

Anaesthetic Related Maternal Deaths in Malaysia – A Review

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Summary

The anaesthetic hazards for the obstetric patient are well known. Based on results of the first two reports on the confidential enquiry into maternal deaths in Malaysia for 1991 and 1992, ten cases of anaesthetic related deaths were analysed. There were 3 in 1991 and 7 in 1992 accounting for 1.34% and 2.8% of maternal deaths respectively. It was estimated that the crude mortality rate for the obstetric patient was 11.4 per 100,000 operative deliveries or a four-fold risk compared to the general surgical patient. One case resulted from administration of intravenous sedation while the rest involved general anaesthesia, seven of which were done under emergency conditions. Inadequate airway management and ventilation in the perioperative period, including during interhospital transfer was the single most important factor causing the majority of these deaths. The use of regional anaesthesia for Caesarean sections is strongly advocated. Substandard care was also present in all cases. Other issues pertinent to improvement of obstetric anaesthetic services are also discussed which include the quality of anaesthetic manpower, upgrading of infrastructure, facilities and staffing of operating and recovery areas, the use of regional anaesthesia, expanding the role of the anaesthetist and the quality of the anaesthetic services in general.

Key Words: Anaesthetic, Maternal deaths, Substandard care, Regional anaesthesia

Introduction

To the anaesthetist, the obstetric patient poses greater anaesthetic risks. The anatomical and physiological changes that occur during pregnancy result in hazards of failed intubation, difficulty in ventilation, greater tendency towards hypoxia, acid aspiration syndrome and supine hypotension syndrome¹. Administration of general anaesthesia and regional anaesthesia including spinal anaesthesia differ from the general surgical population with greater incidences of side effects which may adversely affect both mother and fetus². Although the greater majority of them would be classified as ASA I or II (See Annex A), anaesthetic considerations, assessment and management all require greater skills on the part of the anaesthetist. Given the present situation in Malaysia, where many constraints on infrastructure, resources and staffing exist particularly in East Malaysia, it was very interesting

to study the anaesthetic contribution towards maternal deaths in the country.

Maternal Mortality in Malaysia

Maternal mortality figures have been available as far back as 1947, monitored by the Department of Statistics and the Ministry of Health. As a parameter of standard and quality of medical care and specifically, that delivered to the female reproductive population, the Maternal Mortality Rate (MMR) showed an impressive decline over the years consistent with the development of our health care system. The MMR declined from 530 per 100,000 livebirths in 1950 to 148 in 1970 to 20 in 1990^{3,4}. These figures from the Department of Statistics is lower than that reported by the Ministry of Health because of the different methods of reporting whereby the former received notification from nonmedical personnel. Figures 1 and

2 show the trends in Maternal Mortality and its racial distribution over the past decade.

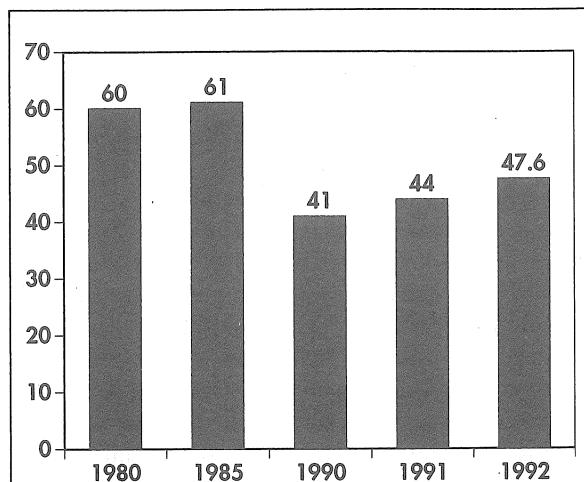


Fig. 1: Trends in maternal mortality since 1980 (MMR per 100,000 livebirths)

