It is a sad commentary upon British anaesthetic practice that it is still necessary, in an article such as this, to recapitulate not only the major danger to the mother associated with general anaesthesia, but also the ease with which it can be averted. The convoluted mode of presentation of the information presented in the most recent Report on Confidential Enquiries into Maternal Deaths in England and Wales (Arthure et al., 1975) makes a detailed unravelling as difficult as with its predecessors, but it seems likely that of the 37 maternal deaths associated with complications of anaesthesia, at least 16—and possibly a further three—resulted from regurgitation and aspiration. In two of these instances the occurrence led to obstructive asphyxia; in the remainder, to the acid-aspiration syndrome. The reappearance for some time in the series of triennial Reports of an asphyxial death from aspiration is disappointing and disturbing. A dietary regimen appropriate to the labouring patient has been advocated, and generally accepted, for almost 20 years, and there has also been general appreciation of the need—should there be reason to suspect the presence of a considerable mass of gastric contents—to empty the stomach before induction of anaesthesia unless the mother or the infant would be placed in serious jeopardy as a result. It has also been advised for many years that the most effective and least unpleasant method of inducing gastric emptying is by administering apomorphine in the recommended manner, and this advocacy has recently received further support from independent observers (Holdsworth, Furness and Roulston, 1974). The other factors which can contribute to the aspiration of a large quantity of regurgitated material are: inefficient and protracted induction of anaesthesia, failure to apply appropriate cricoid pressure and to provide an instantly accessible means of efficient suction. (A fourth reason is the deliberate avoidance of endotracheal intubation; this occurred in two of the cases reported in the most recent series, but hardly merits the compliment of reasoned criticism.) Only rarely should there be considerable gastric contents at a time when operative obstetric intervention is required. In our hospital, we have found it necessary to empty the stomach before induction of anaesthesia on only six occasions in a series of approximately 2000 emergency general anaesthetics. With the increasing emphasis upon the avoidance of protracted labour, and the reduction in the prescribing of narcotic analgesics (which Nimmo, Wilson and Prescott (1975) suggest promote delay in the gastric emptying time), such an undertaking should become even rarer, but the routine safety procedures must invariably be followed.

The continued trail of deaths from acid-aspiration syndrome is even more depressing. For almost a decade anaesthetists have been presented with the conclusive evidence that this condition results from the aspiration of material the pH of which is less than 3.0; very rarely, if ever, is the lethal material less acid, and probably only a few millilitre is required to cause a fatality. Data gathered during a recent Survey (Crawford and Opit, 1976) suggest that the mortality associated with the aspiration of acid material is at least 25%. Such deaths have continued to occur since the period covered by the most recent Confidential Enquiries Report. They are not peculiar to this country; it has been suggested (Baggish and Hooper, 1974) that 2% of maternal deaths in the United States are the result of acid-aspiration. It is equally well appreciated that the pH of the intragastric contents can be maintained above the critical value—and hence the possibility of acid-aspiration syndrome’s occurrence averted—by the institution and unwavering maintenance of a regimen of antacid prophylaxis before elective surgery and throughout labour. This therapy is not unpalatable, is non-toxic, places no undue burden upon the medical and nursing staffs, and is inexpensive. Only factors such as laziness, personal inadequacy and incompetence have delayed the implementation of this simple prophylactic measure throughout every obstetric unit (and, indeed, in every surgical unit (Hester and Heath, 1975)) in the country. The situation is now such that it may legitimately be contended that should a patient (obstetric, surgical or in an intensive therapy unit) die of acid-aspiration syndrome, and it be made
apparent that the appropriate regimen of antacid therapy was not practised in that unit, serious consideration must be given to the extent to which the anaesthetist was responsible.

The other major cause of maternal death associated with anaesthesia has been unexpected hypoxia unrelated to aspiration. There are good grounds for supposing that this reflects the situation in which there is concurrently an episode of ventilatory failure (most frequently caused by difficulty at intubation) and a substantial reduction in cardiac output. The latter results from caval compression, and can be avoided by appropriate positioning of the patient. It is to be hoped that the current insistence upon a lateral tilt of the patient during Caesarean section, and the avoidance of the supine, or dorsal, position throughout labour and at vaginal delivery, will result in the elimination of this category of death from subsequent Reports.

