A SHORT HISTORY OF ANAESTHESIA FOR 
HARE-LIP AND CLEFT PALATE REPAIR

BY
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Since ancient times, hare-lip has been treated by paring the edges of the cleft and holding the raw surfaces together with pins or sutures until healed (Washio, 1968).

The operation could be completed in a minute or so, and when general anaesthesia became available in 1846, it was soon used for these short cases. John Snow reported giving ether for a lip repair in 1847 (Snow, 1847), and, by the time of his death in 1858, had administered chloroform 147 times for this operation, mainly for Mr Fergusson of King's College Hospital. Most of these patients were infants between 3 and 6 weeks old.

When Mr Fergusson performs this operation, the infant is held by a nurse, who is seated opposite to him, whilst its head is placed in his own lap between his thighs. An assistant compresses the labial artery on the right side, by grasping the lip between his finger and thumb, just at the angle of the mouth; a sharp-pointed scalpel is pushed through the lip on the right side, just below the nose, and carried downwards so as to cut away the edge of the fissure; then the same performance is done on the left side of the fissure, while Mr Fergusson compresses the labial artery on that side with the finger and thumb of his left hand. In about twenty seconds from the beginning of the operation, the hare-lip pins are introduced and, the cut edges of the lip being pressed together, the bleeding is at once entirely stopped. I have no doubt that many lives are saved by early operation, especially amongst the poor, as a child with a bad hare-lip cannot take the breast till it is operated on, and there is a very great mortality amongst infants brought up by hand. . . . The blood which escapes when the infant is laid on its back flows back into the throat, and it usually passes on each side of the epiglottis, and runs in to the stomach without any act of deglutition. In a few cases of strong children, in whom the bleeding is rather free, the breathing gets embarrassed, and Mr Fergusson turns the face of the child downwards for a moment to let the blood run out of its mouth. . . . The effects of chloroform pass off very quickly in infants, and it is not often that they last till the operation of hare-lip is finished, short as that operation is. In private practice, indeed, when the parents of the infant are close by, I usually have the opportunity to apply a little chloroform, mixed with spirit, on a sponge; in the course of the operation, when it is required to prevent crying; but in the hospital, the children sometimes cry a little before the operation is concluded. (Snow, 1858a.)

In contrast, cleft palate was not mentioned in medical literature until the Middle Ages, and only a few isolated attempts at treatment are recorded (Saunders, 1968).

Mainly as a result of the work of Roux (1819), successful closure of simple clefts of the soft palate (staphylorrhaphy) was achieved in the early nineteenth century. Roux's method was to pass three sutures across the cleft, then the edges were pared and the sutures tied, drawing the raw surfaces together. This procedure was carried out without any anaesthetic and was only attempted on adolescents or young adults who could endure the pain. Roux's first success was on a medical student, John Stephenson, who later became the first Professor of Anatomy at McGill University, Montreal. An interesting account of his experience is on record as the patient wrote an M.D. thesis on his own operation! (Wallace, 1966.)

This simple method of closure was no use for clefts of the hard palate because the wound sutured under tension broke down. The problem was solved by Von Langenbeck (1861), who made lateral incisions and then lifted the mucosa and periosteum off the bony palate to form mucoperiosteal flaps, which could be moved medially and sutured together without tension, the blood supply from the greater palatine arteries remaining intact.

It is remarkable that these developments in cleft palate repair took place without the aid of general anaesthesia, when this became available. Some surgeons, like Von Langenbeck, used ice to produce local numbing of the palate, and there were a few isolated attempts to use general anaesthesia. The first report of a case, that I can find, appears in the Lancet of 1850. It states that Mr Gay, of the Royal Free Hospital, closed a bilateral...
cleft of lip and hard palate in a boy aged 7 years using chloroform, "and though the narcotic effects did not extend to the latter part of the operation, the patient was saved a good deal of pain at the beginning". The operation was performed in two stages with a week's interval between (Editor of the Lancet, 1850). Similarly, "in 1857, Mr Field of Brighton closed a fissure of the palate under chloroform" (Mason, 1877a). However, the majority of surgeons were against using general anaesthesia for these cases. In 1852, Ferguson of King's College Hospital, who was a leading authority, declared that repair of the soft palate was one of the few operations where chloroform could not be used (Editor of the Lancet, 1852). Sanson, who was associated with Ferguson at King's, wrote in his handbook (1865):

In cases of operation for cleft palate and such manipulations as require co-operation on the part of the patient, chloroform should be dispensed with or else given very sparingly. A few whiffs may be permitted so that the local sensibility may be benumbed. A gangle of iced water is the best local anaesthetic during the intervals of the operation.