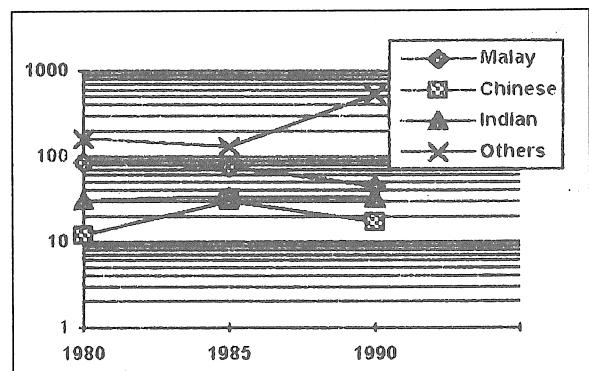


Fig. 2: Maternal mortality by ethnic groups: 1980, 1985, 1990 Peninsular Malaysia

History of Confidential Enquiry into Maternal Deaths in Malaysia

A system of enquiry into maternal deaths in Malaysia was set up in 1989 with the aim of further sustaining the decline in maternal mortality rate. A National Technical Committee for the Confidential Enquiry into Maternal Deaths was established to provide leadership and for the first time, a senior anaesthetist was appointed as a permanent member. Generally, the purpose and format of the enquiry were patterned after

the United Kingdom Confidential Enquiry into Maternal Deaths, which existed since 1952 and published triennially. In Malaysia, the enquiry is carried out annually because there are sufficient number of cases each year to undertake a meaningful audit.

The flow chart on the organisation of investigation and report is given in Annex B. At the National level, the National Technical Review Committee would review these reports and classify them using the International Classification of Diseases (ICD). In particular, areas of substandard care are identified and recommendations are made which are subsequently presented to the Director General of Health Services and relevant divisions in the Ministry of Health. The recommendations are then discussed and a plan of action formulated for the following year.

According to the International Classification of Diseases, a maternal death is defined as death occurring "while pregnant or within 42 days of termination of pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes". It is further classified into direct, indirect or fortuitous; direct deaths are those resulting from obstetric complications of pregnancy, labour and puerperium; indirect deaths are those resulting from either a previous existing disease or from a disease which developed during pregnancy and which was aggravated during pregnancy; and fortuitous deaths are those resulting from causes not related to or influenced by pregnancy. In these enquiries, the term 'substandard care' is used to denote a case in which the actual care, delivered by health care workers to the patient, as inappropriate or deficient, or fall below standard that should have been offered to her. These factors also include shortage of resources for staffing, administrative failure and inadequate backup facilities. In contrast to the term used in the UK enquiries, the term does not include cases where the death was preventable had the patient or her family acted appropriately; this factor is called 'patient factor'. The presence of substandard care has much significance because it identifies avoidable factors in which remedial actions can be taken.

In the UK enquiries, beginning from reports of the

1979-1981 triennia, there included a section on 'late deaths' which occurred between 43 days and one year after delivery⁶. This category is however not studied in Malaysia for the time being.

Results of Confidential Enquiries into Maternal Deaths in Malaysia for 1991 and 1992

The 1992 report on Confidential Enquiries into Maternal Deaths in Malaysia has recently been published by the Ministry of Health and this is the second such report in Malaysia. There was a total of 296 maternal deaths reported in 1992, an increment from 1991 during which there were 252 deaths. (Table I). The number of direct deaths remained virtually unchanged at 203 and 204, while the increase by 44 deaths in 1992 were the result of increased indirect and fortuitous deaths. The corresponding Maternal Mortality Rate (excluding fortuitous deaths) has also increased from 44.0 per 100,000 livebirths in 1991 to 47.9 per 100,000

livebirths in 1992. This increment is likely the result of increased reporting of maternal deaths rather than a decrease in the standard of health care.

The MMR for Malaysia is about five times more than that of the UK whose figures are 7.6 and 10 for the triennia 1985-1987 and 1988-1990 respectively^{7,8}.

