

JOHN T. RUSSELL, M.B., B.Ch., F.F.A.R.C.S. (IREL.), D.A., *Honorary Anaesthetist, Provincial Hospital, Port Elizabeth*

When faced with administering an anaesthetic in midwifery, the anaesthetist has to modify his technique to deal with a unique set of circumstances. There is a definite maternal morbidity and mortality for which the anaesthetist must take some blame. This is associated with aspiration of vomitus, hypotension owing to regional methods of analgesia, shock and haemorrhage. Naturally these occurrences may also be responsible for the non-survival of the foetus. In 1955 Lock and Greiss<sup>1</sup> analysed nearly one million births in America. Forty-five maternal deaths were stated to be directly due to anaesthesia, of which 29% were ascribed to inhalation of vomitus and 25% to spinal analgesia.

#### *Vomiting and Regurgitation*

Aspiration of vomitus is always a possibility in the midwifery patient because of the delayed emptying time of the stomach. In addition the light plane of anaesthesia required is often the cause of the vomiting. Prohibition of the ingestion of all solid food during labour, relying on fluids, sweets or isotonic glucose, should be the rule.

The equipment of every labour ward should include a tipping table or labour bed, laryngoscopes and cuffed endotracheal tubes, a transparent face mask, efficient suction, a bronchoscope and a tracheotomy set.

*Treatment.* When vomiting occurs the patient should be tipped into the Trendelenburg position and turned on her side, the anaesthetic stopped to encourage coughing and the pharynx sucked out. Where inhalation of vomitus has occurred careful tracheo-bronchial toilet should be done. Bronchoscopy may be necessary.

The consequences of the inhalation of gastric contents may be divided into 3 main groups:

1. Gross obstruction of respiration.
2. Mendelson's syndrome—a bronchospastic response to a small quantity of the highly acid gastric contents.<sup>2</sup> The onset may be considerably delayed. On occasions the bronchospasm progresses to acute pulmonary oedema and death. It appears to be confined to obstetrical patients, since surgical patients subjected to the same procedure do not appear to develop it. Haussman and Lunt<sup>3</sup> suggested that it is acute suprarenal insufficiency associated with the state of parturition, and successful results have followed the injection of 100 mg. of hydrocortisone intravenously. Dinnick<sup>4</sup> suggested aluminium hydroxide gel during labour.
3. Blockage of smaller bronchi resulting in patchy atelectasis, bronchopneumonia; lung abscess or bronchiectasis.

*The prevention of vomiting.* In 1955 Morton and Wylie<sup>5</sup> advocated the head-up position of induction for this purpose. The patient is tipped into the head-up position,

pre-oxygenated, induced with a small dose of thiopentone followed by a relaxant. The trachea is intubated with a cuffed endotracheal tube, the cuff being immediately inflated. The rationale is that as vomiting is an active process, quick paralysis of the muscles involved will abort the process. This is not a method for the tyro and it has obvious disadvantages. The lowering of the blood pressure in this position could lead to cardiovascular collapse in a shocked patient. In practice this seldom occurs, and can be dealt with if it does. Theoretically active vomiting may take place between the time of loss of consciousness and the onset of muscle relaxation. Regurgitation may still take place.

The use of a stomach tube or 1/20th of a grain of apomorphine to empty the stomach may cause a considerable degree of collapse, is rather barbarous, and does not in fact, ensure an empty stomach.

Fisher<sup>6</sup> has suggested the insertion of a Miller Abbott tube. Sellick<sup>7</sup> advocates firm backward pressure on the cricoid cartilage during induction, thus obstructing the oesophagus. Bourne<sup>8</sup> in a recent paper suggests induction on the left side in the head-down position, with halothane and oxygen, and intubating in this position, after intravenous succinylcholine. Endotracheal intubation on the side, however, is by no means an easy procedure, and the use of halothane in obstetrics is suspect.

