

# Perioperative Mortality Review in Relation to Pregnancy-Related Deaths

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## Summary

Pregnancy-related deaths in four published perioperative mortality review reports were analysed. The aim is to look at the quality of surgical and anaesthetic services along with the perioperative care provided. The audit identified shortfalls in the logistic and support services and recommended remedial strategies. The review was conducted by a committee consisting of practising anaesthetists, surgeons and obstetricians who analysed the questionnaires collectively. A consensus was reached to categorise the death. There were 280 pregnancy-related deaths. Post-partum haemorrhage accounted for 31.8%, followed by hypertensive disorders of pregnancy (20.0%), obstetric embolism (16.1%), sepsis (10.7%) and associated medical conditions (21.4%). In brief, there were shortcomings in preoperative, intra-operative and post-operative care in some of the cases. Increased consultant input, clinical audit, improvements in monitoring and expansion of critical care facilities were the integral issues recommended.

**Key Words:** Critical care facilities, Clinical audit, Emergency surgery, Post-partum haemorrhage, Perioperative pregnancy-related deaths

## Introduction

The urgent need for developing quality indicators to improve patient-care was perceived in the sixties and seventies. One such study was the National Confidential Enquiries into Perioperative Deaths (NCEPOD) in the United Kingdom established in 1988. The Perioperative Mortality Review (POMR) in Malaysia was initiated in 1990. This was a multi disciplinary activity.

The principal objective was to evaluate the surgical and anaesthetic services; identify the shortfalls in the logistic and support services and formulate remedial strategies to reduce perioperative deaths. The POMR committee has so far published four biennial reports since its

inception. Parallel to this is an independent committee which audits all maternal deaths, headed by the Malaysian Technical Committee on National Confidential Enquiry into Maternal Deaths (NCEMD) established in 1991. This committee reviews all maternal deaths in the country, similar to the Confidential Enquiries in Maternal Deaths in the United Kingdom.

In 1992, the POMR audit was extended nationwide to include all the 12 General Hospitals in Peninsular Malaysia. By the fourth biennial report in 2004, the number of participating hospitals increased from 12 in the first report to 23, encompassing 14 General, 6 District, 2 Teaching and 1 Army Hospitals. In addition to the "direct reporting system" by the clinicians, a

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“parallel reporting system” was established to ascertain the true incidence of the number of perioperative deaths in a particular hospital. This data is analysed periodically by a peer review committee comprising groups of surgeons, anaesthetists and obstetricians.

## Materials and Methods

The POMR audit analysed 280 pregnancy-related deaths during the study period (July 1992-Dec 1999). Perioperative death is defined as death occurring within the total length of a single hospital stay after a surgical or obstetric operative intervention performed under general or regional anaesthesia. The length of hospital stay is defined as a hospital admission during the course of which surgery was performed for whatever reason.

From the fourth report onwards (Jan 1998-Dec 1999), five diagnostic categories of surgical procedures viz: colorectal surgery, pregnancy-related (obstetrics), paediatric surgery, trauma surgery and neuro trauma surgery were designated for the study. These five categories were chosen from ten leading diagnostic categories forming the bulk of the total number of perioperative deaths. Using the parallel reporting system, 94.9% of the pregnancy related deaths were reported and analysed. The design of the initial reporting formats was general in nature, which failed to capture data specific to different types of surgery. The gynaecological cases were excluded after the third report (July 1996-Dec 1997), because many of these deaths were mainly advanced genital tract malignancies<sup>1</sup>.

The exclusion criteria for perioperative deaths were:

1. surgery performed elsewhere during a previous admission but patient was readmitted and died during this admission.
2. diagnostic and/or therapeutic procedures carried out by physicians or other non-surgeons.
3. radiological procedures solely by a radiologist without a surgeon's involvement.
4. obstetric delivery/instrumental delivery in the labour suite.
5. procedures done under local anaesthesia outside the operating theatre.

The American Society of Anaesthesiologist's (ASA) physical status classification was used to stratify risk factors associated with surgery and anaesthesia<sup>2,3,4</sup>. Categorization was done to indicate whether the death

was unavoidable or possibly preventable and was assigned after review by assessors and discussed by the committee<sup>2</sup>. These methods of classification allowed for uniformity in assessment of reports by different assessors.

## Results

During the study period (July 1992-Dec 1997) encompassing the first three perioperative reports, 745,816 surgeries were done and 4,611 deaths were reported, giving a crude mortality rate of 0.62% or 618 deaths per 100,000 surgical procedures. There were 280 pregnancy related deaths in the four POMR reports.