The leading cause of death in both the years were postpartum haemorrhage contributing 27.2% of direct and indirect deaths in 1991 and 20.7% in 1992. Hypertensive disorders of pregnancy (20.1%) and obstetric pulmonary embolism (16.5%) were the two leading cause in 1992 whereas in 1992, they were unspecified causes (20.3%) and obstetric pulmonary embolism (13.5%). In contrast with the United Kingdom, hypertensive disorders rank highest contributing 18.6% of direct maternal deaths in the 1988 - 1990 triennia, followed by other direct causes (16.6%) and pulmonary embolism (16.6%).

Table I
Classification of maternal deaths in Malaysia for 1991 and 1992

Classification	1991		1992	
	No.	%	No.	%
Direct	203	81	204	68.9
Indirect	21	8	47	15.9
Fortuitous	28	11	45	15.2
Total	252	100	296	100

Table II
Total maternal deaths, maternal mortality rates and deaths associated directly with anaesthesia

Year	Total maternal deaths*	MMR per 100,000 live births*	No. of deaths directly due to anaesthesia	Anaesthetic deaths as % total maternal deaths	Rate of anaesthetic deaths per 100,000 live births	Anaesthetic deaths as % of direct deaths
1991	224	44.0	3	1.34	0.6	1.48
1992	251	47.9	7	2.8	1.33	3.43

* Direct and Indirect deaths (i.e. Excluding fortuitous deaths)

Haemorrhage caused 15.2% of their maternal deaths⁸.

Anaesthetic Related Maternal Deaths

It is appropriate that the National Technical Committee also comprised of a senior anaesthetist so that a more accurate analysis can be made particularly where anaesthetic and intensive care was involved in the care of the patient. The proportion of anaesthetic related deaths may be small but is nevertheless significant in view of increasing anaesthetic intervention and the role that anaesthetists should play as a member of the obstetric team.

During the two-year period, there were 10 deaths classified as deaths following complications of anaesthesia and sedation (ICD 668), 3 in 1991 and 7 in 1992, accounting for 1.34% and 2.8% of maternal deaths respectively (Table II). The rate of anaesthetic deaths worked out to be 0.6 per 100,000 livebirths in 1991 and 1.33 per 100,000 livebirths in 1992. Of the direct maternal deaths, anaesthesia contributed 1.48% in 1991 and 3.43% in 1992. The increase is similarly the result of better reporting. The figure for 1992 is 25% higher than that of the UK Confidential Enquiries, in which, for the 1988-1990 triennium, anaesthesia contributed to 2.7% of direct maternal deaths^{8,9}.

These figures do not truly reflect anaesthetic risks to the obstetric patient. Crude mortality rate or the number of anaesthetic deaths in relation to the number of anaesthetics given would be more accurate but unfortunately, figures for the latter are not available. Nevertheless, the rate of Caesarean section is certainly increasing, as may be the number of anaesthetics being given for abortions, evacuation of uterus etc. Therefore, if we assume that 10% of the 542,349 live births in 1992 were operative deliveries, then, the crude mortality rate for anaesthetic deaths will be 11.4 per 100,000 operative deliveries. For 1992, the crude mortality rate for perioperative deaths among general surgical patients of categories ASA I and ASA II was 3 per 100,000 anaesthetics^{5,10}. This means that there is an almost four-fold risk for the pregnant patient undergoing anaesthesia.

All except one death involved administration of general

anaesthesia for Caesarean section (Table III). That single case resulted in death following administration of intravenous sedation for evacuation of the uterus. Seven cases were done as emergency while the other two cases were elective Caesarean sections. In all these cases, there was evidence of substandard care, often in multiple areas. Inadequate management of airway and ventilation in the perioperative period including during transfer to another hospital, caused a large proportion of these deaths, accounting for 2 of the 3 cases in 1991 and 4 out of the 7 cases in 1992.