John Snow (1858b) refers to the problem. "I assisted the late Mr Avery, by giving chloroform in two operations for cleft palate . . . the surgeon, however, much prefers to have the patient awake during this operation, when he can get his assent." In America also, J. Mason Warren, of the Massachusetts General Hospital, affirmed that repair of cleft palate . . . is one of the very few operations in which the use of anaesthetics is inadmissible. Under very peculiar circumstances, I suppose, ether might be administered, but not without some risk to the patient, and much embarrassment to the surgeon, from the constant flow of blood down the throat.

He remarks that "it is necessary to wait until the patient is old enough to fully appreciate the importance of the operation and to submit patiently to pain and inconvenience" (Warren, 1867).

This attitude was changed in the eighteen-sixties by the work of Collis at the Meath Hospital, Dublin, and Sir Thomas Smith of St Bartholomew's Hospital and the Hospital for Sick Children in London.

In January 1868, Smith presented a paper to the Royal Medical and Chirurgical Society (Editor of the British Medical Journal, 1868).

The author's object in presenting this paper was to communicate to the Society a plan of operating on clefts of the palate, applicable to all who suffer from the deformity, but especially to children, to those deficient in physical courage and in the power of enduring pain . . . . The chief novelty in this proceeding was that chloroform could be employed. A painless and speedy operation could therefore be performed, and that with more precision and a greater prospect of success than when the operator was dependent upon the self-control of the patient; while from the painless nature of the operation, the cure of cleft palate could be effected in children, to whom formerly the benefits of staphylorrhaphy were virtually denied.

In the discussion which followed doubts were expressed regarding the danger of blood obstructing the trachea. Mr Clover said, he . . . had given chloroform in many operations on the mouth, without any bad result. It was probably a matter of importance whether the blood was poured out rapidly or slowly. If he were giving chloroform in such cases as those described by Mr Smith, he would keep up the anaesthesia by inhalation through a nose-cap, which he had found very useful in dental cases.

In the same month a letter was published in the British Medical Journal from Collis (1868).

Sir,—Let me call the attention of Mr Thomas Smith to the Dublin Quarterly Journal, Vol. XLIV, p. 345, by which he will see he is anticipated in this improvement . . . I have used it (chloroform) in all my palate operations for two years and a half . . . I believe, I was the first to operate with success on young children, and the first to use chloroform.

This would mean that Collis first used chloroform for cleft palate cases in 1865 and, in support of his claim to have used chloroform before Smith, the following appears in the Dublin Quarterly Journal of Medical Science (Editor, 1867):

. . . it is now fully established that chloroform can be given in these cases. Mr Collis gives it habitually and has been thus able to operate with success on very young children. The danger from chloroform is no greater than in any other operation and the relief from pain and from subsequent shock and depression is of the greatest importance. Of the advantages of early operation as regards the patient's education, it is needless to speak.

The Royal College of Surgeons of Ireland have an album of photographs of Collis's cases in facial surgery presented by him in February 1869. In it are two pictures of a child, beneath which he has inscribed, "Double hare-lip and cleft palate, first successful case operated on under chloroform". It is sad to relate that, in the same year, Collis cut his finger whilst excising a malignant growth from the superior maxilla, and died of septicaemia at the early age of 45.
Initially the chloroform was administered intermittently on an open mask, or on a sponge applied to one nostril. This technique scarcely gave the surgeons good working conditions for the more elaborate operations they were developing.