Undoubtedly the method of choice for the occasional anaesthetist is to induce anaesthesia in the head-down position with the patient on her side. This is borne out by the fact that the incidence of death from anaesthesia in domiciliary obstetrics in the United Kingdom is relatively low, because a large number of deliveries in that country are performed in the lateral position.

This fear of the inhalation of vomitus has caused anaesthetists to look for other forms of pain relief, e.g. local and conduction analgesia methods.

#### *Local and Conduction Analgesia*

*Pudendal block*, with or without local infiltration of the vulva, is satisfactory, but suitable only for limited manipulations such as episiotomy and low forceps delivery. Intra-uterine manipulations are not possible.

*Continuous caudal analgesia* is safe for the infant, but not necessarily so for the mother. Because of the high percentage of sacral abnormalities the failure rate is high. Johnson,<sup>9</sup> however, reported a large number of satisfactory cases where a technique based on the early description of Hingson and Edwards<sup>10</sup> was used. The method should only be used when every means of resuscitation is to hand

since it can cause dangerous hypotension. The forceps rate is high and anomalies of rotation are frequent.

*Lumbar extradural block* gives results similar to caudal block, but the site of injection, being away from the operative field, is less likely to become contaminated. Flowers<sup>21</sup> reported its use in 200 caesarean sections. The continuous technique was used and blood pressure was controlled by an intravenous drip of noradrenaline, a sufficient disadvantage. Besides, the technique requires time and a high degree of skill, neither of which are always available in a busy maternity hospital. The tremendous danger of a 'total spinal' owing to inadvertent subarachnoid injection of large amounts of the analgesic solution must always be borne in mind.

*Subarachnoid block* or spinal analgesia is a subject of controversy. Best<sup>12</sup> recommended it as the method of choice in patients with full stomachs, in those who are heavily sedated, for the delivery of premature babies because of the absence of foetal respiratory depression, for caesarean sections, for patients with cardiac disease, and in all patients who wish to be awake when their babies are born. Saddle block is widely used in the United States. Egerton<sup>13</sup> reported good results in 800 cases. Thorne in Britain<sup>14</sup> reported no neurological complications in over 800 cases. Methylamphetamine ('methedrine') was required by half the patients who underwent caesarean section. Holmes<sup>15</sup> discussed 17 cases of fatal circulatory collapse some minutes after the patient was put into the supine position following subarachnoid injection. Resuscitative measures were of no avail. Women in late pregnancy exhibit what is referred to as the inferior-vena-cava syndrome. In the supine position there is a rise of venous pressure in the legs of up to 7.5 cm. of water, and arterial pressure drops. Turning the patient on to her side reverses this. The pressure of the large uterus on the inferior vena cava retards cardiac filling, thus reducing cardiac output. The addition of extensive sympathetic block owing to subarachnoid injection, which further lowers the blood pressure, can lead to disastrous collapse. This is further discussed by Cappe and Surks.<sup>16</sup>

Undoubtedly today the majority of patients prefer to be asleep during an abdominal operation.

It must be remembered that both extradural and subarachnoid analgesia must be up to D 10, and no administrator, however skilful, can always ensure that the block will not rise to a higher level. Thus hypotension, splinting of the diaphragm by the large abdominal tumour, and possible paralysis of the intercostals are all conducive to hypoxia of both mother and infant. The administration of oxygen is essential and vasopressors necessary in half or more cases. Intra-uterine manipulations must be extremely gentle, since uterine activity can easily be stimulated and it sometimes gives rise to considerable difficulty in delivery. Moreover, it should be remembered that the intravenous injection of ergometrine soon after a patient has received a vasopressor may lead to dangerous hypertension or even apoplexy.

*Local infiltration* for caesarean section requires a high degree of skill and the patient's cooperation if it is to be

successful. Frankis Evans<sup>17</sup> described a useful technique, the 'arrowhead block'. He infiltrates the somatic branches of the 10th, 11th and 12th dorsal and 1st lumbar nerves as they pass across the anterior axillary line between the lower border of the 12th rib and the upper border of the iliac crest.