Analysis of Cases

There was one case of failure to intubate in 1992, in which repeated attempts without maintaining oxygenation resulted in cardiac arrest and anoxic encephalopathy. The reasons for difficult intubation in the obstetric patient are well known and its incidence had been quoted as 1:300¹¹. Assessment of the airway and proper positioning of the head and neck should be stressed as well as training to increase skills at intubation but what is most crucial are actually the steps taken when intubation fails unexpectedly. These include ensuring oxygenation and prevention of hypoxia, avoidance of repeated attempts, prevention of aspiration as well as getting help quickly. It is mandatory that all anaesthetists and staff in theatre be familiar with the failed intubation drill and all necessary equipment to cope with the situation be immediately available⁶.

Misplaced endotracheal tube and oesophageal intubation resulted in one death in 1991 and another in 1992. This problem is repeatedly seen in any survey of anaesthetic critical events, mishaps or closed claims study and is not surprising. Auscultation for breath sounds to confirm tracheal placement of the endotracheal tube can be misleading^{6,12}. Furthermore, detection by the pulse oximeter can be delayed because of preoxygenation and its relatively slow response time. Cyanosis also appears late, occurring well into the surgery, by which time cardiac arrest would be imminent. The only absolute diagnostic test is by detection of carbon dioxide in the exhaled gas. In the United States, the use of a capnograph is mandatory in all intubated patients while in Australia and New Zealand it had been made mandatory from 1st January

Table III
**Deaths directly attributable to anaesthesia; procedures for which anaesthesia was given,
 type of anaesthetic, indications and cause of death**

Year	Operation	Indication	Cause of death
1990	1. Elective Caesarean Section under GA	Previous Caesarean Section and cephalopelvic disproportion	Acid aspiration
	2. Emergency Caesarean Section under GA	Fetal distress	Misplaced tracheal tube presented as postoperative respiratory distress and lung collapse
	3. Emergency Caesarean Section under GA	Fetal distress	Postoperatives respiratory distress? cause, died on arrival to another hospital
1992	1. Elective Caesarean Section under GA	Severe Pre-eclampsia	Hypoxic encephalopathy from failed intubation
	2. Elective Caesarean Section under GA	Transverse lie	Inadequate postop recovery
	3. Emergency Caesarean Section under GA	Failed vacuum	Cardiac arrest from intermittent suxamethonium
	4. Emergency Caesarean Section under GA	Oblique breech and fetal distress	Hypoxia from accidental extubation
	5. Emergency Caesarean Section under GA	Prolonged labour	Acid aspiration
	6. Emergency Caesarean Section under GA	Prolonged labour	Postoperative respiratory distress? cause died on arrival to another hospital
	7. Emergency D&C under Sedation	Incomplete abortion	Cardiac arrest from relative drug overdose

1992^{13,16}. In the United Kingdom, its use is strongly recommended where appropriate¹⁴. In the Recommendations for Standards of Monitoring during Anaesthesia and Recovery published by the Malaysian Society of Anaesthesiologists in 1993, the use of a capnography is strongly recommended for most intubated patients¹⁵. There are other additional

advantages of the capnograph. It allows quantitative assessment of ventilation, early detection of adverse clinical events such as pulmonary air embolism and thromboembolism, can function as an apnoea monitor or disconnect alarm, detection of malignant hyperthermia, detection of breathing circuit malfunction and monitors the progress of

resuscitation¹². Oesophageal detector devices have also been advocated which is simpler, cheaper and equally sensitive and specific^{17,18}. In the absence of these devices, a high index of suspicion must always be borne in mind, and the sayings by Gray "when in doubt, take it out" holds true¹⁹. It is also of utmost importance that all persons giving anaesthetics be competent at artificial ventilation using a mask, bag and airway.

Airway and ventilation problems in the immediate postoperative period after an apparently uneventful anaesthetic and during transfer to another hospital accounted for death in one patient in 1991 and 2 patients in 1992. Inadequate recovery from anaesthesia, inadequate assessment of ventilation and improper control of ventilation and oxygenation during transport were identified as being substandard. There is much inter-individual variation in patients' response to anaesthetic drugs and their residual effects can predispose to complications and therefore they must be monitored and allowed to recover adequately before being transferred to the ward. A recovery area with adequate staff and monitoring facilities should be made mandatory for all operating suites^{5,15,20}. In situations where transfer to a larger hospital is necessary, these patients' condition must be stabilised first and the personnel accompanying the patient must be skilled in airway management and cardiopulmonary resuscitation. Vital signs of the patient must be assessed and monitored throughout the journey to ensure the patient arrives safely. Guidelines for transfer of critically ill patients have been prepared by the committee⁴.

