of the post-operative period it is to be noted that on the 12th day, when the swelling increased in size and was tender to the touch, an opiate preparation was applied locally and a morphine mixture given to relieve the pain.

If these two descriptions represent the conditions of the pre-anaesthetic era in general, it would appear that the surgeons were inclined to operate on fully conscious patients and, rather than rely on drugs for the relief of pain, depend on the rapidity with which they could complete the operation.

#### SURGICAL ANAESTHESIA IN SOUTH AFRICA: 1847-1900

In South Africa 'laughing-gas parties' were quite a novelty in 1846. Members of the Cape Town Institute borrowed a room in the Town House in which they demonstrated the effects of the gas. The reactions of people, who inhaled the nitrous oxide from a bladder, varied considerably. In some the gas produced a state of hilarious intoxication, others became stupefied, and in a few the gas apparently had no effect. As these exhibitions provided great amusement, it was suggested they should be performed in public as a source of entertainment during the winter evenings.<sup>7</sup> This to

some extent parallels similar occurrences described by Thomas Keys in his book *The History of Surgical Anesthesia*.

#### Ether

In the following year the Cape Town newspapers teemed with accounts from overseas of the use of sulphuric ether by inhalation during operations to produce insensibility to pain which, it was said, superseded even the pretensions of mesmerism. At this time public demonstrations of hypnosis were being held in Cape Town, and from India reports arrived of Dr. James Esdaile's work of operating on patients who were in a hypnotic state, a method which in later years was used with some success in South Africa.<sup>8</sup> One of the newspapers<sup>9</sup> referred to Dr. Henry Bigelow's address, which was the first extensive report to be made on ether anaesthesia, and was read before the Boston Society of Medical Improvement in November 1846. (Bigelow was one of the surgeons at the Massachusetts General Hospital.) The newspapers reported that in England Mr. Liston and other principal surgeons employed the inhalation of ether during operations, that the veterinary surgeons had equal success in their sphere of work, and that Professor Clemens of the College of Vevay, in experiments on plants, concluded that they could be etherized as easily as man and animals.<sup>10-12</sup>

The first of these reports appeared in April 1847, about 6 months after Dr. William Thomas Green Morton had given the first successful public demonstration of the use of an anaesthetic (ether) during a surgical operation, at the Massachusetts General Hospital on 16 October 1846.<sup>13</sup>

A published letter dated 24 April 1847 from Dr. Montgomery at Mauritius describes the effects of ether on a patient who was undergoing an above-elbow amputation.<sup>14</sup> The dates of these reports in Cape Town are in keeping with the long time taken for news to travel from America and England.

#### A. Raymond

In South Africa, amongst the enthusiastic but sometimes also sceptical reports, there appeared in *De Verzamelaar, id est: The Gleaner* issued on 20 April 1847 the following small notice: 'Saturday last, an experiment was made by the *Ether Vapour* by Mr. RAYMOND Surgeon Dentist, having drawn from a Gentleman two teeth, and from an other one tooth, without causing any pain—we may therefore congratulate Mr. R. with the good result of his experiment.' This, as far as can be determined, was the first reported occasion on which ether anaesthesia was employed in South Africa.

Mr. A. Raymond described himself as a graduate from the University of Paris; he had his dental surgery in Cape Town at 27 Burg Street. In the following weeks he is reported to have used ether with great success, administering it from an inhaler, which is, however, not described. In one instance in the middle of May 1847 he extracted a carious tooth from the mouth of a mate whose ship was anchored in Table Bay at the time. After the extraction, with the patient still in the unconscious state, he removed a large wart from one of his fingers 'with a single stroke of the cutting forceps'. 'On the patient awakening, Mr. R. expressed a hope that he had not taken too great a liberty by so doing. "Far from it, Sir", he replied, "you have rendered me very great service I should long since have had it taken off, could I have been sure, as now, of its being wholly unattended with pain".'<sup>15</sup>

From the newspapers<sup>16, 10</sup> one is tempted to conclude that the gentleman from whom Mr. Raymond was reported in *De Verzamelaar* to have extracted the two teeth was a medical practitioner. His description of the experiment was as follows: 'A general thrill pervades the body to its very extremities at first, and there occur a series of, as it were, electric discharges in the brain—no better simile is at hand. These feelings give way to a dreamy state, in which external objects partly enter and partly appear excluded: to this follows an utter forgetfulness of everything. The soul appears to have cast off his earthly clog, and to be wandering it knows not where: in a word, there is a complete loss of individuality, a feeling as if one were another person altogether. At this time the operation was performed—the first tooth being extracted without a trace of pain, though it appeared to disturb the lethargic state, so that a dull pain of a trifling nature accompanied the removal of the second. Shortly afterwards the writer awoke, discovering, to his complete amazement, two grim looking teeth on the table at his side. No ill effects followed.'

