

An analysis of the results of consecutive Caesarean Sections at the K. K. Hospital, Singapore during the Year 1964

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Recent advances in the Medical Sciences over the past two decades have placed the operation of Caesarean Sections at a very safe and effective level. Indeed the safety has been so ensured that a visible trend was apparent amongst "Private Patients" towards Caesarean Sections whenever the slightest indication became apparent. Hunter Jones reports the rate for Caesarean Section on the private service as $2\frac{1}{2}$ times greater than the staff service. Obstetric practice at the Kandang Kerbau Hospital in recent years has shown no visible bias of this nature and the results that are presented represent an analysis on this background.

Infant Mortality

Compared to three decades ago, the foetal mortality associated with Caesarean Sections has shown tremendous improvement and this is based on universal reports from every available centre in the world. In the decade 1941 to 1951, the average still-birth rate was about 9 per cent and European centres in 1956 report a still-birth rate of 5 per cent. In an American series from 1952 to 1962, the gross foetal mortality rate was 3.8 per cent and it was noted that this figure was a marked contrast to an earlier series with a 10 per cent rate. At the Kandang Kerbau

TABLE I
Infant Mortality for Caesarean Sections

Europe:	1941 to 1951	...	...	...	9	per cent
	1956	...	...	...	6	per cent
U.S.A.:	1942 to 1951	...	...	...	10	per cent
	1952 to 1962	...	...	...	3.8	per cent
K.K. Hospital:	1960	...	...	...	10.6	per cent
	1964			%		%
				Gross		Corrected
Peri-Natal	...	...	...	90 or 8.9	71	or 7.04
Still-Birth	...	...	...	36 or 3.56	20	or 1.98
First Week	...	...	...	54 or 5.34	51	or 5.06
Total Nos. delivered: 1010 including 2 Pairs conjoined Twins						
Congenital malformations		}		9 cases including 2 Pairs of conjoined Twins		
not compatible with life						
Intra-Uterine Death before Caesarean Sections				10 cases		

Hospital, the peri-natal mortality rate for 500 consecutive Caesarean Sections performed in 1960 stood at 10.8 per cent (10.6 per cent corrected rate) and the figures for this series under review are shown in Table I.

There were 9 cases including two pairs of conjoined twins with Congenital malformations which were not compatible with life and 10 cases were already dead in utero prior to Caesarean Sections but which were nevertheless performed for maternal interests.

The foetal mortality rate although improved over the 1960 report at the Kangang Kerbau Hospital still showed a level which is slightly higher as compared with European and American Centres. The factors responsible for this mortality rate are discussed in the following paragraphs, as follows:-

a) Booking

The booking factor continues to be an important factor in this Institution. As in other series including those for Maternal Mortality, a case is not considered booked at the Institution unless the patient has had no less than three ante-natal visits at the Institution itself. Reflected against the peri-natal mortality, only 14 cases or 15.5 per cent of the cases had been well and truly booked. There is therefore much room for improvement on this factor.

b) Indications for Caesarean Sections

The peri-natal mortality rate when considered against the varying indications for which the Caesarean Sections had been performed are as follows:-

A total of 50 cases of ante-partum haemorrhage out of 220 cases of Caesarean Sections for this indication resulted in a peri-natal death. Both Placenta Praevia and Abruptio Placentae were incriminated. This total of 50 cases gives a gross mortality rate of 55.4 per cent—a drop of 10 per cent as compared to the series in 1960.

33 cases of peri-natal death occurred out of a total of 90 cases—viz. 36.6 per cent and these had Caesarean Sections done for Placenta Praevia. Compared to Abruptio Placentae, there had been 17 perinatal deaths giving a rate of 18.8 per cent in this group. 17 cases associated with Placenta Praevia involved Premature infants and 4 cases had the operations performed on Maternal interests. Similarly 5 cases associated with Abruptio Placentae concerned Premature infants and a similar 4 cases needed the operations because of maternal indications, despite the presence of intra-uterine deaths. Prematurity certainly took a high toll of foetal lives in this ante-partum haemorrhage group but a critical analysis of the series showed that most if not all the cases required operations which were carried out only when very strong indications existed. Ante-Partum Haemorrhage remains a very important indication for Caesarean Sections at the Kangang Kerbau Hospital. It accounted for 21.8 per cent of all the indications for the operation and it took a toll of 55.4 per cent of the total corrected foetal loss.