### A. Age distribution

The age distribution of pregnancy-related deaths is shown in Table I. Since this audit refers to pregnancy related deaths, it is not surprising most (80%) fall in the age group 20-39 years.

### B. ASA grading

Most of the deaths (59.3%) or 166 out of 280 were categorized preoperatively as ASA category 3, 4 and 5. Many of these patients were referred from district hospitals or private clinics for surgery without adequate optimization. Forty one deaths (14.5%) were in category 5, where death was imminent within 24 hours. These were patients in a moribund status on arrival due to delay in referral, inadequate resuscitation or delay in surgical intervention.

### C. Death category

Many of the deaths (64.6%) or 180 out of 280 were in category 4 (Fig.1), notably 4B, where the perioperative deaths occurred in the high-risk patients in whom the management was satisfactory. Thirty-three deaths (11.2%) took place in category 5, who were expected to make an uneventful recovery, but succumbed mainly due to amniotic fluid embolism or pulmonary thromboembolism. Categories 1, 2 and 3 made up (20.6%) or 58 deaths; where the contributory factors were either surgical or anaesthetic or both. There were nine deaths in category 6 where the cause of death could not be ascertained due to insufficient data.

### D. Booking status

Booking status was only highlighted in the fourth report (Jan 98-Dec 99). This was not a major problem because 80 patients (71.4%) who were booked were seen at either Government Clinics or District Hospitals. Thirteen (11.6%) cases were un-booked and data was

not available in 19 (17.0%). The unbooked were either the illegal immigrants or "orang asli" (indigenous), the latter living in terrain which were inaccessible and remote.

#### E. Causes of perioperative deaths

Among the pregnancy-related perioperative deaths (Table II), haemorrhage (31.8%), followed by hypertension/pre eclampsia (20.0%), obstetric embolism (16.1%), sepsis (10.7%) were the main leading causes leading to pregnancy related perioperative deaths.

Uterine atony and retained products of conception account for the majority of these deaths. Complications related to hypertension in the form of acute pulmonary oedema and cerebral haemorrhage, largely due to delay in referral and patient-imposed delays. There were 45 documented cases (16.1%) of obstetric embolism. The latter diagnosis was based more on circumstantial evidence as postmortem consent was available in less than 5% of deaths. Sepsis contributed to 10.7% of the total deaths but no further details were found in all the four reports.

#### F. Operative procedures

Table III highlights the various obstetric procedures, (58.2% or 163 out of 280) were in the caesarean section group followed by peri-partum hysterectomy group (23.9% or 67 out of 280). Although these deaths may be partly attributed to existing inherent risk factors, the fact remains; there is an increased mortality with the abdominal route and hysterectomy.

#### G. Surgical and anaesthetic remedial factors

Surgical remedial factors (Fig 2) contributing to perioperative deaths were seen consistently in the pre, intra and post operative periods. Inadequate preoperative optimization of co-morbid diseases, inadequate assessment, delayed therapy or failure to adhere to protocols, were some of the deficiencies identified. In the fourth report, intra-operative factors did not seem to be a major problem. This is due to the increased participation by specialists and consultants. Anaesthetic factors were identified only in 9.7% of cases.

**Table I: Age Distribution of Patients in Pregnancy-Related Deaths in all Four Reports**

Age (Years)	Jul 92- Jun 94	Jul 94- Jun 96	Jul 96- Dec 97	Jan 98- Dec 99	Total	Percentage
Less than 20	0	1	3	4	8	29
20-29	10	15	19	36	80	28.6
30-39	25	33	32	54	144	51.4
40-49	6	16	8	17	47	16.8
More than 50	0	0	0	1	1	0.3
<b>Total</b>	<b>41</b>	<b>65</b>	<b>62</b>	<b>112</b>	<b>280</b>	<b>100</b>