In the same article he writes that he himself, in association with

others, had successfully experimented with ether, and concluded that this was the liquid which had been used in Boston by Morton. (Dr. Morton did not disclose the true nature of the substance at the time, because he originally had intended to patent his discovery.) The practitioner then goes on to describe some of the observations made in connection with ether anaesthesia. At first the patient almost invariably held his breath and coughed but afterwards becoming accustomed to the vapour breathed quite vigorously. Then followed a period of excitement, which passed off if the inhalations were continued to the point where there was a loss of reflexes and muscular tone, which indicated the stage at which to start the operation.

To carry on in his own words: 'In this unconscious condition the patient will then remain for about three minutes; but it is at the option of the operator to prolong the narcotism to fifteen, twenty or even thirty minutes, without inconvenience to the generality of patients. Thus the most tedious and severe operations of the surgeon, which seldom exceed twenty minutes, and are generally of a much shorter duration, are capable of being performed during the state of insensibility. The most curious circumstance perhaps is that the patient awakes from his lethargy almost at once; but for some hours after, he experiences an unusual buoyancy of spirits, which only evaporates with the ethereal odour itself. In a considerable number of experiments the loss of sensation seems general, but the effects of the vapour are very various.'

He further describes the new remedy as: 'Simple, obvious, free from all show of mystery—except so far as the physiological action of the ether is concerned—the discovery has, in the course of a few months, established itself in the faith of the public as thoroughly as the discoveries of Jenner, Harvey, and the other masters of medical science. It is true that different operators may meet with different success, according to the perfection of the apparatus employed and the susceptibility of the patient; but this is no more than what attends the introduction of every new process—expertness and certainty can only be acquired by an enlarged experience.'

So much for the write-up by the unidentified medical practitioner, which appeared in the *Cape Town Mail* of Saturday 26 June 1847.

#### Henry Anderson Ebdon

Other evidence that experiments with ether had been carried out in Cape Town since April 1847 is found in the *Cape Town Medical Gazette*, of which Dr. Henry Anderson Ebdon (Fig. 1) was the editor. In the editorial of the July number (written in the editorial plural) the investigators describe the apparatus which they employed in the early trials. Later, however, they used a

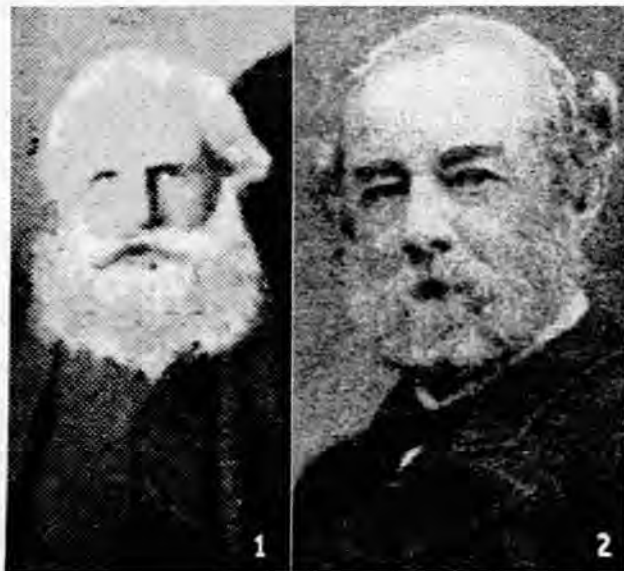


Fig. 1. Dr. Henry Anderson Ebdon.  
Fig. 2. Dr. William Guybon Atherstone.

'Smee's' apparatus in which valves prevented the mixing of inspired and expired gases. This provided greater comfort to the patient, making respiration very much easier. It seems likely that this greater comfort was due in part to the lower concentration of ether vapour and the avoidance of re-breathing and consequent carbon-dioxide accumulation. The experimenters, on inhaling the ether themselves, noticed no difference in the induction time when either of the methods were employed. The experiments with ether caused insensibility to pain in all except two or three cases. In these, failure was attributed to extreme nervousness of the patient, and either to a poor quality of ether inhaled or an irregular working of the apparatus. As it was deemed to be an important acquisition to surgery, it was urged that the profession of the colony gave the new discovery a full trial. It was suggested they use an apparatus similar to their original one, which consisted of a large bullock's bladder containing a 2-inch-square piece of sponge soaked in 1 oz. of pure ether and fitted with a tin mouthpiece, which would cover the lips and the angles of the mouth. The bladder should then be semi-inflated with air and the nose of the patient firmly closed on each inspiration. It was considered that the desired effect would be produced within 3 minutes and, in the extreme, within 8 minutes. It was also suggested that the inhalation of the ether might prove itself to be a valuable palliative and sedative agent in the treatment of spasmodic asthma and in bronchitis of old people.

The next quarterly issue of the *Cape Town Medical Gazette* reported that failures in producing anaesthesia with ether had also occurred overseas. The editorial presumed that it might have been due to the indiscriminate use of the agent, and proposed that the administration should be restricted to patients who did not suffer from head and chest diseases or who were not addicted to opium and brandy. It further relates that 2 amputations had been performed in Cape Town since the last issue of the journal. In the first operation, on a woman of 55 years with arteriosclerosis and in a poor state of health, the patient noticed that the amputation was in progress when she heard the saw passing through the bone. In the other patient, although insensibility to pain had been produced the day before the operation, this degree of success could not be obtained during the actual amputation because of a defect in the apparatus employed. Other reports seem to indicate that the practice of 'trial inhalation' the day before operation was not infrequent.

