

TABLE I. HCG RESULTS AND CLINICAL DIAGNOSIS IN 51 CASES OF SUSPECTED ECTOPIC PREGNANCY

Icon	β -subunit of HCG	Final diagnosis	No. of patients
35-	Negative	Pelvic inflammation	23
		Incomplete/missed abortion	5
		Ovarian cyst	4
		Dysfunctional bleeding	2
		Unexplained abdominal pain	1
2-	Positive	Incomplete abortion	1
		Dysfunctional bleeding	1
2+	Negative	Ovarian cyst	2
		Ectopic pregnancy	6
12+	Positive	Threatened/incomplete abortion	4
		Normal pregnancy	2

number of clinicians without laboratory training, but with clear written instructions, and found this to be acceptably low. There is scope for further clarification of the written instructions, with use of illustrations, which may further improve the reliability of the test. It should be emphasised particularly that a vague blueness without a clearly defined circular shape is not a positive result. This error appears, on retrospective questioning, to have been the source of the false-positive results in this study.

Conclusion

We recommend the use of high-sensitivity urine tests for the β -subunit of HCG such as the modified Tandem Icon test whenever ectopic pregnancy is suspected. A positive result requires further evaluation. With a negative result, 73% of cases in this study, 80% in another,⁶ the diagnosis of ectopic pregnancy can be excluded with a high degree of certainty.

The potential saving in unnecessary surgery and hospitalisation for observation is considerable.

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Primary causes of total perinatally related wastage at Tygerberg Hospital

R. C. PATTINSON, G. DE JONG, G. B. THERON

Summary

The primary obstetric cause of total perinatally related wastage (TPRW) (i.e. all antepartum or postpartum deaths of infants \geq 500 g and who died before hospital discharge) was studied in a clearly defined population in the western Cape over a 1-year period. There were 302 deaths from 7 923 singletons and 31 deaths from 65 pairs of twins delivered from patients cared for by Tygerberg Hospital maternity services. Thirty per cent of the deaths were late abortions, 42% stillbirths, 18% early neonatal deaths, 7% late neonatal deaths and 4% perinatally related infant deaths.

The major primary obstetric events leading to TPRW in singletons were antepartum haemorrhage (27,8%), spon-

aneous preterm labour (24,8%), unexplained intra-uterine deaths (11,9%), infections (9,3%) and fetal abnormalities (7,9%). Multiple pregnancies accounted for 9,3% of the TPRW of all deliveries. The cause, risk factors associated and methods of prevention of abruptio placentae, spontaneous preterm labour and infections should receive priority in perinatal research in the western Cape.

S Afr Med J 1989; **75**: 50-53.

For the obstetrician documentation of the primary event that initiated the sequence of events leading to a stillbirth or neonatal death is of paramount importance. Once the major primary events have been identified, steps can be taken to prevent them. If the cause of a major primary event is unknown, this indicates a priority area for perinatal research.

This concept of the primary obstetric event formed the basis of the clinicopathological classification of perinatal deaths first described by Baird *et al.*¹ in 1954. It has recently been updated and expanded by Whitfield *et al.*² to include late abortions and perinatally related infant deaths. The system developed by Whitfield *et al.*² is applicable to First-World countries. We modified it slightly to accommodate the situation prevailing in the western Cape.

MRC Perinatal Mortality Research Unit, Department of Obstetrics and Gynaecology, University of Stellenbosch and Tygerberg Hospital, Parowvallei, CP

R. C. PATTINSON, M.MED. (O. & G.), F.C.O.G. (S.A.), M.R.C.O.G.

G. DE JONG, B.S.C. HONS, M.MED. (PAED.)

G. B. THERON, M.MED. (O. & G.), F.C.O.G. (S.A.)

The use of the modified Whitfield system over a 1-year period is described and perinatal research priorities for the western Cape are outlined. To our knowledge there has been no published data on primary obstetric causes of total perinatally related wastage (TPRW) yet reported in the RSA.