**Table II: Causes of Pregnancy-Related Deaths in the Four POMR Reports**

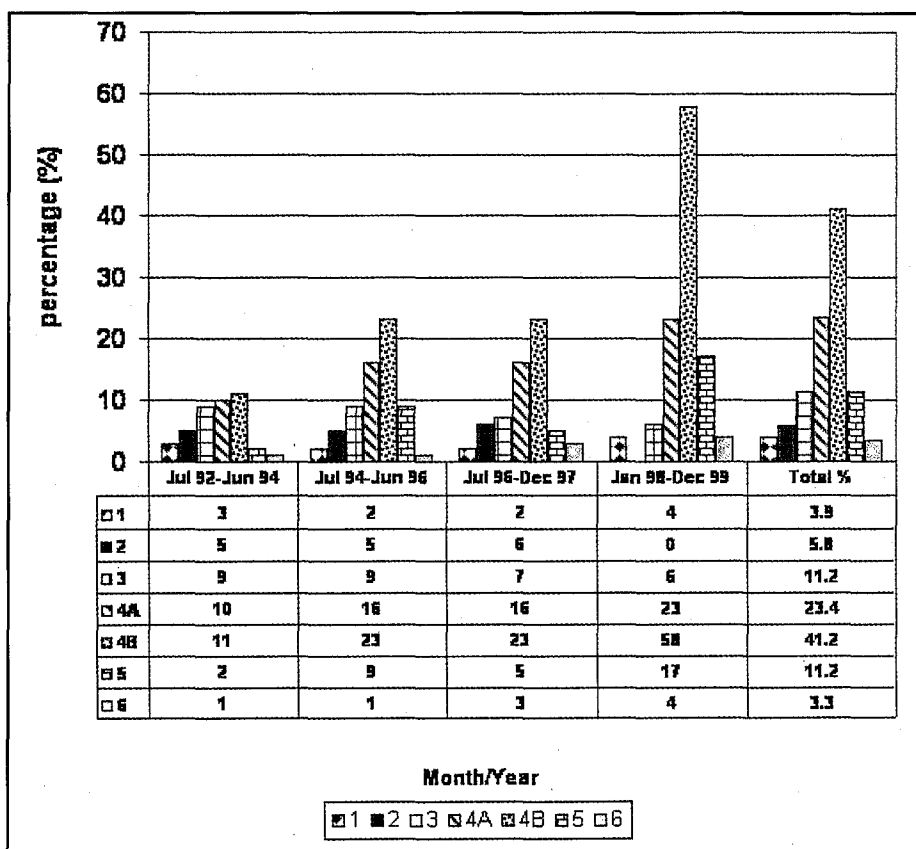
Obstetric causes	Jul 92- Jun 94	Jul 94- Jun 96	Jul 96- Dec 97	Jan 98- Dec 99	Frequency	Percentage
Haemorrhage	13	36	17	23	89	31.8
Severe hypertension/eclampsia	8	5	13	30	56	20.0
Obstetric embolism	10	14	11	10	45	16.1
Sepsis	5	3	7	15	30	10.7
Cardiac disease	0	0	6	8	14	5.0
Pneumonia/ARDS	0	0	0	12	12	4.3
Multi organ failure	0	0	0	5	5	1.8
Anaesthetic related deaths	3	2	0	0	5	1.8
Dengue haemorrhagic fever	0	0	0	2	2	0.7
Others	2	5	8	7	22	7.8
<b>Total</b>	<b>41</b>	<b>65</b>	<b>62</b>	<b>112</b>	<b>280</b>	<b>100</b>

ARDS-Acute Respiratory Distress Syndrome

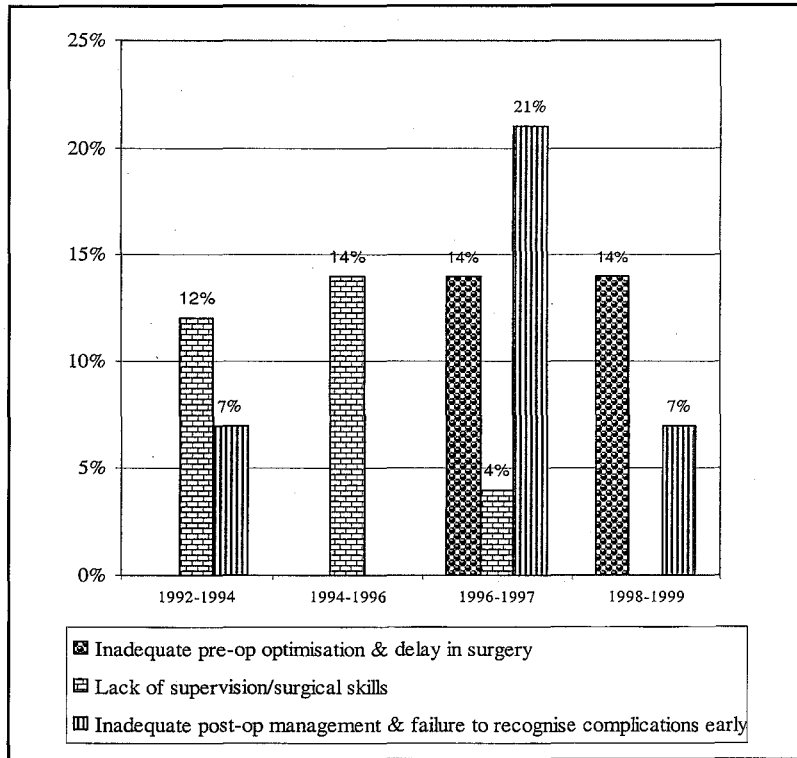
**Table III: Type of Surgery in Pregnancy-Related Deaths**