#### J. Esterhuyse

Not only did man benefit by the new discovery, but it was also used with advantage in operations on animals. In a communication from Stellenbosch dated 10 May 1847, it was reported that Mr. J. Esterhuyse removed a tumour weighing 2½ lb. from the lower eyelid of a horse whilst the animal was under the influence of sulphuric ether. The apparatus he designed was simple, practical and effective. A sheet of wax cloth was rolled to form a cone. The wider end was fixed around the muzzle of the horse and the other end was attached to the ether bottle, which was placed in hot water. Within 1½ minutes the animal fell and remained motionless for 18 minutes, during which time the growth was excised and a hot iron applied to the wound.<sup>17</sup>

#### William Guybon Atherstone

Whilst ether anaesthesia was becoming established at the Cape, a medical practitioner in Grahamstown, Dr. William Guybon Atherstone (Fig. 2) reported his success with ether in abolishing pain during an amputation. This report appeared in the *Graham's Town Journal* on 19 June 1847, and in an article by Dr. Atherstone in the same newspaper dated 26 June 1847. For some time he had experimented with ether in different types of apparatus with and without valves. He eventually decided to use a 2-quart bottle containing 2 oz. of ether stopped with a cork through which 2 holes had been bored (Fig. 3). Through one aperture he pushed a glass tube ½ inch in diameter until the one end reached a position ¼ inch from the ether surface. In the other hole an elastic tube with an ivory mouthpiece was fixed for the inhalation of the ether vapour. Both tubes were then blocked for some minutes to allow the air in the bottle to become saturated with ether vapour. After this the apparatus was ready for use.

Dr. Atherstone emphasized that the success of producing anaesthesia depended on the rapidity of induction. He contended that rapid evaporation of the ether should be aimed at by increasing the surface area of ether rather than applying heat. For this

reason, and also that the vessel might contain sufficient ether vapour, he used a large bottle. He found that if the ether bottle were placed in hot water—a method which he had seen recommended in English papers—the patient was unable to inhale the vapour. It produced a burning sensation in the chest and caused the patient to cough.<sup>18</sup>

He further recommended that the elastic tube should have a large enough diameter to diminish the resistance to inspiration, the respiration should be slow and deep and the breath should be held at the height of inspiration for a few seconds before the gas was exhaled.

The operation was performed on Mr. F. Carlisle, the Deputy Sheriff of Albany, who had suffered from a contracture of the leg for 27 years. In the course of time an ulcer had formed. He would have had the limb removed years ago had it not been for the pain associated with such an operation. After he had inhaled ether vapour and had satisfied himself that it could deaden pain, he consented to the operation under the condition that he would give the signal when the surgeon could begin. So on Wednesday 16 June 1847 everything was set for the amputation. After the



Fig. 3. Atherstone's ether apparatus.

patient had inhaled the ether vapour for a short while, he pinched himself repeatedly to ascertain the degree of insensibility. Eventually he gave the word that the operation could commence. Dr. W. G. Atherstone, assisted by his father and two other medical practitioners, amputated the thigh through the lower third. As the nerves and vessels were cut the patient gave an involuntary scream. When the leg was off the ether bottle was taken from the patient and he started recovering. The whole procedure had taken about 3 minutes.

When he had come to his senses Mr. Carlisle said: '... it's the greatest boon ever conferred on man, I have been totally unconscious of everything—the sound of that horrid saw still grates upon my ear as if heard in a dream from which you have just awoke me, but as for pain I have not felt the slightest.'<sup>19</sup> (He recollected later that he had a dream of attending an amputation on another person.) The patient did well after the operation, except for a period of delirium tremens attributed to the sudden cessation of opium applications, which he had been putting on the ulcer for years. This episode was checked by the administration of a laudanum enema.

It is of interest to record Dr. Atherstone's observations during the operation and his view on the mechanism of producing muscular relaxation. When he had cut the arteries and veins he noticed that the blood issuing from both was dark. He realized that this was due to sub-oxygenation and voiced a warning against carrying on the ether inhalation for a long time. He pointed out that, where previously several assistants had been necessary to overcome the muscular resistance in reducing dislocations and fractures, now ether could be employed to provide adequate muscular relaxation,<sup>18</sup> but erroneously attributed the relaxation more to the partial asphyxia than to the ether itself.

To ensure that all the medical practitioners would benefit by the new discovery and because there was no medical journal in the

Eastern Province he sent a detailed description of the procedure to the newspapers.