A further disappointment in the present Report is the reappearance, after many years, of deaths associated with general anaesthesia given for forceps delivery: there were five of these. Only very rarely should general anaesthesia be required in a case of operative vaginal delivery, and even more rarely among cases in which the infant is a singleton presenting by the vertex. Extradural block and spinal block are outstandingly the anaesthetic techniques of choice in these cases, and a more than very occasional resort to general anaesthesia must reflect either the incompetence of the attendant anaesthetists, the inefficiency of the obstetric service relating to the psychological and medical preparation of the patients, or the poverty of general organization of the anaesthetic service.

The comparative failure of the anaesthetic fraternity to raise its standards in this area is starkly revealed by the number of maternal deaths with "avoidable factors" detailed in the last six successive triennial Reports (table I). The five conditions detailed in the table are the most generous contributors to maternal mortality, and only those associated with pulmonary embolism and with anaesthesia have not shown a reduction in numbers during the past 18 years. In 1955-57 anaesthesia was the associated factor in less than 8% of the "avoidable" deaths, in 1970-72 the comparable figure was more than 18%.

The bleak drama reflected by these figures has had unfortunate general consequences, in that it has concentrated the attention of the body of anaesthetists upon a relatively minor aspect of the importance of anaesthetic practice within obstetrics. It has encouraged anaesthetists who have administrative powers to claim—by implication if not directly—that there is little merit in vesting more anaesthetic time and effort in obstetric units "merely" in the hope of saving 10 maternal lives in England and Wales each year. However, it is now well recognized by obstetricians and neonatologists, as well as by obstetric anaesthetists, that the clinical activities of the latter are of crucial importance to the well-being of both mother and infant. Not only are lives, maternal or perinatal, saved by good obstetric anaesthetic care, but the quality of life of each of the individual patients is enhanced. These facts have been appreciated for many years in respect to deliveries by Caesarean section. The search for that technique of general anaesthesia for Caesarean section which is least harmful to the infant and most beneficial to the mother has now reached the point at which only questions of a minor nature remain to be answered. It is no longer to be doubted that the avoidance of caval compression, preferably by the provision of a lateral tilt, is mandatory to the well-being of both mother and infant (Downing, Coleman et al., 1974). There can also be no gainsaying the fact that the infants of mothers who received approximately 67% oxygen in the inspired mixture will, all other things being equal, be in the optimum acid-base state at delivery (for example, compare Crawford et al., 1976, with Downing, Mahomedy et al., 1974 and with Magno, Selstam and Karlsson, 1975). The continued investigations into a variety of anaesthetic induction agents (Downing, Mahomedy et al., 1974; Holdcroft et al., 1975; Stovner and Vangen, 1974; Holdcroft et al., 1975) and into volatile agents used for the maintenance of anaesthesia (Coleman and Downing, 1975; Crawford and Davies, 1975; Crawford et al., 1976), although pursued with the intent of reducing the incidence of maternal "awareness" from about 4% to zero, and of eliminating entirely the currently extremely low incidence of drug-induced neonatal depression, are now beginning to assume some of the characteristics of academic exercises. The only foreseeable major advance in this area in the United Kingdom is the application on an increasing scale of extradural block for Caesarean section (Baheti et al., 1975). This practice is being pursued with increasing intensity in many centres, and according to all the reports received informally by the present writer—including that of a study conducted in his own hospital—provided that the mother is appropriately "pre-loaded" with i.v. administered fluid, that a lateral tilt is maintained and that the mother breathes...
OBSTETRICS, ANALGESIA AND ANAESTHESIA

Table I. Number of deaths in which there was said to have been an "avoidable factor", related to the five major causes of maternal death as detailed in the six most recent Reports on Confidential Enquiries into Maternal Deaths in England and Wales (H.M.S.O., London)

