ENDOTRACHEAL AND OTHER MODERN METHODS IN THE EIGHTEENTH CENTURY

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The endotracheal technique was illustrated and described by Vesalius (1555), but his method entailed preliminary tracheotomy, as did the endotracheal technique of Trendelenburg (1871). The first accepted account of intubation through the glottis is by Macewen in 1880.

It is interesting, therefore, that endotracheal intubation, by the oral and nasal routes, was described by Kite in 1788, a hundred years before Macewen; and Kite himself does not claim to be the originator of the technique, which he used in resuscitation of the apparently dead.

In the year 1787, the Humane Society (now the Royal Humane Society) decided to offer prizes for the best essays on the Recovery of the Apparently Dead. The essay submitted by a surgeon practising at Gravesend, Charles Kite, Member of the Corporation of Surgeons in London, was awarded the silver medal, and this essay was published in 1788 in book form. As an appendix, there is a description of a pocket case of instruments to be used in the resuscitation of the drowned, of whom Kite apparently saw a great many in his work by the Thames Estuary.

A folding plate illustrates the contents of this case. One of the items, "shaped like a male catheter", is labelled, "An
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instrument to pass beyond the glottis” (Fig. 1). In a second plate, this instrument is shown attached to the “elastic tube”, which could be used, either with this catheter, or with an ivory nozzle to fit the nostril (Fig. 2), for the inflation of the lungs.

In the text, the use of the catheter is mentioned thus:

“...If any difficulty should arise in distending the lungs, it must proceed either from water in the windpipe or a contraction or adhesion of the epiglottis. We have already pointed out the method of discovering when the first circumstance occurs; and when the latter is the case, we shall generally remedy the inconvenience by bringing the tongue forwards, which, being connected to the epiglottis by inelastic ligaments, must of course be elevated. Should any further impediment however occur, the crooked tube, bent like a male catheter, recommended by Dr. Monro, and mentioned by Mr. Portal, Mr. le Cat, and others, should be introduced into the glottis, through the mouth or one nostril; the end should be connected to a blow-pipe, or, what will be more convenient, the pipe for the nose belonging to the elastic...
tube may be removed, and this instrument screwed in its place, according to the plan mentioned in the description of a pocket case of instruments for the recovery of the apparently dead, by Mr. Savigny " (the instrument maker).

The following description occurs in the Appendix:

"Should further impediments however occur, the pipe for the nose is to be removed, and the crooked tube bent like a male catheter, recommended by Dr. Monro, and mentioned by Mr. Portal, Mr. le Cat, and others, is to be screwed on the tube in its place: this is to be introduced through the mouth, or one nostril, into the glottis, when, on blowing through the mouth-piece, or applying the bellows, the lungs will be dilated."

The reference to "Dr. Monro" cannot be identified, but it may be to Alexander Munro, primus, of Edinburgh, who apparently advocated the inflation of the lungs by artificial means as a method of resuscitation (Home, 1951). Antoine Portal (1742–1832) apparently advocated intubation by tracheotomy, but only as a last, desperate resource (Home, 1951). It appears that Claude-Nicolas le Cat (1700–1768) expressed a desire to see a tube designed which could be passed through the glottis to assist in artificial respiration (Fodéré, 1819).

From what has been written, it is obvious that Kite was a man of considerable ability, and a perusal of his book shows that he had a remarkable grasp on the subject of resuscitation. He recognised that laryngeal spasm, as distinct from closure of the glottis by the lowering of the epiglottis, could occur. After stressing that water is not generally found in the lungs of animals recently drowned, he writes, "Allowing then, what is, I think, clearly proved, that death is caused by contraction of the parts about the larynx stopping respiration—it still remains to enquire, concerning the manner in which this stoppage of respiration
acts, so as to occasion that effect”. Earlier, he shows that he was aware that pulmonary oedema could occur in these circumstances, and that this might mislead investigators into thinking that water had been aspirated into the lungs:

“In answer to those who maintain the third opinion, it will be proper to observe, that although water has, beyond doubt, often been found in the lungs of drowned animals; yet that it is frequently absent, is evident from the experiments of men of undoubted authority. Frothy mucus, now and then mixed with blood, is very generally to be met with in the lungs, and sometimes in considerable quantity, owing to the blood and mucus being forced through the vessels by the great distension of the pulmonary artery; and this, I have no doubt, has frequently been taken for water: but if the animals are drowned in water tinged with a colouring substance, the fact will then be readily ascertained. Of ten kittens drowned in this manner, not one drop of the liquor was found in, or to be pressed out of the lungs.”

As a further extension of this belief, he describes similar experiments to show that water never enters the lungs until death has occurred, and he points out that the spasm will relax at that moment, allowing water to “fall in”. This may not be entirely in line with modern belief, but it is not far removed from it.