#### Chloroform

Towards the middle of 1848 the news of a new liquid which had the same effect as ether reached South Africa and in August of the same year this latest medicine, perchloride of formyle, or chloroform, was being advertised to have arrived in Grahamstown.<sup>20</sup>

On 26 May 1849 the *Graham's Town Journal* reported on an operation which Dr. W. G. Atherstone had performed a fortnight previously on a young man, John Swan, who at the time had been anaesthetized with chloroform. After the operation, which was for the excision of a wen in the front of the neck, the patient declared that he had not felt the slightest pain and the only event of the operation he could recall was that of a confused uneasy dream.

In Cape Town the first public announcement of the successful use of chloroform locally appeared about a year later,<sup>21</sup> after Dr. Biccard had administered the anaesthetic for the fourth time. On this occasion he gave it to a woman for the removal of a tumour in each breast to prevent cancer. 'She inhaled for a few minutes Chloroform to about the quantity of a dram and a half. Upon her being overcome by its effects the operation was commenced and finished without her feeling any pain.' The article ended by saying it hoped to serve the country inhabitants, who were unable to acquaint themselves with the increasing methods for alleviating human suffering and were pining under diseases which could only be removed by surgical skill, and that they 'will find something in this short statement to cheer their spirits, and enable them to meet the dreaded hour of the surgeon's call with a composure to which they would have been strangers.'<sup>22</sup>

Thus the first great stumbling-block in the advancement of surgery had been overcome, but another big problem still had to be solved. This problem was that of sepsis, which was responsible for an extremely high mortality and morbidity rate amongst patients treated surgically.

#### Carbolic

At a time when the world was acclaiming the success of ether anaesthesia the Hungarian Semmelweiss published his treatise on asepsis in 1847. In dealing with puerperal mortality he was convinced that direct contact of uninfected hands and material was the cause of sepsis in the uterus. By disinfecting the hands in chloride of lime he reduced the puerperal mortality from 9.9 to 1.3%. Although he had a few followers his work was not recognized by the majority. Twenty years later, Lister presented his antiseptic technique in the treatment of compound fractures. For many years he too had to fight for the acknowledgement of his theories against the opposition of his professional brethren.<sup>23</sup>

One of his first followers in South Africa was Dr. J. P. Fitzgerald of King William's Town. The Colonial Government had drawn his attention to Lister's ideas and methods. In a letter dated 6 March 1869 addressed to the Colonial Secretary at Cape Town, he writes on his experience of using carbolic acid in the treatment of extensive lacerated wounds and mentions that he had used it as a dressing after amputations. He was most impressed by the sudden cessation of pain after the application of carbolic acid on several contused and lacerated wounds and by the freedom from local and constitutional disturbances resulting in the rapid recovery of his patients.<sup>24</sup> This is the first reference to any form of local anaesthesia in South Africa by the application of drugs. To this day phenol has its place as a local anaesthetic for topical application and as a powerful disinfectant. However, mortality following surgery remained relatively high until Semmelweiss' teachings of asepsis were brought to light again by Schimmelbusch under the guidance of von Bergmann. Thus the present era of aseptic surgical technique was born in 1885.<sup>25</sup>

#### Chloral

In the mid-1870s Dr. J. F. Allen of Pietermaritzburg experimented with chloral as an anaesthetic for children. After the administration of 45-60 grains the state of unconsciousness persisted for 3-4 hours. He found that this type of anaesthetic was not attended with success in adults.<sup>25</sup>

#### Chloroform and Ether

When operations were performed, and in those days they were few and far between, chloroform was the anaesthetic chosen in

the majority of cases.<sup>26</sup> In obstetrical practice, however, chloroform was only employed in isolated instances, and craniotomy was preferred to Caesarean section;<sup>27</sup> one presumes that the former was performed without anaesthesia.

Where general practitioners were separated from one another by hundreds of miles, they were obliged to operate single-handed. The doctor was both anaesthetist and surgeon. After inducing anaesthesia himself, he handed over the administration of the anaesthetic for its maintenance to the local village constable or the chemist, to the teacher or the patient's wife, to the dentist, or even to his own 'Cape boy' cart driver, whilst he himself carried out the operation and also kept a watchful eye on the general condition of the patient as well as on that of his lay helper; the watchword being, as expressed by James Syme's aphorism, 'attend to the respirations, never mind the pulse'.

#### Deaths under Anaesthesia

The practitioners rarely administered ether alone; usually it was in combination with chloroform or with chloroform and alcohol—the A.C.E. mixture, which contained the agents in various proportions to individual liking. The main reasons given for the uncommon use of ether were its pungent property and the lack of teaching in anaesthesia. Chloroform was more easily administered and the induction was more pleasant to the patient. In 1907 only 8 out of 22 medical examining bodies in Great Britain required students to show evidence of instruction in anaesthesia, but in 1911 the General Medical Council of Great Britain stated that all medical examining bodies required their candidates to show proof of knowledge and training in anaesthesia.<sup>28</sup> The majority of students considered it a necessary evil to study anaesthesia to comply with the regulations, and after qualification the young doctors showed very little interest in the administration of anaesthetics, which was chiefly by the 'rag and bottle' method.