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<tbody>
<tr>
<td>Toxaemia</td>
<td>103</td>
<td>77</td>
<td>51</td>
<td>38</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>72</td>
<td>69</td>
<td>45</td>
<td>30</td>
<td>31</td>
<td>26</td>
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<tr>
<td>Pulmonary embolism</td>
<td>14</td>
<td>21</td>
<td>16</td>
<td>11</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>Abortion</td>
<td>91</td>
<td>90</td>
<td>83</td>
<td>103</td>
<td>92</td>
<td>59</td>
</tr>
<tr>
<td>Anaesthesia</td>
<td>24</td>
<td>24</td>
<td>16</td>
<td>24</td>
<td>34</td>
<td>31</td>
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an oxygen-enriched mixture, the acid–base state of the infants is equally as good as is that of infants whose mothers had received a recommended technique of general anaesthesia. They do not display any degree of drug-induced depression, and are delivered of mothers who, in the majority of cases, are grateful for the experience.

The main focus of interest and activity in the field of obstetric anaesthesia is now upon the conduct of labour and vaginal delivery. The impressive flowering of the "new obstetrics"—characterized by increased humaneness as well as by resort to science rather than to folklore—is exemplified in the delivery suite by an increased incidence of induction of labour, a greater insistence upon the avoidance of protracted labour (by application of the tenets of the "active management of labour") and an increasing application of monitoring of the progress of labour, the pattern of changes in intra-uterine pressure and the pattern of changes in foetal heart rate and, on occasion, of the acid–base values derived from samples of foetal scalp capillary blood. The interaction between these latter activities and the pursuit of the effects and the effectiveness of methods of obstetric analgesia can be described in some instances as symbiotic. Certainly the provision of adequate analgesia throughout labour has encouraged the more intensive application of augmentation of labour and of monitoring, and equally the latter has facilitated the better appreciation of the particulars of maternal and foetal–neonatal responses to techniques of analgesia.

Rarely does a labouring patient in a well-informed obstetric unit receive more than two doses of a narcotic analgesia (usually pethidine 100 mg per dose), and a single dose of the drug is the general rule. Techniques of continuous or intermittent i.v. infusion of pethidine have been described (Eliot et al., 1975; Evans et al., 1976), but appear to be unlikely to come into common usage. It has been demonstrated that a single dose of pethidine can lead to a 10% reduction in the oxygen tension in maternal arterial blood during labour (Huch et al., 1974), and the depressant effects of such medication upon the neurobehavioural responses of the subsequently delivered infant have also been detailed (Brackbill et al., 1974). On the other hand, intermittent inhalation analgesia is likely to be innocuous to both mother and child.

The inadequate relief of labour pain leads to several undesirable effects additional to the emotional distress of the mother: maternal oxygen consumption is increased (Sangoul, Fox and Houle, 1975), there is a steady increase in the concentration of free fatty acids in maternal blood (Maltau, Andersen and Skrede, 1975) with a concurrent increase in maternal metabolic acidosis (Pearson and Davies, 1973a, b; Thalme, Belfrage and Raabe, 1974; Thalme, Raabe and Belfrage, 1974) and, unless labour is being stimulated, the effectiveness of uterine contractions diminishes (Maltau and Andersen, 1975). As a reflection of these changes the foetus also becomes increasingly acidotic (Pearson and Davies, 1974a, b; Thalme, Belfrage and Raabe, 1974). Thus relief from pain in labour is a necessary requisite to the delivery of an infant in optimal condition. Analgesics administered by systemic injection or by inhalation are, unfortunately, not impressively effective, as has been demonstrated in several well-regularized studies (Holdcroft and Morgan, 1974; Maltau, Andersen and Skrede, 1975). There is now little reason to doubt that continuous extradural analgesia is par excellence the technique which provides for the most efficient analgesia and the greatest safety for the foetus (Pearson and Davies, 1973a, b, 1974a, b; Thalme, Belfrage and Raabe, 1974; Thalme, Raabe and Belfrage, 1974; Zador and Nilsson, 1974; Maltau, Andersen and Skrede, 1975). Any suggested deleterious effects upon the foetus or the newborn have been demonstrated to be insignificant, certainly when bupivacaine is the drug employed.