TABLE II

Haemorrhage (Ante-Partum)

Gross	1960	1964
Placenta		
Praevia	24 or 43.6%	33 or 36.6%
Abruptio		
Placentae	12 or 21.8%	17 or 18.8%
Total:	36 or 65.4%	50 or 55.4%
Total Nos. Cases operated in 1964		
Placenta Praevia	194 cases or	19.2%
Abruptio Placentae,	26 cases or	2.5%
Total:	220 cases	21.8%

2. Toxaemia and Eclampsia

A total of 6 peri-natal deaths were associated with this group of indications for Caesarean Sections. This represented 8.4 per cent of the total corrected peri-natal loss as compared with an incidence of 5.5 per cent in the 1960 series. Critically reviewed, the more pressing factor was maternal interests and two-third of the loss were associated with prematurity.

3. Obstetric Abnormalities

As in the 1960 series, under this caption is listed a host of other indications as follows:

Obstetric Abnormalities

	1960	1964
Prolonged Labour including Failed Trial of Labour & Foetal Distress	8 or 14.5%	8 or 11.2%
Transverse Lie & Obstructed Labour	4 or 7.3%	8 or 11.2%
Prolapsed Cord	2 or 3.7%	7 or 9.8 %
Ruptured Uterus	1 or 1.8%	6 or 8.4 %
Total:	<u>15 or 27.3%</u>	<u>29 or 40.6%</u>

Compared to the 1960 series, there had been an overall increase in this group of indications which resulted in a peri-natal loss. Prominent rises were seen in the cases associated with Prolapsed Cord and Ruptured Uterus with a $2\frac{1}{2}$ times and $4\frac{1}{2}$ times increase respectively as compared to the 1960 series. The same recurring avoidable factors are emphasised and perhaps a judicious increase in the strength personnel might go a long way in reducing the avoidable factors.

Co-Existing Medical Conditions

As compared with the 1960 series, there had been 3 cases in this group that resulted in a peri-natal loss in this present study. This represented 4.2 per cent of the corrected total peri-natal mortality in this present survey.

Two peri-natal deaths involved Diabetic Pregnancies, both with superimposed toxæmia. Both were premature babies delivered by Caesarean Sections and both died from Hyaline Membrane Disease. A total of 23 Diabetic Pregnancies had been delivered by Caesarean Sections during the year 1964 and the toll of 2 peri-natal deaths gives a rate of 8.5 per cent amongst this total of Diabetic Pregnancies

There had been one peri-natal loss related to one case with disseminated lupus erythematosus which was delivered by Caesarean Section. The cause of death was ascribed to Hyaline Membrane disease and the baby was delivered with a premature weight of 3 pounds and 10 ounces. Some improvements

have been observed in the Kandang Kerbau Hospital on the management of cases in Pregnancy with medical conditions complicating but an officialising process is still being awaited to initiate a Physician cum Obstetrician ante-natal clinic for the institution.

c) Birth-Weights

Paediatricians frequently tell us that in Caesarean Sections, it is primarily the loss of premature infants which results in a relatively high peri-natal mortality rate. Problems associated with the respiratory distress syndrome in the newborn especially Hyaline Membrane disease, intra-cranial haemorrhages, feeding problems and increased susceptibility to infections all contribute to the relatively high foetal loss. As in the previous series, all babies of weight 4 pounds and under are classified as premature and those over 4 pounds are classed as mature. The related mortality ratios are as shown in Table 4.

The figures are all corrected ratios and based on a total of 71 babies. Compared to the 1960 series reported there has been shown no appreciable difference in the mortality rate viz: of 36 per cent for premature babies and 64 per cent for mature babies.