Patients and methods

For the period 1 January 1986 - 31 December 1986 all deaths occurring *in utero* or postpartum in patients delivering at Tygerberg Hospital and its surrounding community clinics were studied. The population consists of roughly 92% coloureds and 8% blacks. Rural referrals were excluded from the analysis. Every stillborn baby and its placenta were examined by a paediatrician the day after delivery. At a weekly Stillbirth Meeting held by an obstetrician and paediatrician, the case records and findings were analysed and a primary cause of death defined by the criteria given below was allocated to each baby. A weekly Neonatal Death Meeting between the Department of Paediatrics and the Department of Obstetrics was also held to allocate the primary and final cause of death for each neonate. In determining the cause of death, an autopsy was only carried out in exceptional circumstances on stillborn babies and, where consent could be obtained, on dead neonates and infants. The discharge records and registers of both these departments were used to ensure recording of all deaths.

The following definitions were used: (i) **late abortion** — a baby weighing ≥ 500 g but of less than 28 weeks gestation or, if gestational age was unknown, weighing < 1000 g (both liveborn and stillborn babies were included in this category); (ii) **stillbirth** — a baby born with no heart beat at or after 28 weeks' gestation or, if the gestational age was unknown, weighing ≥ 1000 g; (iii) **early neonatal death** — a baby of ≥ 28 weeks' gestation or, if gestation was unknown, weighing ≥ 1000 g born with a heart beat but dying ≤ 7 days postpartum; (iv) **late neonatal death** — a baby of ≥ 28 weeks' gestation or, if gestation was unknown, weighing ≥ 1000 g born with a heart beat and dying after 7 days but \leq than 28 days postpartum; (v) **perinatally related infant death** — a baby surviving the neonatal period but dying while still in hospital due to complications arising in the perinatal period, e.g. necrotising enterocolitis or bronchopulmonary dysplasia (this definition is modified from that of Whitfield *et al.*² because in the South African situation it is not yet possible to follow-up all the babies for their first year because of lack of adequate paediatric follow-up facilities, a migrant population and poor patient compliance); and (vi) **total perinatally related wastage (TPRW)** — the sum of all late abortions, stillbirths, early neonatal deaths, late neonatal deaths and perinatally related infant deaths.

The definitions of primary causes of deaths were:

1. **Spontaneous preterm labour** — a baby born at less than 37 completed weeks or weighing less than 2500 g where the gestational age was unknown; (i) **idiopathic preterm** — labour in a patient within 12 hours of rupture of membranes or with intact membranes and on examination of the placenta no evidence of infection or abruption placenta could be found; (ii) **premature rupture of membranes** — membranes ruptured more than 12 hours before the onset of contractions and the baby was preterm (if infection supervened after rupture of membranes the primary cause remained premature rupture of membranes, but the fact that chorio-amnionitis occurred was recorded); and (iii) **incompetence of the internal cervical os** — if proven by special postpartum investigations, such as a hysterosalpingogram or Hegar's test.

2. **Infections:** (i) **syphilis** — positive serological tests for syphilis and the presence of clinical and/or radiological signs of congenital syphilis; and (ii) **amniotic fluid infection** —

characterised by one or more of the following: infection clearly evident on the placenta examined by the method described by Naeye and Ross;³ a foul smelling baby and placenta at delivery; or clinical evidence of infection in the mother. The membranes must be intact at the onset of labour.

3. **Antepartum haemorrhage:** (i) **abruptio placentae** — more than 15% of the placenta has an adherent blood clot and there were clinical signs of abruption, namely tenderness of the uterus and vaginal bleeding; if the patient also had other problems such as hypertension, abruption placenta was still allocated as primary cause but the complicating factor was also noted — this was a further modification of the classification of Whitfield *et al.*² but was chosen because a proportion of mothers have no or infrequent antenatal care; (ii) **placenta praevia** was diagnosed if a diagnosis before delivery was made using standard techniques; and (iii) **antepartum haemorrhage of unknown origin** — the patient bled antepartum but no cause could be determined antenatally or postpartum on examination of the placenta.