Nature of operation	Jul 92-Jun 94	Jul 94-Jun 96	Jul 96-Dec 97	Jan 98-Dec 99	Total	Percentage
LSCS	19	35	42	67	163	58.2
Emergency LSCS+TAH	5	0	0	13	18	6.4
Peripartum TAH	14	21	17	15	67	23.9
MRP	0	5	2	0	7	2.5
ERPOC	0	2	0	0	2	0.7
Exploratory Laparotomy	0	0	1	9	10	3.6
Others	3	2	0	8	13	4.7
<b>Total</b>	<b>41</b>	<b>65</b>	<b>62</b>	<b>112</b>	<b>280</b>	<b>100</b>

LSCS -Lower Segment Caesarean Section  
 TAH -Total Abdominal Hysterectomy  
 MRP -Manual Removal of Placenta  
 ERPOC -Evacuation of Products of Conception



**Fig 1: Percentage of Obstetric Cases within Death Categories from July 1992 to December 1999 (n=280)**



**Fig 2: Surgical Remediable Factors (n=280)**

**Discussion**

The pregnancy related death audit is one of the five surgical diagnostic groups of the nation-wide perioperative mortality review initiated in 1990. This makes it the second longest running clinical audit besides the NCEMD. The crude mortality analysed in all the surgical disciplines of POMR was analysed to be 618 deaths per 100,000 surgical procedures compared to 700 in the NCEPOD<sup>5</sup> and 300 in the Scottish Audit of Surgical Mortality<sup>6</sup>.

An audit is a fundamental component of a professional activity<sup>7</sup>. The NCEPOD is now well established in the United Kingdom (excluding Scotland) and has acquired an undeniable influence on the practice of anaesthesia and surgery<sup>8</sup>. Haemorrhage continued as the primary cause of perioperative pregnancy related deaths (Table II), followed by hypertensive diseases of pregnancy and obstetric embolism. Haemorrhage contributed to a third of maternal deaths in the United Kingdom<sup>9</sup>. In Malaysia, post partum haemorrhage (PPH) had been the leading cause of maternal mortality since the

inception of NCEMD<sup>10</sup> in 1991. Unfortunately, PPH is not predictable antenatally. Uterine atony and retained products of conception accounted for almost all these deaths. Age and parity were noted to be strong risk factors<sup>10</sup>. Emphasis on management of third stage of labour was highlighted with the use of syntometrine and controlled cord traction<sup>11</sup>. In the event of failed medical treatment, early surgical intervention by uterine compression sutures, embolization techniques and internal iliac artery ligation (IIAL) that transiently reduces pelvic pulse pressure were recommended<sup>12</sup>. The first POMR Report<sup>4</sup> alluded to reactivation of an already established rapid system of communication to facilitate a fast, efficient and co-ordinated team management of selected obstetric emergencies. Haemorrhage in obstetrics can be torrential and the second POMR report<sup>13</sup> alluded to provision of adequate support facilities, immediate fluid and blood/blood component replacement. In addition, this report emphasized prioritization and stabilization of hypovolaemic patients and also at risk patients for surgical complications to be attended by the most

senior personnel available. Likewise, the NCEPOD (2000) editorial<sup>7</sup> too alluded to an increased consultant input from both anaesthetists and surgeons. With the prevailing heightened patient expectations, emphasis on better utilization of critical care services was also addressed<sup>14</sup>. Compared to the first two POMR reports, the third report (July 1996-Dec 1997) acknowledged to increased participation by the practicing surgeons and anaesthetists. The report also highlighted the need for the availability of fully staffed 24-hour dedicated emergency operating theatres.

Majority of the pregnancy related deaths were seen in the age group 20-39 years. The Department of Statistics, Malaysia<sup>15</sup>, alluded to 92.6% total births in this age group. Pregnancies in mothers beyond 40 years are usually complicated by co-existing medical disorders<sup>16</sup>, whereas, the younger mothers often succumb due to early pregnancy complications of pregnancy induced hypertension and its sequelae<sup>17</sup>.