It is conceded that improvements in the facilities of the Premature Baby Unit Nurseries as well as improved premature Nursing care will no doubt help to improve the rate; and in the series under review, there is the observation that attempts were made by the Obstetricians to avoid doing Caesarean Sections for Premature

TABLE IV
Birth-Weights

	1960	1964
Prematures:		
1 - 2 Pounds	-	2 cases
2 - 3 Pounds	5 cases	6 cases
3 - 4 Pounds	15 cases	15 cases
Total:	<u>20 cases or 36%</u>	<u>23 cases or 32.4%</u>
Matures:		
Over 4 - 5 lbs.	8 cases	20 cases
5 - 6 lbs.	10 cases	7 cases
Over 6 lbs.	17 cases	19 cases
	<u>35 cases or 64%</u>	<u>46 cases or 64.7%</u>
Unrecorded:	-	2 cases or 2.9%

Pregnancies but in the majority of cases analysed, the operations had to be done in the interests of the maternal patients.

d) Anaesthesia

Analysis of the type of Anaesthesia on the foetal mortality gave little significance to the figures presented as the great majority of cases had a General Anaesthesia for the Caesarean Sections. The related figures are as shown in Table 5.

TABLE V
Anaesthesia for Caesarean Sections (1964)

Type	Nos. Done	Perinatal Loss	
		Nos.	Per Cent
General	938	65	91.6
Spinal	61	4	5.6
Local	5	1	1.4
Epidural	2	1	1.4
Caudal/Local	2	-	-
Total:	<u>1008</u>	<u>71</u>	<u>100.0</u>

There was the problem of delay in the provision of the Anaesthetic service that had been worrying and this probably had the greater part to play in the foetal mortality ratio than the type of anaesthetic used. In recent months however, at the Kandang Kerbau Hospital, there has been stationed a near full time obstetric anaesthetic service and it is hoped to achieve better results as a result of the provision of this service.

e) Racial Risk

This present analysis decided to review the racial risks, if any, on the foetal mortality rates and the distribution of this ratio is shown in Table 6.

TABLE VI
Racial Risk

Race	Total Nos.	Corrected Peri-Natal Loss	Risk
Chinese	728	52 : 73.2%	1 in 14
Indon-Malays	144	9 : 12.7%	1 in 16
Indians	124	10 : 14.1%	1 in 12.4
Eurasians	8	- -	-
Arabs	3	- -	-
Japanese	1	- -	-

There was no related racial risk for peri-natal mortality in the present series under review.

f) Parity

Analysis of the parity risks as related to peri-natal mortality gave significant findings as below:

TABLE VII
Parity

Parity	Nos.	Per Cent
1	8	11.2
2	9	12.8
3	10	14.0
4	7	9.8
5	8	11.2
6 & over	29	41.0

The risk of a peri-natal loss in Caesarean Sections appeared to be significantly high in the group Parity 6 and over as compared to those of lesser parity and this varied from 3 to 4 times as can be seen in the figures presented. The increased associations of this group with ante-partum haemorrhage, toxæmia of pregnancy, prolapsed cord and prolonged labours no doubt, account for this increased foetal risk. Like in Maternal Mortality, one of the foremost avoidable factors would be to discourage this group from embarking on a pregnancy and family planning measures would seem to be useful.

g) Maternal Age

An attempt to ascertain if maternal age had a significant factor on peri-natal mortality was made in the present analysis. Except for the two extreme age groups viz. under 20 years of age and over 40 years of age—which two groups had 3 peri-natal loss each, the other age-groups gave no significant differences.

The related analysis are as follows:-

TABLE VIII
Maternal Age

Age-Group	Total Nos.	Per Cent
Under 20 years	3	4.2
21 - 25 years	15	22.0
26 - 30 years	19	26.4
31 - 35 years	18	25.1
35 - 40 years	13	18.1
Over 40 years	3	4.2
Total:	<u>71</u>	<u>100.0</u>

The figures represent corrected peri-natal mortality.

h) Operating Surgeons

A study of the status of the operation surgeons concerned with the cases of Caesarean Sections which had resulted in a peri-natal loss was carried out in this series under review. Significant figures obtained were as follows:-

TABLE IX
Operating Surgeons

Status	Total Nos. of Cases	Corrected Peri-Natal Loss	Peri-Natal Loss Risk
Consultants	113	11 : 15.5%	1 in 10
Senior Registrars	188	15 : 21.1%	1 in 13
Medical Officers	707	45 : 63.4%	1 in 16
Total:	<u>1008</u>	<u>71</u> <u>100.0%</u>	

