TITLE : **CAUSES OF PERINATAL DEATHS IN GA-RANKUWA HOSPITAL OBSTETRICS UNIT -**
AN AUTOPSY STUDY OF 100 CASES

AUTHOR : **Mufandilani Nelson, MUTHUPHEI**

STUDENT NO : MTHMUF001

COURSE : M.Phil (Paediatric Pathology)

INSTITUTION : University of Cape Town

SUPERVISOR : Professor R O C Kaschula

TABLE OF CONTENTS

CHAPTER 1

1. Title : Causes of perinatal deaths in Garankuwa Hospital Obstetrics Unit – An autopsy study of 100 cases

2. INTRODUCTION

Perinatal mortality is regarded as an indicator of the social status and obstetrical care within a given community. The developed world has witnessed a dramatic decline in perinatal mortality as standards of living improved.[1] Unfortunately this turn of events has not been seen in the Third World where mortality remains very high.

When improved perinatal autopsy techniques are applied the causes of perinatal deaths are readily appreciated. No previous autopsy study has been conducted at our hospital. The application of new techniques has stimulated the present study, which is also intended to monitor current and future clinical practice.

3. Problem formulation

What are the common causes of death in the perinatal period at Ga-Rankuwa Hospital?

4. Aims of the study

a. To assess the common causes of fetal and neonatal deaths at our hospital.

b. To determine those causes which are preventable and propose specific obstetric interventions.

c. To obtain a baseline for future studies along the same line.

d. To lay a foundation for clinicopathologic discussion with clinical colleagues.

5. Research Methodology

An autopsy study is to be conducted on each and every stillbirth and neonatal death that occurs during the period of study. The technique will be discussed in detail in Chapter 3.

6. Demarcation and limitation of the study

The study population include pregnant women in the locations and villages which are served by Ga-Rankuwa Hospital. These include Ga-Rankuwa, Soshanguve and the informal settlement of Winterveldt.

The accuracy of the study is limited by inadequate clinical information provided by clinical staff. As the study is new in the area, the benefits to the clinicians and the community will only become apparent after it is completed. In cases where the clinical diagnosis is obvious no autopsy will be requested. This will affect the final statistics. X-ray facilities are not readily available and many skeletal anomalies will be missed by the autopsy. No cultures are being done which will lead to many infections being missed. In most of the cases the placentas are not submitted, leading to the failure of recognition of those causes of death that are associated with the placenta.

7. Definitions of concepts or terms:

a. Stillbirth : Any antepartum death involving a fetus that weighs > 500g.

b. Fresh stillbirth : Antepartum death without evidence of decomposition.

c. Macerated stillbirth: Antepartum death with evidence of decomposition or autolysis.

d. Neonatal death : Death occurring within the first 28 days of life.

e. Intrapartum death: Death occurring during labour.

f. Intrauterine growth retardation(restriction): Any fetus whose weight is 10% less than expected for gestational age.

CHAPTER 2

The value of perinatal autopsy in medical practice

The American Medical Association has defined perinatal death inclusive of neonates as any death occurring within the first 28 days of life or stillbirth weighing 500g and more.[4] Many of these deaths are caused by infections and/or hypoxic/anoxic episodes, both of which may be preventable.[5,6]

The low autopsy rate has been lamented by several authors.[1,2,3,4] In the perinatal period this low rate is accompanied by a generally poor quality of necropsy technique and reporting. The causes for the low autopsy rate include

- Parental refusal to give consent for an autopsy (do not realise the benefits or are not made to realize the benefits by the person seeking the consent).
- Failure of clinicians to request post mortem examination (too much trust in the modern investigative techniques).
- Poor understanding of the contribution of autopsy to patient care.
- Failure of the clinicians to explain to the parents the findings of an autopsy examination.
- Poor perinatal autopsy techniques and interpretation.

Several studies have emphasised the need for the revival of autopsy.[4,5] This paper reviews some of the benefits accorded by a good perinatal autopsy examination.