In the one case involving intravenous sedation, the patient had been inadequately resuscitated for bleeding secondary to incomplete abortion and a curettage was done under pethidine and valium. Standard doses of intravenous sedative drugs is a relative overdose in the hypovolemic patient and basic monitoring must be carried out by a staff who is dedicated to monitoring the patient and preferably trained in cardiopulmonary resuscitation. Appropriate monitoring equipment should be available.

Acid aspiration pneumonitis accounted for one case each in 1991 and 1992. There was no information regarding whether antacid prophylaxis was given or

whether there was difficulty with intubation and it was not possible to ascertain if cricoid pressure was applied correctly. Adequate assistance for correct application of cricoid pressure and the use of nonparticulate antacids and H2 receptor blockers to increase the gastric pH above the critical value are standard practices in obstetric anaesthesia. Guidelines for this purpose have been established and in Malaysia, the protocol has been circulated to all hospitals since 1991 although it is still premature to see if there has been a decline in maternal deaths as a result of this procedure. In the UK, despite adherence to these guidelines, there was still concern that they had failed to prevent one maternal death in the 1985-1987 triennium and another 2 deaths in the 1988-1990 triennium^{7,8,9}. A number of late deaths due to ARDS (Adult Respiratory Distress Syndrome) was also contributed to by aspiration. It was suggested H2-receptor blockers should be administered to all patients who may require anaesthesia and to patients with pre-eclampsia, and a non-particulate antacid be given before induction of general anaesthesia. It was recommended that preoperative nasogastric aspiration should still be considered in those patients who had received opioid analgesia during long labour where delayed gastric emptying is suspected and the stomach should be routinely emptied before extubation to minimise risks of postoperative aspiration^{8,9}.

One death in 1992 resulted from an adverse drug reaction involving the use of intermittent suxamethonium for maintenance of anaesthesia. The patient developed asystole and inadequate resuscitation led to severe hypoxic encephalopathy and death. With superior intermediate acting nondepolarising muscle relaxants available now, the use of suxamethonium should be limited to rapid sequence induction of anaesthesia and not for maintenance of muscle relaxation during surgery. It was interesting to note that there was no cases of anaphylactic or anaphylactoid reaction reported.

Similarly seen in the UK enquiries, the majority of these disasters involved inexperienced or inappropriate personnel, who demonstrated lack of knowledge and skills when dealing with the crises. There was lack of supervision and help was unavailable or late. In East Malaysia, most anaesthetics are administered by trained

medical assistants. This practice though less than desirable may continue due to acute shortage of physician anaesthetists.

Deaths where anaesthesia was a contributing factor

There were some deaths which though were not directly due to anaesthesia, had some degree of anaesthetic contribution. In 1991, 9 cases were identified in which, had a higher level of skill and judgement been exercised in the anaesthetic intervention, a different outcome could have been made. In these cases too, medical assistants and junior anaesthetic officers working alone in small hospitals were repeatedly involved.

There were five cases where intraoperative haemorrhage was inadequately managed. The degree of hypovolemia was seriously underestimated and there was inadequate use of invasive hemodynamic monitoring and intensive postoperative care. In some instances where blood was not readily available, colloids and crystalloids were not used adequately to restore blood volume while blood was being sent for. Postpartum haemorrhage accounted for over 20% of all deaths and was the leading cause of maternal deaths during the two years. Therefore, resuscitation skills is of concern and must be improved. It should be standard practice to insert large bore IV cannulae and a central venous pressure (CVP) line and to call for senior obstetric and anaesthetic assistance as soon as severe blood loss is observed or suspected. The first goal of resuscitation is to maintain cardiac output by restoring blood volume. Blood pressure is a poor indicator of cardiac output and the onset of hypotension already signifies severe hypovolemia. Provision of blood and blood products for obstetric emergencies must be adequate including in private hospitals. In the 1992 report, a method to reduce haemorrhage by aortic compression was illustrated and advocated which could help maintain blood flow to vital organs during resuscitative measures to replace the blood loss⁵.