4. **Intra-uterine growth retardation (IUGR)** was defined as a primary cause of perinatal death where no recognised causes of IUGR were found. The baby had to be a fresh stillborn or neonatal death and the mass had to be less than the 10th percentile for gestational age for the growth curves of Keen and Pearce.⁴

5. **Hypertension:** losses attributed to pre-existing hypertension or proteinuric hypertension, or to the complications of its treatment. The nature of the hypertensive disorder was recorded as a subcategory.

6. **Fetal abnormality:** an anatomical or clinical diagnosis that the abnormality was incompatible with life.

7. **Trauma:** stillbirths or neonatal deaths of normally formed babies of at least 1500 g and where mechanical difficulty complicated delivery or where precipitous labour caused a fetal cerebral haemorrhage. The birth weight of 1500 g was arbitrarily chosen by Whitfield *et al.*² Birth weights under 1500 g are usually designated idiopathic preterm labour or more rarely as IUGR.

8. **Intrapartum asphyxia:** stillbirth or neonatal death of normally formed babies of at least 1500 g and where evidence of peripartum hypoxia existed, e.g. cord prolapse or meconium aspiration.

9. **Maternal disease:** losses attributed to any medical or surgical condition excluding hypertension. An example of this would be diabetes.

10. **Other** conditions are rare and can be specifically mentioned, e.g. rhesus-iso-immunisation and non-immune hydrops fetalis.

11. **Unexplained intra-uterine death:** stillbirths and late abortions of normally formed fetuses for which no cause could be found. This group included macerated babies and fresh unexplained stillbirths. The fresh stillbirths less than 38 weeks or less than 2500 g were classified under the idiopathic preterm labour group.

12. **Multiple pregnancy:** a fetal death occurring in any patient with multiple pregnancies. A second primary cause can be allocated, but multiple pregnancies should be analysed separately.

Results

From 1 January - 31 December 1986 there were 7923 singleton pregnancies and 65 pairs of twins delivered in Tygerberg Hospital and its surrounding clinics. These deliveries exclude rural referrals and transfers of patients from outside the hospital's immediate drainage area. The perinatal mortality for singletons was 22.6 per 1000 births and for multiple pregnancies 89.3 per 1000 births. TPRW for singletons was 38.1

per 1 000 births. The TPRW for multiple pregnancies was 238,5 per 1 000 births.

The primary obstetric cause of deaths as related to TPRW is shown in Table I and to birth weight in Table II.

In the group with spontaneous preterm labour, 55 deaths were idiopathic, 18 were due to premature rupture of membranes and 2 were due to an incompetent cervical os. Of those with premature rupture of membranes, chorio-amnionitis occurred in 11 cases, 3 associated with MacDonal sutures and 2 with group B β -haemolytic streptococcal infection.

Twelve babies died from syphilis and 16 from the amniotic fluid infection syndrome. One of these was associated with group B β -haemolytic streptococcal infection.

In the group of deaths caused by antepartum haemorrhage, 80 were from abruptio placentae, 3 from placenta praevia and 1 from antepartum haemorrhage of unknown origin. Twelve of the patients with abruptio placentae had hypertension recorded in the antepartum period. Of the patients with abruptio placentae 71 had known gestational ages, 20 of these babies were small for gestational age.

In the group of deaths primarily caused by hypertension, 1 was associated with eclampsia and the remaining 18 were related to proteinuric hypertension. Twelve additional patients with hypertension were classified under antepartum haemorrhage and if included in the hypertension group would increase the percentage of deaths due to hypertension from 5,7% to 9,3% of the TPRW.