TABLE X
Maternal Mortality

Centre	Rate
North of England 1949	Classical Section ... 4.0% to Lower Segment ... 0.3%
McIntosh Marshall —Mass Statistics 1949	Variations from ... 4.3% to ... 0.09%
North American Clinics 1940-1950	Variations from ... 0.3% to ... 0.01%
North Carolina (Hunter Jones)	1940 to 1952 ... 0.4% 1952 to 1962 ... 0.3%
Beck & Hillejan (Western Germany)	1937 to 1956 ... 0.36%
Kandang Kerbau Hospital	1960 series ... 0.00% 1964 series ... 0.49%

It would appear that no significance can be drawn from this aspect of analysis as it may appear that the highest risk for a peri-natal loss were in those cases operated on by the consultant staff, viz. 1 in 10 compared to the risk of cases operated on by medical officers, viz. 1 in 16. It is reasonable to assert, however, that generally it had been the more difficult and the more complicated cases that were performed by the consultant staff, and less complicated and relatively easier cases had been performed by medical officers in training.

Maternal Mortality

The maternal mortality rate of 35 years ago at 6 to 10 per cent was prohibitively high and was mainly responsible for giving a fearful stigma to the operation of a Caesarean Section. Over the years, many factors including advances in Anaesthesiology, Haematology, antibiotics and chemo-therapy as well as advances in surgical techniques and materials coupled with sounder obstetric care and management, have all contributed to making dramatic falls in the maternal mortality rate for Caesarean Sections. Comparative figures are tabulated in Table 10.

In the previous report, it had been stressed that the Zero maternal mortality rate over 500 consecutive Caesarean Sections had been a chance incidence. It was also pointed out that perhaps the true mortality is in the region of 0.3 to 0.4 per cent. In the year 1964, a total of 1008 Caesarean Sections had been performed at the Kandang Kerbau Hospital and this occurred amongst a total hospital delivery of 39, 598 pregnancies, giving a Caesarean Section Rate of 2.5 per cent. There had been 5 Maternal Deaths associated with the 1008 Caesarean Section operations giving a rate of 0.49 per cent or 0.049 per 1000. This mortality rate had occurred against a back-drop of conditions involving a high non-booking rate of ante-natal patients, semi-emergency to emergency conditions, unspecialised obstetric anaesthetic service and the presence of both trained and skilled surgeons as well as obstetric surgeons in training.

The clinical resume of these 5 maternal deaths are appended:—

Case 1—Admission No. 3262 (*Madam At*)

An Indian—age 38 years—Para 13 Gravida 14—poorly booked ante-natal patient with only a minimum of 3 ante-natal visits. Was admitted in labour at 36.4 weeks maturity and had symptoms of severe Pre-eclamptic Toxaemia of Pregnancy together with a Twin Pregnancy. Slow progress of labour coupled with onset of maternal and foetal distress prompted a Caesarean Section 12 hours after admission. A General Anaesthesia was employed with Gas and oxygen and scoline for induction. Patient was intubated. Normal operating time was involved but at the end of the operation, cardiac arrest occurred and cardiac massage resuscitated the patient. But good conditions of the patient could not maintain and patient died 24 hours after the cardiac arrest.

Case 2—Admission No. 16449 (*Madam TGL*)

A Chinese patient—Age 36 years—Para 10—Non-Booked patient. Was admitted with a history of delivery of 1st Twin at Home about two hours before admission. Second Twin delivery was complicated by Obstructed Labour caused by a transverse lie with impacted shoulders but intra-uterine death had occurred at the time of admission. A lower segment Caesarean Section was carried out under a General Anaesthesia which was completed some two hours after admission and four hours after the delivery of the first twin. Records showed some difficulty with intubation for the general anaesthesia and the operation was fraught with difficulty. The medical officer reported loose friable tissues of the lower segment with moderate blood loss and difficult haemostasis. Patient was out of the anaesthesia but was found to be in state of peripheral circulatory failure and shock. Despite organised resuscitation measures, the condition of the patient did not improve and the patient succumbed 17 hours after the completion of the operation.