The first improvement was the adoption of oro-pharyngeal or nasopharyngeal insufflation of chloroform vapour from a Junker's apparatus. Buxton recommends this method in the third edition of his book published in 1900, and the same method in the sixth edition published in 1920.

This technique enabled the anaesthetist to prolong the administration, but a head-down position and swabbing were the only means of preventing blood from going down the trachea. Some surgeons did require the anaesthetist to keep the patient light enough to cough if blood entered the glottis, but not so light as to cause vomiting! Until the nineteen-twenties (Blomfield, 1922) chloroform was the agent of choice for these operations as there was less bleeding and salivation than with ether and the level of anaesthesia was easier to control. A disadvantage of chloroform was postoperative vomiting, which sometimes jeopardized the surgical repair (Blomfield, 1912; Silk, 1914). Berry and Legg (1912a) give clear advice on these problems.

Whenever possible the services of a skilled anaesthetist should be obtained. It is not an easy matter to keep the patient at just the right stage of anaesthesia throughout the operation. The anaesthesia should be deep enough to abolish sensation, but not to do away with cough reflex, at least while there is any likelihood of blood or saliva running into the larynx.

The most suitable anaesthetic is undoubtedly chloroform, owing to the facility with which it can be administered. We have sometimes employed ether for induction, but the tendency to the secretion of mucus and saliva, as well as the increased venous congestion caused by the ether, is a distinct objection in an operation where venous haemorrhage is apt to be troublesome.

The chloroform may be administered at first on a Skinner's mask or other apparatus, or by means of a simple square of lint. During the progress of the operation it should be given through a Junker's tube inserted either into one nostril or preferably at one corner of the mouth. The anaesthetist should take care that his tube does not interfere with the surgeon's view of the field of operation. He should also avoid putting the end of the tube too near the upper opening of the larynx, lest laryngeal spasm should be induced thereby.

An experienced anaesthetist will often be able to lend a hand with the sponging, and must carefully watch the condition of the pharynx, reminding the chief assistant at times that it requires sponging.

If the bleeding be unusually free and should get beyond the control of the assistant, or if vomiting occur (which should not be the case), it may be advisable to suspend the operation for a short time while the child is turned on its side.

The difference to the surgeon, between doing a cleft palate operation with a thoroughly experienced anaesthetist and an inexperienced one, is the difference between pleasure and pain!

A refinement of the nasopharyngeal insufflation technique was achieved by passing a nasal insufflation catheter until it lay just above the glottis. A second wide-bore rubber tube could be passed through the other nostril down to the same level and the pharynx packed above this, the patient expiring through the wide tube. Without the wide tube, expiration could only be through the pack, which, if soaked in blood, caused the mouth to fill with bloody froth and obscured the site of operation.

The mouth gags, which were used for palate surgery at this time, affected the anaesthetic administration in three ways.

Lane's (1916), Fergusson's, Mason's (1877b) and Doyen's simply held the mouth widely open, so it was necessary to pull the tongue forward by means of a tongue stitch to maintain a clear airway and to keep the tongue out of the surgeon's way.

Sir Thomas Smith's gag, which he referred to in his original communication on the use of chloroform, and similar gags by Trelat, Whitehead and Geffer, all incorporated a tongue depressor. This kept the tongue out of the surgeon's way, but it was noted that it was "very important that the gag be rightly placed as regards the tongue, lest the latter be pressed downwards upon the larynx and interfere with the breathing". Also that, "the assistant must keep the head well extended . . . if the head is allowed to slip into a flexed position, troubles with respiration are apt to occur" (Berry and Legg, 1912b).

Thirdly, both Mason's and Doyen's gags were modified with thin metal tubes fixed to the gag blades through which the anaesthetic vapours could be insufflated into the oropharynx. Similarly, but much later, one version of the Dott gag incorporated a tube in the tongue depressor for oropharyngeal insufflation of the anaesthetic.

The next great advance was the introduction, and adaptation, of endotracheal anaesthesia for these young children and infants. This develop-
ment took place gradually during the nineteen-
twenties and thirties.