However, the increase in the deaths with chloroform administrations, often occurring during the induction period, became a matter of great concern amongst the medical profession. In South Africa the death of a person whilst under the influence of a general anaesthetic was subject to investigations by the Resident Magistrate or Field Cornet because of the interpretation of the Inquest Act of 1875, and later of 1919. Before this, the holding of an enquiry in cases of a sudden death had become necessary by custom in the Cape Colony;<sup>29</sup> it became a written law with the promulgation of the Act. To-day the same regulations are valid by virtue of section 86 of the Medical Dental and Pharmacy Act, 1928.

It was soon recognized by many that chloroform was not suitable for patients sitting in the dental chair and that the proportion of deaths during anaesthesia was higher at Johannesburg than at sea level. By far the majority of fatalities at Johannesburg took place when the patients were under the influence of chloroform.<sup>30</sup> In the last decade of the nineteenth century and in the beginning of the twentieth medical men in South Africa voiced the opinion that ether was safer than the generally used chloroform, and so ether became more frequently employed. One of the advocates of a change in this direction was Dr. George Warwick Bampfylde Daniell, the first specialist anaesthetist in South Africa.

#### THE MODERN DEVELOPMENT OF ANAESTHESIA IN SOUTH AFRICA

##### George Warwick Bampfylde Daniell

Dr. Daniell qualified in 1888 M.R.C.S. (Eng.) L.R.C.P. (Lond.). The following year he came to the Cape and set up as a general practitioner in Caledon, where he remained until 1897. After the Boer War, in which he acted as a Civil Surgeon, he left for England to devote his time to anaesthesia, and was appointed as an anaesthetist to various hospitals in Great Britain and as a lecturer in anaesthesia to medical students. In January 1906 he returned to South Africa and began to practice in Cape Town, confining himself entirely to his speciality. A year later he moved to Johannesburg, where he had been appointed as a specialist anaesthetist to the Johannesburg General Hospital. After his resignation in 1908 he was succeeded by Dr. Frank Burnand Mudd. In 1921 Dr. Daniell and Dr. Mudd accepted the lectureship in anaesthesia at the Cape Town and Johannesburg medical schools respectively. Ten years after his retirement Dr. Daniell died in Port Elizabeth on 16 January 1937. In his time he was regarded as the highest South African authority in anaesthesia. He designed and modified various appliances, some of which were in use as recently as 10

years ago. He contributed many articles towards the medical literature.

#### Ethyl Chloride

Whilst he was in England he invented the Daniell ethyl-chloride inhaler (Fig. 4) which was then considered the best of its kind. It allowed for the gradual administration of ethyl chloride, whereas beforehand ampoules had been crushed and the liquid poured on to a mask, allowing but poor control of vapour concentration. The inhaler came into use in South Africa in 1904. Before this time ethyl chloride had seldom, if at all, been employed in this country. In a letter which appeared in September 1904 in the

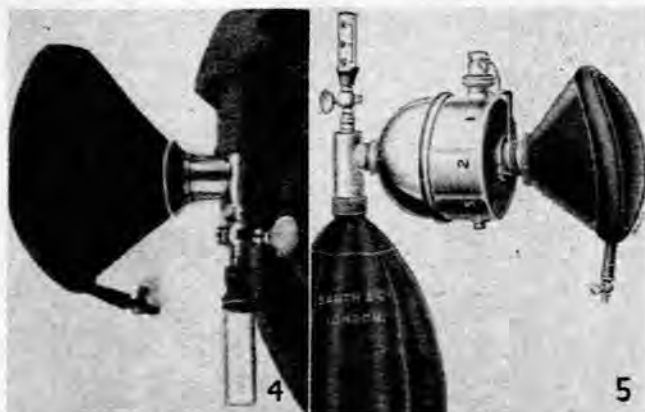


Fig. 4. The Daniell ethyl-chloride inhaler.  
Fig. 5. The Clover ether inhaler.

*South African Medical Record*, Dr. C. J. Hill Aitken from East London wrote that ethyl chloride was as safe as gas and much handier, because the inhaler and the glass cylinder could be carried in a small handbag. 'Without doubt it will be a boon to the Profession and to the public.' At first ethyl chloride was used continuously throughout operations, but this technique was soon abandoned and its primary function became that of an inducing agent and ether was administered for maintenance.

#### Nitrous Oxide

The gas referred to in the above letter is nitrous oxide. As the continuous-flow method of administration, which required large quantities of the gas, was the only one known at the time, practitioners, for economic reasons, used it sparingly. They mainly gave it as an inducing agent, for short operations and in dentistry. The preparation of the gas involved high costs and it had to be shipped from England to South Africa. For refilling, the cylinders were sent back, where they were tested by the English Board of Trade and sometimes discarded without compensation. When the compressed gases were returned they could only be transported at special rates and on special ships as deck cargo. It took at least 3 months before the cylinders reached their owners again. During the 1914-18 war the shipment of the cylinders was prohibited; after the war until the early 1930s the administration of the gas remained uncommon here except for bad-risk and special (e.g. diathermy) cases.<sup>31</sup> It was only in 1928 that the firm Allen Liveridge Industrial Gas (S.A. 1927) (Pty.) Ltd., Johannesburg, later known as African Oxygen and Acetylene (Pty.) Ltd., manufactured nitrous oxide in Johannesburg on a commercial scale. The plant they installed was capable of producing several times the then known requirements of the Union, Rhodesias and adjacent territories.<sup>32</sup> The development of the re-breathing and carbon-dioxide absorption techniques and the local preparation of nitrous oxide brought down the cost of this anaesthetic to a reasonable level, and the surgeons, at the request of their patients, gradually increased their demand for nitrous oxide and oxygen anaesthesia.