Case 3—Admission No. 22658 (*Madam TP*)

A Chinese patient—Age 44 years—Gravida 14 Para 12 1 abortion. Completely Unbooked Patient. Was admitted with symptoms of labour which had begun about 2 hours prior to admission. The maturity of the pregnancy was at

about term. Two hours after admission, review of the patient found the patient to be with a suspect rupture of the uterus and a laparotomy-Caesarean Section operation was carried out an hour later. The foetal heart was already non-existent. Anaesthesia was a General and cyclopropane was used for induction together with scoline and intubation. This was maintained by gas, oxygen and intermittent ether. After the delivery of the baby, a Hysterectomy was carried out because of the confirmed ruptured uterus but cardiac arrest occurred before the completion of the operation and the patient failed to be resuscitated despite external and internal cardiac massage.

Case 4—Admission No. 27409 (Madam NST)

A Chinese Patient—Age 37 years—Gravida 8 Para 7—Unbooked Patient. Was admitted into hospital with symptoms of early labour. Had symptoms of toxæmia on admission and a review four hours after admission found cephalo-pelvic disproportion at full dilatation of the cervix with established foetal distress. A lower segment Caesarean Section operation was carried out one hour later but the medical officer ran into technical difficulties with the operation causing the patient to lose a fairly large amount of blood. The Senior Registrar assisted in the closing stages of the operation but cardiac arrest occurred and despite resuscitative measures, death had to be recorded one hour after the baby was delivered. A live male baby was delivered. Records showed that a General Anaesthesia was provided for the patient.

Case 5—Admission No. 32092 (Madam TAK)

A Chinese patient—Age 36 years—Gravida 5 Para 4—Unbooked. Was admitted into hospital as a case of ante-partum haemorrhage at a maturity of 34 weeks gestation. Conservative management as for a Placenta Praevia was carried on till 4 weeks later when pregnancy was terminated by a lower segment Caesarean Section operation for Central Placenta Praevia. A General Anaesthetic was given and a live female baby was delivered. The puerperium was morbid and stormy and on the 5th post-operative day, a burst abdomen occurred. An emergency secondary suture operation was carried out by a trainee officer and a general anaesthesia was again provided. About 25 minutes after comple-

tion of the operation, cardiac arrest occurred and despite internal cardiac massage, the patient failed to recover.

In drawing comments on the maternal deaths that had occurred, it will be necessary to point out that the non-booking factor and high parity together with an age over 35 years constituted significant avoidable factors. Indeed these same factors are apparent in a general maternal mortality survey. These facts must be strongly driven home to the public in an intensified family planning and public health education campaign if future fatalities are to be avoided. All the patients were subjected to a general anaesthesia and the anaesthetic had been given by a relatively junior anaesthetist. A case can be strongly made for the provision of a prompt obstetric anaesthetic service staffed by qualified experienced anaesthetists.

Morbidity

If death did not result, morbidity of one form or another invariably exists in all cases that have had a Caesarean Section operation. For a start, every case is immediately immobilised after an operation and an average recovery period of four weeks is required. Disability during the recovery period invariably affects maternal-baby relationships and there will be deficient baby care and feeding difficulties. The recovery period may be prolonged in those cases with wound sepsis, anaemia, urinary tract and chest infections—all would-be concomitants in a major operation of this nature. Other morbidity features include:—

a) Blood Transfusions

In the present series under review, a total of 412 cases or 40·8 per cent of the total cases required blood transfusions. In all, a total of 665 pints of blood were used for Caesarean Section operations throughout the year under review. All these patients no doubt had to be exposed to the hazards of a blood transfusion and indeed 3 cases of blood transfusion reactions were recorded. This is of course an appreciably low figure. It is pleasing to note that in recent months at the Kandang Kerbau Hospital, a fully effective blood transfusion service has been initiated and one does not have to rely now on the main blood bank centre at the General Hospital some 3½ miles away.

TABLE XI

Summary of Maternal Deaths

Status of Patient	Parity	Age	Indication for Caesarean Section
1. Indian Booked 3 Visits	13	38 years	Twin with Toxaemia and both Maternal & Foetal Distress.
2. Chinese Unbooked	10	36 years	Retained second Twin with transverse lie & impacted shoulders
3. Chinese Unbooked	12	44 years	Suspect ruptured uterus & possible cephalopelvic disproportion
4. Chinese Unbooked	7	37 years	Toxaemia of Pregnancy with cephalo-pelvic disproportion
5. Chinese Unbooked	4	35 years	Ante-Partum haemorrhage - later Secondary suture done for a burst abdomen