There was one case involving a severe pre-eclamptic and gestational diabetic who had a cardiac arrest during the recovery period. There was insufficient information to ascertain the cause of arrest and this case demonstrates again the vital role of the recovery room.

One patient who had sustained hypoxic brain damage, died from an obstructed tracheostomy tube which occurred in the ward after a prolonged stay in the intensive care ward. How and why she sustained the hypoxic brain damage was not detailed in the report.

Another patient died of respiratory distress in the recovery room after an apparently uneventful anaesthetic. Although the case was classified as amniotic fluid embolism, there was insufficient information to exclude anaesthetic misadventure, which is highly likely as the incidence occurred soon after an anaesthetic.

There was one death in a patient with Eisenmengers syndrome and history of cardiac failure who died of acute cardiac failure during an epidural anaesthetic. Although the use of a regional anaesthesia is highly controversial in this high risk patient, management warrants close invasive hemodynamic monitoring including direct intraarterial blood pressure, central venous pressure and pulmonary capillary wedge pressure. Such patients are better managed at referral centres where invasive monitoring and intensive care facilities are available.

Discussion

Several crucial issues have been identified in these deaths, some of which formed the basis for the many strong recommendations made by National Technical Committee. These issues are worthy of some discussion.

The quality of anaesthetic manpower

It is evident that all the above catastrophes were to a large extent caused by operator error or by inadequate experience, training or knowledge. Therefore it is appropriate that priorities should be aimed towards increasing the quality of anaesthetic manpower, including training and accreditation of anaesthetists. The current recommendation for safety standards in anaesthesia requires that a medical officer have at least one year of training before he or she can be allowed to work unsupervised in a district hospital. Where an anaesthetic specialist is available, at least 4 to 6 months training is required before an officer can administer

anaesthesia for Caesarean section⁵. The rapid turnover of anaesthetic officers as well as the 'loss' of these officers to postgraduate training programmes create a constant vacuum in an already diminished pool. Anaesthetic providers, obstetricians as well as health care planners must have increased awareness of this situation that the training and distribution of qualified anaesthetic officers can be optimised and preventable maternal deaths minimised.

Various protocols relating to safety in anaesthetic practice and obstetric anaesthesia in particular have been prepared for the Ministry of Health i.e. Recommendations for standards of monitoring during anaesthesia and recovery, guidelines for acid aspiration prophylaxis, guidelines on transfer of critically ill patients, guidelines on intravenous sedation for minor procedures^{4,5,15}. Implementation and monitoring of these practices will help planning of facilities, training of officers and help to reduce mortality.

Early specialist involvement is advised in management of complicated pregnancies that may need operative deliveries and hence avoid delegation to junior anaesthetists. There should also be mechanisms by which help can be summoned easily and quickly when crises occur.

Upgrading of infrastructure, facilities and staffing of operating theatres and recovery areas

The technological evolution of monitoring equipment has made it possible for changes in physiological parameters to be detected very early i.e. before clinical signs appear. Devices such as pulse oximeters and capnometers have extended the clinician's ability to monitor effectively and should be available in all operating rooms. The technical spin-offs which are of proven value should be passed on to all patients in the operating room.

The cases above also demonstrated that many deaths occurred following problems encountered in the postoperative period in the recovery area. Studies have shown that although the total incidence of operative mortality is decreasing, the proportion of anaesthesia associated deaths occurring in the early postoperative period remains fairly constant and is largely

preventable^{20,21,22}. The recovery room must therefore be seen to be as important as the operating theatre or intensive care unit. The quality of staff, design of the area and facilities provided should reflect this and the duties of medical and nursing staff clearly defined. The recommendations on standards for anaesthesia and recovery have included protocols for reception and discharge of patients from recovery rooms and this has been adapted uniformly in most government hospitals.