#### Oxygen

Shortly after Dr. Daniell started his anaesthetic practice in South Africa he gave demonstrations of nitrous oxide and oxygen anaesthesia throughout an operation,<sup>33</sup> but its use remained confined to isolated cases for a considerable time. When he

moved to Johannesburg he found that neither nitrous oxide nor oxygen was available at the General Hospital.<sup>34</sup> It was not the practice to administer oxygen in association with anaesthetic agents. The original idea of adding oxygen to an anaesthetic was to diminish the respirations, but Dr. Daniell emphasized the safety and comfort it contributed in anaesthesia. However, in 1908 oxygen was not easily obtainable and the transport of the cumbersome cylinders with oxygen and nitrous oxide further limited their use, especially in country districts.

To overcome this disadvantage a portable apparatus called 'Oxone' generator was advertised and probably used to obtain oxygen. 'Oxone', a compact preparation of hydrogen peroxide, produced oxygen when brought into contact with water and it was alleged to be generated at the exact speed required for the inhalation in a man's lung.

In 1908 the New Transvaal Chemical Co. Ltd. manufactured oxygen on a commercial basis and in 1915 Lever Bros. (S.A.) (Pty.) Ltd. took a controlling interest in this Company. The goodwill, plant and stock of Lever Bros.' oxygen business at Denver and at Congella, Durban, were disposed of to the Allen Liverside Company 12 years later.<sup>35</sup>

Although oxygen was being manufactured in this country, its price remained high for many years, which of course did not encourage its use. During the First World War a shortage of oxygen cylinders caused an irregular supply, and even for some years later these cylinders continued to be a novelty.<sup>36</sup>

Ethylene was not used in South Africa to any extent, the only record I could trace in this respect was in connection with experiments made by Dr. T. Greenwood Hall in 1921. He had saturated ether with ethylene and carbon dioxide and used this agent as an anaesthetic in surgical and dental operations. At about the same time a description of this anaesthetic, called 'Ethanosal', appeared in a résumé of a paper by Drs. Wallis and Hewer in the British Medical Journal.<sup>37</sup>

The commonest method of administering anaesthetics was the open one by means of the wire-framed mask covered with lint or wide-meshed gauze, but the practitioners did employ others as well, such as the Clover inhaler with its modifications (Fig. 5), the Shipway apparatus, or rectal and local anaesthesia.

**Endotracheal Ether-Oxygen.** For operations around the head and neck and where the practitioner had to work single-handed, rectal anaesthesia was advised. It was given either by introducing warmed ether vapour or a warmed mixture of ether and olive oil into the rectum. In 1915 Shipway's endotracheal ether-oxygen apparatus came into use. It was recommended for head, chest and upper abdominal operations and for applying artificial respiration.<sup>38</sup> After the patient had been anaesthetized a catheter of such a size as to allow the expiratory gases to pass easily between the catheter and the laryngeal wall was introduced either down the larynx or through the laryngotomy or tracheotomy opening which had been made beforehand. By means of a hand bellows—in later years by a foot bellows or by an electric motor working a rotary blower—air alone or with oxygen could be pumped through the ether container. The ether vapour was then led through a coil immersed in a hot-water receptacle (Fig. 6), and from there the warmed ether vapour reached the patient either through the endotracheal catheter or *via* a mask made of porous material or

of perforated celluloid in which the holes had been partially occluded with a sponge or a piece of flannel. Dr. Daniell modified this apparatus by passing the air and oxygen first through a coil immersed in hot water and subsequently through the ether. From the ether container the vapour reached the patient *via* the warmed coil as already described (Figs. 7 and 8). When the patient's own respiratory movements had been abolished the pumping mechanism maintained adequate ventilation. Thus, this method of controlling respiration has been known for over 40 years.\* It probably, however, operated largely through diffusion respiration.

As practitioners realized the safety of ether as an anaesthetic agent its use increased and by 1921 Shipway's warmed-ether apparatus had become so popular that it was used extensively by private practitioners and in hospitals throughout South Africa.<sup>39</sup> It enjoyed that position for a quarter of a century.

*Ether was first produced in South Africa* on a commercial scale in January 1918 by the firm The Natal Cane By-Products, Ltd., which had been established 3 years previously. Anaesthetic ether was imported from overseas before this, and still is to some extent.<sup>41</sup>

**Local anaesthesia** was not frequently employed by practitioners in South Africa. Its regular use was mainly confined to the ophthalmologists and the dentists. At first only those trained on the Continent practised regional anaesthesia.