In general a perinatal autopsy is approached like an adult autopsy. There are, however, some important differences. A perinatal autopsy warrants an accurate assessment of the organs which will relate to normally expected growth and development. The autopsy should elucidate the gestational age and appropriateness of development and establish the time of death as related to the birth process. The pathologist must also be able to detect subtle congenital malformations. Examination of the placenta is essential in

perinatal autopsy as it could demonstrate the presence of perinatal infection or reveal changes that are associated with hypoxic or anoxic deaths.

Benefits to the clinicians

Studies have shown lack of correlation between the antemortem clinical diagnosis and the autopsy diagnoses.[4,6] The discrepancy may be as high as 40 percent. A good perinatal autopsy can usually identify the cause and mode of death. An autopsy is, therefore, useful in confirming, clarifying and correcting the clinician's diagnosis. It assists the clinician to discover new disease entities. This may render the clinician humble and more cautious in making clinical diagnoses. A wrong clinical diagnosis should not be seen as a bad reflection of the diagnostic acumen of the physician, but an indication of how much knowledge we still need to discover. In this way an autopsy can be useful for auditing the clinician's diagnoses. An autopsy can be used in the evaluation of new diagnostic aids. In perinatal medicine, ultrasound has been used to diagnose intraventricular haemorrhages and intrauterine congenital abnormalities. New modalities such as MRI should be evaluated against autopsy findings for them to be fully useful aids.

The current diagnostic aids should not be allowed to compete with autopsy or diminish its importance. The two should rather be viewed as being complementary.

An autopsy will give the physician a better understanding of the disease. Without a perinatal autopsy we would not have understood the effect of anoxia in the various tissues. Most disease associations (syndromes) have been elucidated by autopsy studies. A good perinatal autopsy will provide facts and accurate unbiased data upon which medical statistics should be founded. This is in contrast to the clinician's guess which leaves everyone happy but might be incorrect. With the majority of patients being children, this would provide some idea of the disease pattern in that community. The physician will also be notified of the incidence of different diseases, which will give him useful insight into the state of health of the community. In respect to congenital malformations the autopsy can serve to evaluate new surgical techniques used in correcting the defects. Good examples are correction of

biliary atresia and separation of conjoined twins. A thorough study of the anatomy at autopsy elucidates anatomical variations which ~~is~~ are useful in future encounters with similar abnormalities.

The effects of different new drugs on the fetal and neonatal organs can also be evaluated by studying these organs at autopsy. An autopsy can also serve as a source of organs for transplant, for example, skin and bone marrow.[7]

Benefits to the family

The parents of the dead baby would usually benefit from knowing the exact cause of death of their child. It is important to know whether the cause was infection, birth trauma, metabolic or genetic.[8] The feeling of being responsible for the child's death is common amongst parents. Other family members and the community may blame the parents for the child's death. An autopsy may be essential for removing the feeling of guilt amongst the family. Knowledge of the exact cause of death will be beneficial to the family. This is usually accomplished by a postmortem conference between the physician and the family members. In case of contagious diseases, like syphilis, tuberculosis and meningitis an autopsy may lead to investigation and surveillance of contacts within the family. This will lead to an early diagnosis and management of those who have contracted the disease.

Unexpected information may be revealed by an autopsy investigation. This may lead to metabolic screening and genetic work-up leading to early treatment. In communities where beliefs in witchcraft and poisoning are still rife, demonstration of disease may convince the family of the true cause of death. This may avoid the witch-hunts which are so common in such communities. An autopsy will also assist the physician in counselling the parents of the deceased. The question in most parents' minds is "will the next child also be affected?" Armed with autopsy findings the clinician can explain the recurrence risk to the parents. Infections and sporadic malformations are not likely to recur, and this should be carefully explained to the parents. On the other hand chromosomal abnormalities and genetic disorders have a higher chance of recurrence during subsequent pregnancies. Such knowledge is essential to the obstetrician to closely monitor the

pregnancy and intrauterine period in the subsequent pregnancy. This can easily be achieved by the use of ultrasound and amniocentesis. The family of a dead child may derive comfort from the knowledge that some organs from their child will be used for transplantation, for example, cornea and bone marrow. The feeling of contributing to medical education is also satisfying to some parents.