Promoting the use of regional anaesthesia for operative deliveries

The use of epidural and spinal anaesthesia will avoid general anaesthesia related problems, in particular problems of intubation, tracheal tube misplacement, ventilator disconnection and aspiration, and certainly could have avoided most of the above mortalities. Spinal anaesthesia is easy to do, rapid in onset and lack toxicity due to local anaesthetic. In the general surgical population, there is little difference in perioperative mortality between various anaesthetic techniques in relatively healthy patients scheduled for elective surgery, but there is evidence to suggest that regional anaesthesia is more beneficial in high risk surgical patients²³. Early morbidity and mortality in elderly patients in whom an emergency repair of hip fracture was carried out under spinal anaesthesia is also reduced compared to general anaesthesia^{24,25}. In the United States and Europe, regional anaesthesia is the method of choice for obstetric deliveries^{2,26}. But is regional anaesthesia, in particular spinal anaesthesia totally safe and acceptable in the hands of a mixed anaesthetic provider?

Performing regional anaesthesia including spinal is different in the obstetric patient for various anatomical and physiological reasons^{1,2}. There are higher incidences of side effects and especially hazardous is hypotension as a result of sudden sympathetic blockade aggravated by supine hypotension syndrome which may adversely affect the mother and fetus; inadequate block, variable degree of block, nausea, vomiting, postdural puncture headache, backache etc. The level of anaesthesia achieved is also variable and the dose of the local anaesthetic needs to be individualised if not titrated. The latter is only possible if a catheter technique is

used. Indeed, the prevention and treatment of complications must also be as important as considering the indications for and performing of the block.

Drawing from experience reported in the UK Confidential Enquiries, maternal deaths have resulted from regional anaesthesia. Direct deaths were due to cardiovascular collapse in a patient with valvular heart disease and fluid overload in a patient given a spinal anaesthetic. Regional anaesthesia also contributed to several deaths involving massive haemorrhage by impairing cardiovascular responses and concealing postoperative haemorrhage. Deaths have also resulted in the presence of cardiac disease and pulmonary hypertension and there was one cardiac arrest following an epidural top-up in a cardiac patient. In one late death, profound central neural blockade resulted in hypoxia and neurological damage^{7,8}.

On the other hand, the Penang Hospital experience on 514 cases of spinal anaesthesia for Caesarean section performed by medical officers between July 1992 to April 1994 showed that the technique is safe and well accepted by patients and surgeons²⁷. Over 93% of patients viewed their experience favourably. Doses of 2-2.5mls of 0.5% heavy bupivacaine produced analgesia ranging from T10 to above T4 with transient hypotension occurring in 22.4% of patients while persistent hypotension only in 3.5%. The incidences of difficulty in breathing, nausea, vomiting, post-spinal headache were very low. There was no mortality encountered. These experiences prove that where there are no contraindications, spinal anaesthesia should be the method of choice for routine Caesarean sections.

Data is lacking on the number of cases done in the country under regional anaesthesia but it is increasing. Supervision should still be carried out on these practices and guidelines laid out.

There have been an influx of literature over the past few years on the use of combined local anaesthetic and opioid for spinal anaesthesia, the use of spinal catheter technique and the combined spinal and epidural technique for Caesarean section and pain relief in labour^{2,28}. A safer and flexible regional technique may be in the horizon.

At the same time, increased patient education on the merits of regional anaesthesia should be intensified to promote greater acceptance of this technique.

Expanding the role of the anaesthetist

Anaesthetic intervention is increasing beyond the confines of the operating theatre. The position and skills of anaesthetists give them a unique and valuable role in obstetric care. Not only do they administer anaesthesia for operative deliveries and complications of third stage of labour, they now provide pain relief for labour, assist in resuscitation of severe haemorrhage and provide intensive care management of complicated pregnancies and therefore, are able to take greater responsibility in reducing maternal deaths.