Caesarean section and peri-partum hysterectomy contributed to majority of the perioperative deaths (Table III). Ravindran<sup>18</sup> reported caesarean section rate in government hospitals was 10.5% in 2000 and 11.0% in 2001. Mayor<sup>19</sup> reiterated a rate of 12-15% to be acceptable if caesarean section is done strictly on medical grounds. The four perioperative reports have consistently shown the inherent risks of emergency procedures leading to higher mortality. The surgical workload consisted of 10.7% (30 out of 280 deaths) as elective and 83.7% (250 out of 280 deaths) as emergency in nature. Emergency surgery was identified as an important risk factor for perioperative deaths<sup>20</sup>.

In the United Kingdom in recent decades<sup>21</sup>, hypertensive disorders in pregnancy have remained one of the leading causes of both maternal and perinatal morbidity and mortality. The management has not significantly altered for many years as no insight has been gained into the pathophysiology of pre-eclampsia (PE). In a case control study by Yadav and Saxena<sup>22</sup>, they have shown increased incidence of pre-term delivery, labour inductions, caesarean-section rates, stillbirths and special care nursery admissions. The actual cause of PE is still uncertain despite the concerted efforts of researchers. The third POMR report<sup>1</sup>, recommended an urgent need to prepare and implement clinical practice guidelines. To this effect, a training manual on hypertensive disorders in pregnancy<sup>23</sup> was prepared and published in the year

2000, by the National Technical Committee on NCEMD to all the health care providers nationwide. In this manual, identification of pregnant women who are at risk of developing hypertensive disorders of pregnancy, ambulatory care (out-patient care), maternal and foetal surveillance, in-patient management, timing of delivery, care during intra and post-partum periods and follow-up care were elaborately discussed.

A major drawback of the POMR was its failure to collect data on the total number of surgeries for each specific procedure. As the denominator was not available, the study was unable to quantify the risk of death for a specific condition. The POMR data nevertheless, is mainly obtained from government institutions, but no input from the private institutions. Hence, this review may not reflect the true picture for the entire country.

Although booking status was seen in 70% of patients, minority groups of unbooked were either the illegal immigrants or "orang asli" (indigenous), the latter living in terrain which were inaccessible and remote. Suleiman et al<sup>24</sup> referred to highest maternal deaths amongst home deliveries 53/100,000 live births compared to 36/100,000 in government hospitals and 21/100,000 in private institutions.

Some deaths occurred without warning. Greater awareness of the signs and symptoms of obstetric embolism may help in the prevention of an embolic phenomenon. Higher parity obstetric mothers with advanced age, and obesity<sup>25</sup> are well-known risk factors. Pregnant women however are more prone to thrombotic risk because of the hypercoagulable state. The national consensus on prophylaxis of venous thromboembolism<sup>26</sup> published in 1999, needs to be implemented. Although deep vein thrombosis is not recorded as a common phenomenon in Malaysia, however a study done in University Hospital, Kuala Lumpur<sup>27</sup> had reported an incidence of 76.5%.

Postmortems are done but in very few (<5%) cases in obstetric patients making pathological confirmation difficult<sup>28,29</sup>. Postmortem examination is a vital tool and of great value in assisting the clinician to arrive at an understanding of the cause of death and the relatives to come to terms with their loss. Unfortunately consented autopsies are difficult to obtain in the wake of social and religious settings in Malaysia.

Majority of the operative deliveries were done as emergencies (89.3%), drawing attention to the danger

of emergency versus elective caesarean sections. The four reports have consistently indicated the inherent risks of emergency procedures leading to higher mortality. Worthy of note is the fact that the risk of death is higher by eight times in emergency surgery<sup>30</sup>. In fact, several hospitals had no provision for emergency theatres to function during working hours and instead available only in the afternoons. The bulk of these emergencies were done after office hours and mostly by junior doctors without direct supervision. Great majority of the emergency cases were referred cases from district hospitals with no specialist coverage. Early referrals and reorganization of theatre committees were discussed to address these recurring issues.

### Conclusion

Perioperative pregnancy related deaths reflect on several pertinent issues that need to be squarely

addressed to improve quality of care. Whilst patient factors contributed to a small proportion of deaths i.e. delay in seeking treatment, other remediable factors like optimal resuscitation and stabilization, consultant input and early surgical intervention by experts appear to be prevalent in this review. Recommendations of the POMR should reach all care-givers (who in turn should receive adequate training) so that implementation of intervention strategies would be effective.

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