#### *General Anaesthesia*

In *general anaesthesia* for obstetrics increased skill has contributed to a marked improvement in the perinatal mortality in the past two decades. It is no more unreasonable to ask the junior houseman to perform a lower segment caesarean section than it is to have him administer an anaesthetic to a woman in labour. A smooth quick induction is essential, for the depth of anaesthesia must rapidly be increased beyond the danger level of vomiting. It is also necessary that all drugs used should be effective in non-toxic doses, easily destroyed or excreted, with no postoperative ill-effects. It has been shown by Appgar and Papper<sup>18</sup> that all anaesthetic and analgesic drugs which exert a systemic effect cross the placental barrier.

Except for gallamine triethiodide ('flaxedil'), which Crawford and Gardiner<sup>19</sup> showed to cross the placental barrier in significant amounts, the commonly used relaxant drugs in clinical dosage can be used with no fear that they will affect the infant or uterine activity.

Skilful administration of cyclopropane, using as much as 50% with oxygen for induction, or nitrous oxide and oxygen augmented by a volatile anaesthetic, can produce satisfactory results. Adequate oxygenation throughout is essential. Ethyl ether and trichlorethylene, with or without relaxants, are probably the most popular. It should be mentioned that the pitocin drip should be used with caution if anaesthetics are given which cause irritability of the cardiac conductive mechanism. Lesser<sup>20</sup> reported the death of a patient to whom a pitocin drip was administered before she had excreted the cyclopropane used for the induction of the anaesthetic.

Mackay,<sup>21</sup> Russell,<sup>22</sup> and Albert<sup>23</sup> have amply demonstrated clinically that halothane ('fluothane') is a potent relaxant of the pregnant uterus. This has been confirmed experimentally by Embrey, Garrett and Pryer<sup>24</sup> and Vasicka and Kretschmer.<sup>25</sup>

Crawford<sup>25</sup> suggests that halothane be used in obstetrics for this specific action alone. He emphasizes that uterine relaxation, unless properly controlled, may fail to respond to ergometrine and pitocin. Halothane is not recommended for routine obstetrical anaesthesia.

It has been shown by numerous authors that a small sleep dose of an intravenous barbiturate, thiopentone, 'kemithal' or methohexitone<sup>26-29</sup> ('brietal'), followed, as a rule, by succinylcholine, intubation, and controlled respiration with nitrous oxide and oxygen until the birth of the infant, is the most satisfactory routine method. The Appgar<sup>30</sup> method of evaluation was the usual one adopted for the assessment of the infant. The technique is less depressant of the newborn infant than other commonly used anaesthetic techniques and compares most favourably with conduction analgesic methods. Naturally, in almost every instance the mother prefers this type of anaesthetic.

Both McKechnie and Converse<sup>31</sup> and Crawford<sup>32</sup> found that there was no appreciable placental barrier to thiopentone. The foetal blood level of the drug is at its maximum at the onset of anaesthesia. Crawford,<sup>19</sup> however, showed that the foetal blood level fell thereafter. The longer the time interval between the injection of the thiopentone and the delivery of the baby, the lower the foetal blood level is likely to be. A dose of 250 mg., not repeated, is reasonably safe. This is due to the redistribution of the drug from the maternal blood to the maternal tissues, which takes place rapidly. Most of the thiopentone in the foetal blood is redistributed to the maternal blood, and thence to the maternal tissues. Crawford<sup>33</sup> points out that when the interval between induction and delivery is prolonged to 20 minutes or more a notable increase in neonatal depression is obtained. The other factors which might well be of importance in this class of case are the local haemodynamic changes allied to that producing the inferior-vena-cava syndrome, which could result from the patient's lying supine and paralysed on a hard table for a considerable length of time. Manhandling of the patient into and out of the lithotomy position is also likely to disturb the uterine circulation. It is probably in part for all these reasons that, in addition to the obstetric factors which themselves cause the delay, examination under anaesthesia before section, and trial of forceps followed by section, so frequently are associated with neonatal depression.