At first endotracheal insufflation was practised, that is, a thin insufflation catheter was passed by direct vision into the trachea. Magill first used this method on infants in 1921 (Magill, 1962, personal communication) and the late Sir Denis Browne believed that Magill first intubated a patient, for repair of cleft palate by Harold Gillies, at Great Ormond Street in 1924 (Browne, 1962, personal communication). When the method was used in adults, two tubes, one a narrow-bore catheter and the other a wide-bore rubber tube, were passed into the trachea, usually via the nose. The anaesthetic vapours were insu-
fflated through the catheter and expiration took place freely through the wide-bore tube. As a child’s glottis was too small to accommodate two tubes, the wide-bore expiratory tube had to lie in the pharynx with its lower end just above the glottis. In 1924, Magill published a description of a metal device which clipped the lower end of the expiratory tube to the shaft of the endo-
tracheal catheter and maintained it in correct position. The other end of the expiratory tube was brought out through the mouth so, if necessary, the pharynx could be packed off above the metal clip without obstructing expiration.

Dott (1971, personal communication) intro-
duced intratracheal insufflation anaesthesia for cleft palate babies in Edinburgh, when he joined the staff of the Children's Hospital in 1927, having had experience of the technique for anaesthetizing experimental animals, including small monkeys, since 1921 (Dott, 1923).

Birt of Great Ormond Street described the use of endotracheal insufflation in children in 1927 and, in 1931 Magill still recommended the method for infants under 1 year of age, although he was using his wide-bore rubber tubes for all other ages.

It seems that in spite of this progress there were few anaesthetists capable of managing the technique. In 1932 Denis Browne wrote, "intratracheal gas and oxygen through a nasal catheter is the best (anaesthetic for cleft palate operation) of all, but few are competent to give it". It appears that the use of endotracheal anaesthesia for these cases, as we know it today, with inspiration and expiration taking place through one wide-
bore tube, developed in the early nineteen-
thirties.

In 1932 Magill devised his flexible armoured tube (Magill, 1962, personal communication). This was uninkinkable yet had a good lumen, but it was not uncrushable and, in a discussion at the Royal Society of Medicine in 1947, he recom-
mended a small malleable metal gutter to protect the tube as it passes over the inferior alveolar margin under the gag blade (Aserman, 1947).

Magill also designed a tube in 1936, which incorporated a terminal inch of normal Magill endotracheal tube cemented to a wider-bore, thicker-walled tube to reduce internal resistance and prevent occlusion by surgical pressure (Magill, 1962, personal communication). A similar tube was described by Denis Browne and also by Cole (1945).

By 1936 Digby Leigh and Fitzgerald of Montreal were using Magill’s tubes. Ayre of Newcastle, in 1937, was doing the same for Wardill’s cases and so also was Gillespie, who was working with Kilner at the Elizabeth of York Hospital for Children at Shadwell in 1939.

Coincidentally with the introduction of endo-
tracheal anaesthesia for lip and palate surgery, there was a change from chloroform to ether as the agent of choice. In 1922 Blomfield noted that, “when the operation is performed under chloroform throughout, the infants are often of an alarming pallor and feebleness by the end, in marked contrast to their usual state under the treatment described above”, i.e. anaesthesia main-
tained with ether from a Shipway’s apparatus. The last reference I can find to the use of chloro-
form in these cases is in 1930 (Rood and Webber); thereafter, ether and oxygen or ether, nitrous oxide and oxygen are recommended. In 1938 Frankis Evans said, “Chloroform as an anaesthesia has a definite place in the anaesthetist’s armamentarium but it should never be adminis-
tered to children”.

The other fundamental contribution to safe anaesthesia for these cases was Ayre’s (1937–38) description of his T-piece technique. This achieved a very high degree of non-rebreathing during spontaneous respiration, with minimal resistance. It is only fair to point out that Magill was using his armoured tubes with the Y metal
connection before this and, of course, achieved the same effect.

Thus, by the end of the nineteen-thirties a safe and efficient technique for anaesthetizing these infants was available.