There were 3 deaths caused by traumatic deliveries, 2 in breech births and 1 because of precipitous labour. In the group of intrapartum asphyxia, 8 deaths were due to cord prolapse and 3 to fetal distress and meconium aspiration.

The fetal deaths due to maternal disease were 1 each for diabetes mellitus, pneumonia, heart failure and auto-immune thrombocytopenia. The other causes of deaths were 2 from non-immune hydrops fetalis and 1 from rhesus disease.

Of the unexplained intra-uterine deaths, 2 were fresh stillbirths at 38 and 40 weeks respectively. The rest of the babies in this group were macerated.

In patients with multiple pregnancies there were 31 infant deaths, 15 caused by spontaneous preterm labour, 9 from abruptio placentae, 5 from IUGR and 2 from the transfusion syndrome. Twenty-six infants weighed less than 1 500 g, 17 of these being less than 1 000 g. There were 12 late abortions, 8 stillbirths, 7 early neonatal deaths and 4 perinatally related infant deaths.

Severe prematurity and the respiratory distress syndrome were responsible for 54% of the early neonatal deaths whereas necrotising enterocolitis, septicaemia and pneumonia were responsible for 79% of the late neonatal and perinatally related infant deaths. Two-thirds of the babies died in the early neonatal period compared with one-third in the late neonatal and infant period.

Three hundred and fifty-nine (4,5%) of the patients delivered had no antenatal care. In this unbooked group, 86 singleton

TABLE I. TPRW — SINGLETONS

Primary obstetric causes	Late abortions	Stillbirths	Early neonatal deaths	Late neonatal deaths	Perinatally related infant deaths	TPRW (%)
Spontaneous preterm labour	37	7	16	10	5	75 (24,8)
Infection	14	11	2	1	—	28 (9,3)
Antepartum haemorrhage	14	56	10	4	—	84 (27,8)
IUGR	—	8	4	2	1	15 (5,0)
Hypertension	6	1	5	3	4	19 (6,3)
Fetal abnormality	10	7	5	1	1	24 (7,9)
Trauma	—	1	2	—	—	3 (1,0)
Intrapartum asphyxia	—	5	6	—	—	11 (3,6)
Maternal disease	—	2	2	—	—	4 (1,3)
Other	—	1	2	—	—	3 (1,0)
Unexplained intra-uterine death	9	27	—	—	—	36 (11,9)
Total (%)	91 (30,1)	126 (41,7)	52 (17,9)	21 (7,0)	11 (3,6)	302

TABLE II. PRIMARY OBSTETRIC CAUSE OF DEATH IN BIRTH WEIGHT CATEGORIES

Primary obstetric cause	500 - 999 g	1 000 - 1 499 g	1 500 - 1 999 g	2 000 - 2 499 g	> 2 500 g
Spontaneous preterm labour	50	15	7	2	1
Infection	17	3	4	2	2
Antepartum haemorrhage	20	15	20	15	14
IUGR	7	1	3	4	—
Hypertension	10	6	2	1	—
Fetal abnormality	10	4	3	1	6
Trauma	—	—	1	—	2
Intrapartum asphyxia	—	—	—	—	11
Maternal disease	1	2	1	—	—
Other	1	1	—	—	1
Unexplained intra-uterine death	11	3	6	2	14
Total	127	50	47	27	51
TPRW / 1 000 deliveries / birth weight group (excluding multiple pregnancies)	840	279	153	6	8

TABLE III. COMPARISON OF MAJOR PRIMARY OBSTETRIC CAUSES OF SINGLETON PERINATAL DEATHS BETWEEN THREE CENTRES*

Order of merit	Tygerberg (%)	Glasgow ² (%)	Riyadh ⁶ (%)
1	Antepartum haemorrhage (34)	Fetal abnormality (27)	Fetal abnormality (30)
2	Unexplained intra-uterine death (14)	Spontaneous preterm labour (25)	Intrapartum asphyxia (17)
3	Spontaneous preterm (12)	Antepartum haemorrhage (12)	Spontaneous preterm labour (14)
4	Infection (7)	Hypertension (8)	Unexplained intra-uterine death (13)
5	Fetal abnormality (6)	Unexplained intra-uterine death (7)	Antepartum haemorrhage (9)
6	IUGR (6)	IUGR (5)	Maternal disease (7)
Perinatal mortality rate	22,6/1 000	11,9/1 000	17,6/1 000