#### Premedication

Premedication before elective caesarean section should not consist of any drug which is likely to depress the foetus. This should automatically exclude pethidine, morphine and the barbiturates, although there is no doubt that anaesthetists will continue 'to get away with' indiscriminate use of these drugs in obstetrical patients. The phenothiazine derivatives have been proved to be of use in this connection, the best known being chlorpromazine ('largactil') and promethazine ('phenergan'). Chlorpromazine is rather unpredictable in its action,<sup>34</sup> is a good anti-emetic, but can cause troublesome hypotension. Phenergan is useful as a sedative, reduces vomiting, relaxes bronchial musculature and inhibits secretions. Dundee and Moore<sup>35</sup> showed it to have an anti-analgesic action. In spite of this it is still a most useful premedicant in midwifery, particularly as Eckenhoff and others<sup>36</sup> proved it to have a mild stimulative effect on respiration.

Cyclizine ('marzine', 'valoid'), a non-phenothiazine, in 50 mg. doses by injection, has a moderate sedative action, is an excellent anti-emetic, suppresses secretions, and does not affect respiration. Dundee and his colleagues have shown that it, too, reduces the action of the analgesic drugs.<sup>37</sup> Dawkins,<sup>38</sup> however, recommended the administration of analgesics before the patient leaves the table, which is good practice and avoids any unpleasant sequelae.

There are numerous other drugs which are not in common usage.

Atropine, 0.6 mg., is often the only premedicant given, alone or in combination with other drugs, for its antimuscarinic effect and as an antisialogogue.

Pethidine, in combination with nalorphine, or alone, the nalorphine (10 mg.) being administered intravenously to the mother before the birth of the infant, or to the infant by injection into the umbilical vein (0.2 - 0.5 mg.), is sometimes used. It is open to debate whether the simultaneous administration of a drug and its antidote is good clinical practice.

#### Infant Resuscitation

Infant resuscitation frequently falls to the anaesthetist's lot. Flagg's<sup>39</sup> classification is useful:

1. The stage of depression when the infant is rousable. This seldom requires more active treatment than the clearing of the air passages (a soft rubber sucker should be used) and skin stimulation.

2. The stage of spasticity with cyanosis. Respiration is gasping and irregular, but upper respiratory reflexes are active. Clearing of the air passages, emptying of the stomach to prevent any regurgitation and positive-pressure ventilation by means of a mask is usually adequate. Endotracheal intubation is seldom necessary.

3. The flaccid stage with absent reflexes and failing circulation. Endotracheal intubation is lifesaving. Suction can be performed through the OO endotracheal tube and then positive pressure of up to 60 cm. of water has been shown by Goddard<sup>40</sup> to be safe for periods of 0.2 to 0.3 of a second, with an interval twice as long to allow for expiration and for filling of the right auricle. Uniform expansion of the lungs is said to be achieved. If the infant fails to respond within 20 minutes it usually indicates congenital abnormalities or cerebral damage, frequently owing to anoxia. Endotracheal intubation in the neonate is not easy and must be gently performed so as to avoid damage to the delicate tissues.

Oxygen, stimulants such as amiphenazole ('daptazole'), 3 mg., nalorphine, if indicated, maintenance of skin temperature and skin stimulation are all helpful.

Oxygenated, heparinized blood injected into the umbilical vein (or the artery in severe cases) causes a rapid rise in heart rate and blood pressure and seems to reach the coronary arteries and left ventricle very rapidly.

In conclusion, anaesthesia in midwifery is still far short of perfection and its importance has tended to be overlooked. Until recently the standard lagged behind that of other branches of the speciality, but more and more work is being done, and we can confidently expect further advances in the not too distant future.

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(Supplement — South African Journal of Obstetrics and Gynaecology)

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