It would appear that the most important development in this branch of anaesthesia in the last thirty years (in this country at any rate) has been the provision of properly trained anaesthetists. The technique which we inherited from our colleagues of the pre-war era was basically sound and improvements have been only in detail.

In the nineteen-forties interest centred on the airway. Dott’s gag, introduced in 1928, was a modification of the Davis gag used in Boston, incorporating sharp hooks to hold on the edentulous gums of infants (Dott, 1971, personal communication). Originally used with an intratracheal catheter for insufflation anaesthesia, the tongue depressor of the gag did not affect the airway but, later, when Magill’s ordinary rubber tubes were used for oral intubation in palate cases, the tubes tended to be kinked or crushed by the gag blade. Some anaesthetists avoided this difficulty by using naso-endotracheal intubation for palates (Aserman, 1947; Segal, 1947) but the tube was liable to get in the surgeon’s way as it lay in the floor of the nose. Also, if it is necessary to work on both the lip and palate at one sitting, or perform a pharyngoplasty, a nasal tube was unacceptable.

Ideally, the airway should be an oro-endotracheal tube, which is uncrushable where it crosses the alveolus, unkinkable as it curves over the back of the tongue, and of adjustable length to suit each case, to avoid intubation of the right bronchus.

In 1943 Humby and Hawksley described their tube which incorporated an expiratory valve. The proximal part of the tube in the mouth was metal and uncrushable and the distal part rubber. They modified the Davis mouth gag by making a slot in the tongue depressor to accommodate their tube. Goldsmith (1948) described a special metal connection for rubber tubes with a similar modification of the tongue depressor of the Dott gag. Davies (1954) found that he could use Magill’s ordinary rubber tubes without kinking if the Dott gag had a central slot in the tongue depressor.

Others followed Magill’s example and used reinforced tubes or tubes made of new materials. Portex endotracheal tubes were introduced in 1944 (Thornton) as being less kinkable than those made of rubber (Hunter, 1944-45). Also (1955) introduced the Oxford reinforced oral tubes and recommended them for cleft palate cases.

The problem of providing a perfect airway for these cases has not yet been solved and there is no doubt that a tube which is satisfactory with one surgeon will not do for another.

Until the advent of halothane, new anaesthetic agents such as divinyl ether (Daplyn, 1946) failed to displace ether in hare-lip and cleft palate anaesthesia. Perhaps halothane will succeed ether as the agent of choice for these cases, and possibly for the same reason that chloroform held sway in the early days, namely, that halothane is easier to administer than ether; but who knows yet whether it is safer?

Ayre’s T-piece technique with spontaneous respiration continues as the simplest and most popular method of administration.

A closed system with non-return valve has had some vogue in Canada (Leigh and Kester, 1948; Stephen and Slater, 1948) and America (Fink, 1954).

During the last twenty years, the use of controlled intermittent positive pressure respiration, with or without the use of muscle relaxants, has become more popular for paediatric cases (Rees, 1960). Undoubtedly, in the past, laboured respiration and underventilation was largely responsible for the hyperpyrexia and convulsions which developed in some hare-lip and cleft palate cases.

In recent years there has been interest in the blood loss suffered by these cases. The ready availability of blood transfusion has made limitation of blood loss less vital to recovery but, nevertheless, minimal bleeding at operation does facilitate more accurate and quicker surgery.

Moderate hypothermia was advocated by Kilduff, Wyant and Dale (1956), but the use of locally injected solutions containing adrenaline is the most popular method of limiting blood loss. Tempest (1958-59) and Gordon Jones (1962) have proved that the method is practical and effective. Wallbank (1970) has shown that, in infants and children up to 2 years of age, the doses of adrenaline required may be safely used in the
presence of small concentrations of halothane.

Those who are interested in the history of this branch of anaesthesia must regret that our Victorian and Edwardian colleagues did not write more about their early struggles with these cases. Also, it is a pity that most of the surgeons who wrote extensively on the subject only briefly referred to the anaesthetic problems and omitted to mention their anaesthetists by name.