It is not surprising to find that Kite had some, to us, curious notions concerning respiration. The following passage at least shows that Kite used the lancet less than his colleagues, and that he attempted to give reasons for his actions:

“It is, however, to be observed, that large and repeated bleedings do not seem so indispensably necessary in the present instance, as in apoplexies arising from some other causes, as artificial respiration will in general answer the purpose of removing the over-distention of the venal system, consequently the compression of the brain, nearly as effectually and expeditiously; and is not liable to be attended with any disadvantages. In a full inspiration, the vesicles of the lungs are expanded, and at the same time
the capacity of the pulmonary blood-vessels is considerably increased, so as to receive a larger quantity of blood from the right ventricle. In expiration, the vesicles are collapsed, and the contents of the blood-vessels are, in consequence, driven into the left auricle and ventricle. This process, frequently repeated, will in a short time remove the congestion in the great vessels; and the compression of the brain, which depended upon that congestion, will, I conceive, be as readily overcome as by opening a vein. On this account, and particularly as it is removing the cause of death, we cannot hesitate one moment in pronouncing, the restoring of the action of the lungs to be of the very first importance in all our attempts to recover the apparently dead. Dr. Fothergill, with great propriety, compares the lungs of drowned people to a clock whose pendulum has stopped; yet, says he, renew but the action of the lungs in the one, and touch but the pendulum in the other, and all again is life and motion. The same gentleman observes, in another place, that to inflate the lungs, especially of drowned persons, completely, requires no inconsiderable share of skill and dexterity."

Yet none can deny the wisdom and truth of the principles which he laid down. Although he described various methods of "removing the compression of the brain, and the congestion about the heart and lungs", and of "exciting the irritability of the muscular fibres", yet he states categorically:

"Let it be observed, as an invariable rule, that in all attempts to recover the drowned, our attention should be principally and primarily directed to—the administration and proper regulation of the inflation of the lungs—and the application of heat."

Concerning the inflation of the lungs by the insertion of a tube into the nostril or by mouth-to-mouth breathing, he suggests a manœuvre which might well be adopted by modern anaesthetists who wish to perform so-called "controlled" respiration in the absence of an endotracheal tube; namely, "by making a suitable pressure on the prominent part of the wind-pipe, he prevents the air passing into the stomach".
Should all other methods of inflation fail, tracheotomy is advocated as a last resort, a tube to be inserted and the lungs inflated by a bellows; “I acknowledge, however, I should not expect it would succeed when the other means have failed.”

There are other points on which Kite held extraordinarily advanced views. For instance, he foreshadows the more recent knowledge of the stimulation of respiration by exciting reflexes from the tracheo-bronchial tree: “Air loaded with the vapour of tobacco—of the volatile alkali—of the spirit of sea salt—and spirit of sulphur, have been recommended with the view of exciting the action of the lungs with greater expedition.” However, he casts doubts on the advisability of using these stimulants, and continues:

“With fairer prospect of success, is the dephlogisticated air of Dr. Priestley recommended for the same purpose. Dr. Fothergill, in particular, has distinguished himself by his truly ingenious remarks on its application to the subject now under our consideration. It must be observed, however, that in this instance the Doctor’s practice seems entirely influenced by a theory, which supposes the cause of death, in drowned people, to be noxious air stagnant in the cells of the windpipe; and as this species of air neutralizes mephitic air, and renders it respirable, ‘it seems,’ says the Doctor, ‘to be the direct antidote supplied by nature for correcting the contaminated air stagnant in the bronchial cells, and also for inflating the lungs, in preference to common air.’”

He is not convinced of the efficacy of dephlogisticated air, but is willing to give it a trial. He points out the difficulties, however, because, for only 10 minutes of artificial respiration at 10 inflations per minute, no less than 30,000 cu. inches of gas (two hogsheads) would be required. This would be very expensive, but, he writes, and those in charge of health services might well consider, “The costliness of the article, however, is the most trifling objection
which can be brought against it, and could not require one moment's consideration, was it found to answer, and could it be readily procured and conveniently administered." 

It should be remembered that, at the time Kite wrote, the discovery of oxygen (dephlogisticated air) had only been published 13 years before (Priestley, 1775), and its part in respiration was yet unknown; a somewhat conservative outlook was therefore natural.

Like those in our own day, Kite realised the difficulty of determining whether death had or had not occurred. He relied upon no one sign, but thought that lack of response of muscles to electrical stimulation was proof that the state of death was irreversible. He also used the electric current to hasten recovery, and noticed that the diaphragm could be brought into action by it. He writes:

"The part which, in my experiments on drowned animals, I found to be the most readily excited to action, was the diaphragm; and although the shocks were directed so as to pass through the auricles of the heart, consequently much above that muscle, yet it was always brought into great contractions."

He could hardly be aware that the shocks he was administering were probably exciting diaphragmatic action by stimulating the phrenic nerves in their course past the heart. It was not until 1863 that Kidd and Lobb (Sansom, 1865) showed that electrical stimulation of the phrenic nerves was a practical method of performing artificial respiration.

Kite, in his book, deals mainly with the recovery of the apparently dead from drowning, but he also discusses the similar state of those who have been hanged, struck by lightning, or are suffering from syncope. In each case, he stresses the importance of artificial respiration by inflation.
There is no doubt that he was a great practitioner of medicine, and his greatness is enhanced by his modesty. Every theory and every method are weighed in the balance. The extracts given above show that, although his references are unfortunately incomplete, he never fails to acknowledge the source of all his ideas.

Kite's book was published 163 years ago; medical science has risen to great heights since then, but there can be little doubt that an intelligent person, who has read no other work on the subject save Kite's, would be able to render better aid to a drowned man than most medical practitioners of to-day.

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REFERENCES

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