During the two years in question, postpartum haemorrhage, hypertensive disorders and obstetric pulmonary embolism were the leading cause of maternal deaths and anaesthetic input for resuscitation and intensive care management can be significant. The early and appropriate involvement of anaesthetists may help alter outcomes positively in these cases. The establishment of High Dependency Units in maternity units also requires anaesthetic contribution such as in supervision of patient care and training of auxiliary personnel e.g., midwives, junior obstetricians. Obstetric anaesthesia is a recognised subspecialty which has contributed immensely to the safety of modern obstetric anaesthesia and analgesia and it is timely that this subspecialty be encouraged.

The quality of anaesthetic service

Anaesthetic related maternal deaths during the two years form a small proportion of maternal deaths and it had been deduced that the quality of anaesthetic service in the country was excellent⁵. Other mortality studies on anaesthesia also reported very low mortality rate such as the Confidential Enquiry into Perioperative Deaths (CEPOD) in the United Kingdom which reported it as being 1 in 185,086 cases in 1987²⁹. In Malaysia, the anaesthetic mortality rate studied between July 1992 and June 1994 was 1.3 per 10,000 cases¹⁰. However, we may be looking at the 'tip of the iceberg'. Mortality studies such as these, only examine an extreme end of the spectrum of anaesthetic complications and is therefore, an insensitive detector

of deficiencies in the system. As Harrison remarked "Counting the dead is a crude method for gauging the quality of anaesthesia"³⁰. The impact of any new innovations, practices or strategies would also be difficult to assess from mortality studies. The different profile of infrastructure, staffing, anaesthetic services rendered and status of patients managed differ among the different anaesthetic units, would mean that to generalise on the quality of the service would be unfair and inaccurate.

Conclusion

For the first time, the Confidential Enquiry into Maternal Deaths in Malaysia has enabled the Ministry of Health to examine anaesthetic practice and performance in obstetrics. The findings parallel that of other mortality and morbidity studies where causes of errors and mishaps are concerned. The audit has enabled several meaningful recommendations to be

made. A more widespread use of regional anaesthesia for routine Caesarean sections to reduce mortality due to airway and airway related problems is strongly advocated as well as expanding the role of the anaesthetist outside the operating theatre. The current anaesthetic related maternal mortality rate is quite low taking into account the limitations of human resources in particular the various grades of anaesthesia providers. The lowering of mortality and morbidity associated with the administration of anaesthesia is a goal towards which we must all individually and collectively continue to strive.

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Annex A**Physical Status Classification of American Society of Anaesthesiologists**

Status*	Description
I	Healthy patient
II	Mild systemic disease
III	Severe systemic disease, not incapacitating
IV	Severe systemic disease that is a constant threat to life
V	Moribund, not expected to live 24 hours irrespective of operation

* An E is added to the status number to designate an emergency operation

Annex B
**Organisation of Investigation and Reporting of Maternal Deaths
Ministry of Health, Malaysia**

Time frame	DEATH	Identified by Coordinator Investigated by Investigator MCHO Notified
1-2 weeks	KIK/K1-1 filled (incl. narrative report)	<ul style="list-style-type: none"> - by investigator and relevant personnel in Health Sector - submitted to Hospital for completion where relevant - Information inter-state by MCHO - if no Health Dept. involved, all parts filled by hospital
	Comments by MOH/MO I/C or specialist	after relevant discussions
	Submitted to state MCH Officer	<ul style="list-style-type: none"> - Obtains Code No 1 - Writes combined summary
2 months	State Maternal Mortality Meeting. KIK/K1 - 2 filled	<ul style="list-style-type: none"> - Bhg. 1 detached - Factors identified - State level action - Comments
	KIK/K1 1 and 2 submitted to MCH Division Min. of Health	<ul style="list-style-type: none"> - Confidential cover
4 months	Review by National Technical Committee	<ul style="list-style-type: none"> - Annual Report Statistics - Recommendations to DG of Health