**Lumbar Anaesthesia.** At the South African Medical Congress held in Pretoria in 1907, Dr. E. F. A. Sthamer read a paper on Lumbar Anaesthesia and its practical application in surgery, in which he gave a description of the method and some of his experiences with this type of anaesthesia.<sup>42</sup> However, the difficulty in mastering the technique of spinal, caudal, epidural, and nerve-block infiltrations and the time necessary to perform them hindered their extensive use.

**Pre-operative Care.** Another important development which took place in the first 2 decades of this century was the more adequate preparation of the patient for an anaesthetic. Whereas anaesthetists hardly ever examined their patients systematically beforehand and, if they did, then it was only where there was a suspicion of heart or pulmonary disease, it now started to become a routine. It was urged that blood-pressure readings should be included to determine the state of the cardio-vascular system pre-operatively, and that urinary examinations would reveal important information.

**Premedication.** Practitioners began to realize the benefit of the administration of drugs before the operation, not only as an adjuvant to the anaesthetic and a counter-balance to its side-effects, but also to allay the fear in the patient's mind and to ensure a good night's rest. Atropine had been injected pre-operatively on some occasions, chiefly to counteract the inhibitory effect of the vagus on the heart; its use became more frequent to minimize salivary excretion with the increase in ether anaesthesia. By some hyoscine was favoured because of its additional depressant

\* The first apparatus for maintaining prolonged periods of artificial respiration was demonstrated by Dr. W. Steuart in Johannesburg in 1918. It was made for the treatment of children suffering from respiratory failure in an epidemic of anterior poliomyelitis. As, however, the apparatus was only completed after the last patient had died he called for suggestions which would render it more efficient should it come into operation. Whereupon it was proposed that a dog should be fully curarized to act as a test.<sup>39</sup>



Figs. 6, 7 and 8. Daniell's modification of Shipway's endotracheal ether-oxygen apparatus.

effect. The addition of morphine to the premedication also put the patient in a calm state of mind, and reduced the amount of anaesthetic required during the operation. At first an objection to this use of morphine was that it affected the size of the pupil and thus interfered with an important sign of the depth of anaesthesia, but practitioners soon learnt to put more reliance on the type, regularity and amplitude of the respirations and on pulse and blood-pressure readings. Authorities advised not to give too large a dose of morphine, because this delayed the return of reflexes and of consciousness, and to be wary in giving it to patients with increased intracranial pressure and advanced respiratory diseases. At times patients received chlorbutol (Chloretone), potassium bromide or barbitonum (Veronal) as substitutes for morphine in the premedication.

On some occasions the morphine-scopolamine combination in repeated doses constituted the sole anaesthetic, which if necessary could be supplemented by ether inhalations. This combination also found its use in obstetrics to produce 'twilight sleep', but the danger of respiratory depression in the newborn was repeatedly emphasized.

In the conduction of anaesthesia Dr. Daniell stressed the importance of a clear airway, adequate oxygenation, and free chest expansion. Apparently the anaesthetists of that time had difficulty in dealing with their female patients, who were reluctant to loosen their corsets sufficiently. An American gynaecologist estimated that they produced an all-round pressure of 30 lb.

**Intravenous Anaesthetics.** A new era in the administration of anaesthetics commenced in this country with the introduction of hexobarbitonum solubile (Evipan sodium) in 1933.<sup>43</sup> It provided a rapid and pleasant induction, thus avoiding the feeling of suffocation produced by the mask. It is true that basal narcotics such as the rectal administration of bromethol (Avertin) since 1930<sup>44</sup> and the intravenous injections of butyl-β-bromallyl barbitone sodium (Pernocton sodium) and of pentobarbitone sodium (Nembutal) had been employed, but it was Evipan sodium which popularized the use of intravenous anaesthesia. The drug now most commonly used for this purpose is thiopentone sodium (Pentothal sodium), which Dr. C. W. H. van der Post, of Durban, administered for the first time in South Africa in 1936.<sup>45,46</sup> Although a 10% solution of the drug was injected originally, experience taught that a lower concentration provided a more accurate dosage, which contributed to greater safety, and also made perivascular reactions less likely to occur if some of the solution were inadvertently deposited in the tissues.

**New Inhalation Anaesthetics.** Two years previously a new inhalational anaesthetic, cyclopropane, had been brought out to South Africa by Dr. Royden M. Muir.<sup>47</sup> During his visit to the United States of America in 1933 Dr. Waters of Madison coached him in its use. Encouraged by what he had seen in America, and after some experience, he took 2 cylinders filled with cyclopropane back to England and gave the first administration with it in London.<sup>48</sup> On his return to South Africa he started giving it in Cape Town. Its use, however, remained limited mainly owing to the high cost of the gas.

After the Second World War many developments took place in the field of anaesthesia. In 1946 another new inhalational anaesthetic, trichloroethylene (Trilene), made its appearance in South Africa.<sup>49</sup> It was to replace the chloroform in using the Boyle's apparatus. This machine gained in popularity and gradually replaced other appliances to a large extent. Its use, or that of an apparatus resembling it in construction, became imperative with the advent of curarimimetic drugs as a means of assisting or controlling the respirations by intermittent positive pressure.