Surgeon	Type of Anaesthesia	Anaesthetist	Cause of Death
1. Senior Registrar	General	Junior	Cardiac arrest
2. Trainee Officer	General	Junior	Shock & Circulatory failure
3. Senior Registrar	General	Junior	Cardiac arrest associated with shock and haemorrhage
4. Medical Officer & Senior Registrar	General	Junior	Cardiac arrest associated with shock and haemorrhage
5. Trainee Officer	General	Junior	Cardiac arrest

TABLE XII

Maternal Morbidity Pyrexia

Pyrexia	504 cases	: 50.0 %
Puerperal Pyrexias	294 cases	: 29.1 %
Pyrexias of Significance:		
Wound Sepsis	45 cases	: 4.4 %
Urinary Tract Infections	322 cases	: 31.9 %
Chest Infections	48 cases	: 4.7 %
Peritonitis & Ileus	6 cases	: 0.59%
Phlebo-Thrombosis	1 case	: 0.09%

b) Pyrexia

Pyrexia was recorded in 504 patients *viz.* 50 per cent of the total number of cases.

294 cases qualified for inclusion as Puerperal Pyrexias and this represented 29.1 per cent of the total cases that had Caesarean Sections.

The pyrexias of significance are recorded as follows:—

18 cases of the wound sepsis group required secondary sutures for the wound breakdowns and one case had a burst abdomen that resulted in a maternal death following secondary suture. All the 6 cases of peritonitis and ileus improved with the standard regime of treatment.

In addition, one single case of phlebotrombosis was recorded amongst the 1008 cases in comparison with the absent cases in the 1960 series. Indeed this condition and other vascular thrombotic episodes and the very dreaded pulmonary embolism appears to be very uncommon in experiences at the Kangang Kerbau Hospital.

It is pleasing to record that despite the high incidence of urinary tract infections, there had been no case of immediate stress or true urinary incontinence as a sequel of fistulous connections between the ureters, bladder and the uterus and vagina. The high incidence of urinary tract infections in this series of Caesarean Sections under review gives a pointer to the urgent necessity for the study of this problem in great detail and with a view to making recommendations how urinary tract infections may be minimised under such circumstances.

c) Puerperal Psychosis

There had been 4 cases out of the total of 1008 cases that were diagnosed with puerperal psychosis and psychiatric treatment was required in all the 4 cases concerned.

In the previous series it had been pointed out that no Mother goes through the experience of a Caesarean Section without any psychic trauma—the extent of the trauma varies with the individual and with the circumstances leading to the Caesarean Section. It is reasonable to draw attention again to Dugald Baird's series (1955). Four years after the operation, 66 per cent of the women had not had another pregnancy when the rest of the controls had had at least one. It is true that Caesarean Sections do have a deterrent effect on a subsequent preg-

nancy but perhaps amongst the enlightened, the educated and those less easily frightened, the situation is entirely different especially if they know that the Caesarean Section had been the only means of saving their baby.

Finally but by no means the least of the long-term problems in this situation is the question of "Obstetric Invalidism". This connotation coined in the previous series describes a woman with a previous Caesarean Section scar who in a subsequent pregnancy would need specialised ante-natal care and compulsory institutional confinement. With the present rate of Caesarean Sections, every five years will see no less than 5000 new "obstetric invalids" and these will not include those that have had more than one Caesarean Section. The need to label an individual as such as an "Obstetric Invalid" is merely to ensure complete safety for the individual in a subsequent pregnancy and not to designate any intimation that the patient is crippled to an extent. The more Caesarean Sections done on a case should make the case more an "Obstetric Invalid". From a long term point of view of planning of Obstetric Services, more obstetric beds will need to be provided.

There is an oft repeated question which "obstetric invalids" will put to Obstetricians. Indeed this question may be put by all obstetric patients. The question is "What is the maximum number of Caesarean Sections that can be done on a single patient with safety?" This question may not be too difficult to answer if the Universal Family Planning campaign at present being waged gathers its desired effects. It is safe to say that no maximum need be set for any individual provided the patient is in the hands of a careful and skilled obstetrician. Of course each succeeding Caesarean Section becomes more technically difficult. At the Kangang Kerbau Hospital, sterilisation is offered to patients who are having their third or more Caesarean Section.

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