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**REACTION TO PROPANIDID**

Sir,—A 39-year-old woman was anaesthetized on 2nd June, 1971, for cauteryization of a cervical erosion. She was in good health, and there was no personal or family history of any allergy or sensitivity. She had had one previous general anaesthetic four years ago, when propanidid was not used.

Propanidid, given by an intermittent technique in a 5 per cent solution, was the only drug administered; an initial dose of 350 mg was followed by small increments, the total dose amounting to 600 mg. Recovery of consciousness followed the normal pattern, and she was awake and conversing about 5 minutes after the procedure was begun.

However, 5 minutes after recovery of consciousness, she developed a blotchy, scarlet, confluent rash, especially evident on the upper chest, neck, and shoulders. She then began to feel unwell, and the scarlet rash gradually changed to a mottled bluish-white appearance; she appeared slightly cyanosed, and her systolic blood pressure was 80 mm Hg. It was by this time 15 minutes since she had recovered consciousness.

The administration of hydrocortisone 100 mg and 0.9 per cent sodium chloride 500 ml intravenously then resulted in swift improvement in her blood pressure and return of colour to normal over the next 15-20 minutes. Large, raised urticarial patches began to appear at this time on the trunk and limbs—about 40 minutes after the initial dose of propanidid. The general improvement was maintained, however, and these urticarial patches disappeared over the course of 1½ hours. At no time was there evidence of any bronchospasm.

It is noted that the woman recovered consciousness in a completely normal fashion, and that signs of sensitivity were not apparent until well after the anaesthetic effect of the drug had ceased. If propanidid is used for short operations such as the outpatient procedure described here, it would seem judicious to warn the recovery room nursing staff of the possible hazard involved, so that delay in obtaining assistance should not occur.

This is the first occasion on which sensitivity to the drug has been encountered by the writer after some 6,000 administrations.

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**MEASUREMENT OF CRITICAL FLICKER FREQUENCY AFTER INTRAVENOUS ANAESTHESIA**

Sir,—As a means of measuring the recovery phase after intravenously administered thiopentone and methohexitone, estimation of the critical flicker fusion threshold, (or the flicker fusion threshold, f.f.t.) was used by Dr M. D. Vickers and myself in 1961. The work was completed the next year and presented as an essay which was awarded the Registrar's Prize in the Section of Anaesthetics of the Royal Society of Medicine, 1963.

I send this as information for the benefit of Drs Grove-White and Kelman, in whose paper on the measurement of f.f.t. after subhypnotic doses of intravenous anaesthetics I noted the following in the Discussion section: "The present study is, to our knowledge, unique in that the drugs were administered intravenously, rather than orally. It is therefore, difficult to make a detailed comparison between our results and those of previous workers."

I am due to present a paper entitled, "The measurement of recovery from anaesthesia: a comparison of methohexitone and propanidid", at the Epontol Symposium organized by Bayer at Scheveningen, June 10-12, 1971. This is in effect a continuation of the work begun 10 years ago: a Dawe Stroboslash 1200E was used for measuring the f.f.t. in two volunteers, who at intervals over a period of 12 months received a graded series of equipotent doses of intravenous methohexitone and propanidid. A baseline f.f.t. measurement was taken before each test injection. During the recovery phase, repeated f.f.t. readings were taken until the pre-anaesthetic figure was reached. At this point, recovery was deemed complete. It was thus possible to measure the time and compare the pattern of recovery after anaesthetic doses of these two agents.

I disagree with Dr Grove-White's observation that, because depression of the f.f.t. is a very sensitive index of the action of drugs like methohexitone, it is therefore of little value in the assessment of recovery from, for example, dental anaesthesia.

I am so convinced of the importance of this measurement as an indication of the integration of the central nervous system, because of its very objectivity and simplicity, that I am embarking on another series of investigations into the recovery phase following intravenous diazepam. These three agents are gaining popularity, particularly in dental clinics for conservative work, and our concern must be for the possible medicolegal aspects of insufficient surveillance during the recovery period following long procedures under general anaesthesia. An accurate assessment of full recovery is vital in the interests of the safety of these patients.

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