**Relaxant Drugs.** Whereas good relaxation could previously only be achieved with local or deep general anaesthesia, intravenous injections of d-tubocurarine chloride now gave the same effect with light general anaesthesia. South African anaesthetists gained some experience of d-tubocurarine chloride at the various theatres of war, but its more general use in this country, as Intocostrin, dates from 1946.<sup>50</sup>

After this, various other relaxant drugs were tried out—gallamine triethiodide (Flaxedil)<sup>51</sup> and decamethonium iodide (Eulissin)<sup>52</sup> in 1949, succinyl chloride (Lysthenon, Scoline)<sup>53</sup> in 1952, and laudexium methosulphate (Laudolissen)<sup>54</sup> in 1953. Furthermore, in recent years hypotension and hypothermia, have been developed as adjuvants to general anaesthesia, which in selected instances have been a valuable aid in various operations.

#### THE STATUS OF ANAESTHESIA IN SOUTH AFRICA

By force of circumstances a general practitioner of the early days often had to call in the help of laymen to give anaesthetics. Only 30 years ago the following statement was made: 'Any practitioner can legally employ anyone whomsoever as an anaesthetist, he shouldering the whole responsibility'.<sup>55</sup> Such action, however, was condemned except in special instances,<sup>56</sup> but it was doubted if any Medical Council (until 1927 every Province of the Union had its own Medical Council) would regard it as a ground for disciplinary action.

In 1927 the Federal Council of the Medical Association of South Africa passed rules for professional conduct which *inter alia* set out that it was detrimental to the honour and interests of the medical profession to employ an unregistered person as a paid anaesthetist at an operation.<sup>56</sup> Nine years later the South African Medical and Dental Council put the matter quite clearly by resolving 'that the administration of anaesthetics was an act pertaining to the calling of a medical practitioner'.<sup>57</sup> Dental practitioners, however, had been administering anaesthetics since the early days and according to a notice sent to them in April 1938 were permitted to give nitrous-oxide anaesthesia. This apparent restriction was done away with in 1944 by a resolution passed by the South African Medical and Dental Council, which read: 'The Council further resolved that in the practice of dentistry, the administration of anaesthetics by dentists should be unlimited'<sup>58</sup> and some provisos were added.

When the registration of specialties was introduced in 1938 to protect the public and medical practitioners from the pseudo-specialists, anaesthesia was listed among the specialties of medicine.<sup>59</sup> The regulations governing specialization since that time have been revised from time to time. After the Second World War a medical practitioner had to be in the possession of a higher qualification in Anaesthesia in addition to other requirements, before he could register as a specialist anaesthetist. The Witwatersrand Medical School, Johannesburg, was the first to provide facilities for such a higher degree to be taken in South Africa, instituting the Diploma in Anaesthesia<sup>60</sup> in 1947. In later years the University of Pretoria and the University of Cape Town also made it possible for medical practitioners to obtain a higher qualification in Anaesthesia.

During the last war, on 1 August 1943, the South African Society of Anaesthetists was founded in Johannesburg. This organization is a Group of the Medical Association of South Africa and has as its main aims (a) the promotion of the science of anaesthesia; (b) the correlation of the interests of all practising anaesthetists in South Africa and the determining of the relationships which should exist between anaesthetists, and between anaesthetists and hospitals (public and private), Government authorities, the general public and the medical profession in general; and (c) to represent and further the interests of anaesthetists.<sup>61</sup>

At the instigation of this society a separate Section of Anaesthesia was formed for the first time at the 34th (1st post-war) South African Medical Congress, which was held in Durban in October 1946. At the end of the opening plenary session on the 'Conquest of Pain' the Congress passed a unanimous resolution stressing the desirability of founding Chairs in Anaesthesia at the South African medical schools.<sup>62</sup> The University authorities did not consider the time ripe for this action. In 1947 none of the medical schools had well organized departments of anaesthesia, but since that time the position has greatly improved by the appointment of full-time teaching staffs.

Nevertheless, the recommendations made by the Commission of Inquiry into Anaesthetic Deaths, appointed by the Government in January, 1936,<sup>63</sup> have only been partly observed, for it is possible that an intern at certain institutions may go out into general practice without having given a single anaesthetic during his internship year. This has been criticized for the reason that the theoretical as well as the practical teaching of anaesthesia is of great importance in the training of students and interns, if skilled medical practitioners are to be provided throughout South Africa for the safe administration of anaesthetics.

In the past a comparison has been drawn between intravenous anaesthesia and the Libyan Desert, which Rommel is reputed to have described as a tactician's paradise and a fool's graveyard. To-day this analogy could well be applied to every sphere of anaesthesia. If the present-day anaesthetist is to fulfill the demands required of him for the benefit of his patients and to facilitate the

work of the surgeon, he must possess a good knowledge both of his own speciality and of the basic and clinical sciences of medicine.

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