These statements apply to all pregnancies in which the infant is viable, but it is likely that the benefits to the perinate of extradural block given to the mother during labour will be more easily apparent, and of
greater importance, in cases in which the focus is already at risk when labour starts—in cases of maternal hypertension, pre-eclampsia, diabetes, Rhesus incompatibility with antibodies, intra-uterine growth retardation, and so forth. However, there is a further, equally important advantage provided by this method of analgesia. There is now little reason to doubt that extradural block given for labour and delivery (or, in the event of required haste, spinal block given for delivery) markedly reduces the propensity to perinatal morbidity and mortality associated with the breech delivery of a singleton (Bowen-Simpkins and Fergusson, 1974; Crawford, 1974; Donnai and Nicholas, 1975; Darby, Thornton and Hunter, 1976), in cases of vaginal delivery of a multiple pregnancy (Crawford, 1975) and in all cases in which the infant is immature at delivery.

Thus it will be seen that anaesthesia has much to contribute to obstetric excellence far beyond the mere provision of a service of general anaesthesia for the occasional Caesarean section, and the "candy floss of a luxurious method of pain-relief in labour". These conclusions have important administrative and community implications. The Western world, partly in response to the situation of diminishing resources and redistribution of wealth, is aiming for (and in several countries, has already achieved) zero population growth. If the community is to maintain its standards and to sustaint its cultural and economic development, the corollary of that ambition must be that every conceptus which reaches the state of inra-uterine viability passes through the "shadow of the valley of birth" (N. Eastman, personal communication) and emerges from its post-natal phase with its genetic and social potentials undiminished. Obstetric medicine (involving obstetricians, midwives, perinatologists and obstetric anaesthetists) is that branch of the health service most critical to the well-being of the community currently and for decades to come, and requires to be given the top priority in each allocation of resources, finance, equipment and manpower. By that token, therefore, it is essential that within the specialty of anaesthesia, prime regard be paid to the effective training of at least a cadre of anaesthetists in obstetric anaesthesia and, of even greater moment, that obstetric units receive adequate anaesthetic staffing.

It seems likely that the only way in which anaesthetic involvement in obstetric work will be effectively provided is to ensure that there is total commitment at consultant level (Crawford and Opit, 1976). Logistically, this means that each obstetric unit delivering more than approximately 2500 infants annually should be given full-time consultant anaesthetist cover, divided preferentially between two or three individual consultants. It is likely that during the coming decade at least, the number of deliveries in the United Kingdom will be within the range 600 000–700 000 annually. There is an increasing rate of closure of small units and of coalescence of those in the low–medium range (in the interest of both economy and safety), so it is likely that roughly 80–90% of women will be delivered in an obstetric unit which conducts more than 2500 deliveries annually, and thus the number of such units in the U.K. will be 200–250, each of which should be staffed by one "equivalent whole-time" consultant anaesthetist, supported by an appropriate number of trainees. This is by no means an unrealistic target. Its achievement is likely to require the establishment of a mere handful of new consultant posts, and for the rest, re-organization and the redeployment of existing manpower, predicated upon the evaluation of priorities referred to above, and a reduction of the current subservience to the more exotic and the less fruitful branches of non-obstetric surgery, will suffice. The time has long passed since infants could be considered as expendable—either quantitatively or qualitatively.

SUMMARY

A brief review of recent advances in the understanding and practice of obstetric anaesthesia and analgesia is presented. The failure to reduce maternal mortality associated with anaesthesia is related to laxity in the provision of anaesthetic services to obstetric units. The outstanding importance for the quality of life of infants and mothers, of a well-conducted obstetric anaesthetic and analgesic service is emphasized. Relating this to the needs of the community, it is claimed that the demands of obstetrics should have priority in the anaesthetic service, and that this requirement can and should be met by a redeployment of anaesthetic personnel, especially at consultant level.

REFERENCES

(AUTHOR’S NOTE: With two exceptions, I have given references only to publications which appeared subsequent to 1973, on the assumption that interested readers will be well acquainted with the literature previous to that date.)