*Babies \geq 28 weeks or \geq 1000 g and died *in utero* or in first 7 days of life.

and 14 twin babies died. The TPRW for the group of singletons was 238,6 per 1000 births and all the twin babies died. The major causes of death in the singletons were preterm labour 21 (24,4%), abruptio placentae 20 (23,3%) and infection 17 (19,8%). There were 8 (9,3%) unexplained deaths.

Discussion

The major primary obstetric events leading to perinatal deaths in the western Cape are antepartum haemorrhage, spontaneous preterm labour, unexplained intra-uterine death, multiple pregnancy, infections and fetal abnormalities. These obstetric factors differ considerably from those given in South Africa's only locally written obstetric textbook⁵ and those in the commonly used English-language textbooks.

In comparing these factors with two other published series (Table III), it is seen that there are marked differences between each centre. This emphasises the need to collect local data. Mesleh⁶ reports that in Riyadh in Saudi Arabia there is a very low perinatal mortality rate. However, this cannot be explained by good perinatal care because of the large number of deaths from intrapartum asphyxia and 12,7% of his patients were unbooked. The lifestyle in Saudi Arabia is very different from the western Cape since smoking, alcohol and promiscuity are prohibited. Perhaps this difference in lifestyle can partly explain the high perinatal mortality in the western Cape due to factors such as spontaneous preterm labour, infections and antepartum haemorrhage.

The advantage of using the TPRW instead of the standard definition of perinatal mortality is clearly illustrated in this study. Late abortions were responsible for 30,1% and late neonatal deaths and perinatally related infant deaths combined were responsible for 10,6% of the perinatal wastage. Improved neonatal care has meant that the numbers of babies surviving more than a week has greatly increased. However, some of these babies will still die. The change of pattern of the final causes of neonatal death in the first week from respiratory problems to necrotising enterocolitis and septicaemia after a week indicates more attention must be focused on the last two problems.

By using the TPRW classification and macroscopically examining the fetus and placenta together with clinical records carefully, the causes of 89% of deaths were explained. In about 10% of cases the babies were macerated and no diagnosis was possible. Special investigations in such patients are probably not justified. Autopsies could possibly only help in making a

diagnosis in very few cases; however, by using histology of the placenta⁷ it might be possible to assign more accurately the cause of death in some patients, e.g. spontaneous preterm labour.

By collecting simple data with each patient, such as booked status, address and preventable factors, much descriptive information can be gained which can generate hypotheses that can be tested later. In this area the unbooked mother is clearly identified as a problem. It is interesting to note the high percentage of infections and spontaneous preterm labour that were primary factors responsible for the perinatal wastage. This supports the hypothesis that unbooked patients are more likely to have sexually transmitted diseases and a more promiscuous lifestyle.⁸

In conclusion, the modified Whitfield classification of primary obstetric causes of perinatal death was simple and inexpensive to use. Valuable information was obtained and three areas of major concern were identified for future research — these are antepartum haemorrhage, spontaneous preterm labour and infections.

We would like to thank Miss M. S. Daniels for providing all the folders for us, Drs G. F. Kirsten, J. C. Thom and P. A. Henning of the Department of Paediatrics for their help with the Neonatal Death Meetings, all the registrars from the Department of Obstetrics and Gynaecology and the Department of Paediatrics who contributed to the study, the Medical Superintendent of Tygerberg Hospital for permission to publish and Mrs H. Krüger for typing the manuscript. This study was supported by the South African Medical Research Council.

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