Medical education

A perinatal autopsy is useful in the education of members of the medical fraternity. The autopsy can easily add to the continuous education of the attending physicians. In this way an autopsy can serve as a tool for quality assessment and quality control. Trainees in pathology can also learn from a perinatal autopsy. Organs with congenital malformations may also be kept in specimen bottles for use in educating medical students. Indeed, most of the organs with rare disorders, may be viewed as bottled specimens.[9]

Benefits to the society

The research based on autopsy studies may show ethnic and geographic differences of specific diseases. This understanding may lead to a more rational approach which will serve to save the society's resources. The knowledge of what children are dying of is essential so that authorities can do something about it. The interaction between the family and the clinician will help educate the community about the value of perinatal autopsy. It also provides the pathologist with a social meaning within the community.[10]

Research

Perinatal autopsy can be used to advance research and this has not been fully exploited. Most of the progress in cellular pathology has been using tissue obtained from autopsy material. This has involved the maintenance of cells in cell cultures, organ cultures and xenotransplants.[11]

Studies of the effects of hypoxia in different organs have been achieved using the perinatal autopsy. It has also been used in the study of carcinogenesis, especially genetic cancers like retinoblastoma. It has been

used to elucidate the effect of the environment in causing congenital malformations.

The value of an autopsy in the study of metabolic diseases has been demonstrated, showing the extent and pattern of organ involvement. There is however neglect of this as a tool in advancing research.

Environmental factors

In adults the effects of the environment on pathology are well established. Though not as well established, a perinatal autopsy can demonstrate the effect of the environment on the outcome of pregnancy. Correlation between concentrations of certain substances in tissues with environment data has been used to establish the effect of these substances on tissues. The effects of alcohol, smoking and drugs on fetal development have been studied using autopsy[12;13].

Medico-legal role of perinatal pathology

Perinatal pathology may be important in resolving medico-legal issues. Though it is easy to establish the cause of death, the mode of death is more difficult to demonstrate and might be more relevant in a legal case[14].

In stillbirth it might be essential for the estimation of the time of death. This can be of assistance in litigation cases against obstetricians (whether death occurred before or during labour). The autopsy can also be useful to doctors working in neonatal units.

Who should perform the perinatal autopsy?

In South Africa there is a need for good quality perinatal autopsies to be performed. There are very few specialist paediatric pathologists to cope with all perinatal autopsies. The results of a perinatal autopsy not only affect the future reproductive behaviour of the parents and their close relatives, but also subsequent generations to come (if there are genetic abnormalities). It is therefore, essential that all general pathologists with an interest in paediatric pathology should be well trained and encouraged to do perinatal

autopsies. In this situation difficult slides and complex malformations may be referred to the specialist paediatric pathologist[15].

In conclusion it has been found that new investigative modalities have not reduced the necessity for a perinatal postmortem. We should strive for the improvement in the quality and rate of perinatal autopsies. Clinico-pathological conferences are necessary to make perinatal autopsies more meaningful. We need to establish a good rapport with parents. The physicians must also be prepared to answer parent's questions after the completion of any autopsy.

A good perinatal autopsy service is essential for the collection of accurate perinatal mortality data that is used to guide decision makers in planning health care and in allocating resources.

CHAPTER 3

LITERATURE REVIEW – PART II

Causes of perinatal deaths

In Chapter 2 the value of perinatal autopsy was discussed. This chapter focuses on the different causes of death in the perinatal period.

Several studies have shown a decline in perinatal mortality in the developed world[1,2,3,4]. This decline was, however, not seen in the developing countries[1,2,3,4]. In these situations the perinatal mortality rate (PMR) is regarded as measure of socioeconomic status and the level of obstetric care in the society. An improvement in the social status always leads to a reduction in mortality. Most autopsy series in Africa have focused on the infant mortality rate with very little work being done on perinatal mortality.[1] This has been compounded by the lack of trained personnel who could conduct a proper perinatal autopsy.

Many studies have been published on perinatal mortality. These studies are, however, difficult to compare. Different authors use different approaches. There are differences in terms of patient selection and referral depending on the type of the hospital being investigated[5]. The investigator's area of interest has also been used to explain the different approaches. Many studies are epidemiological and are based on the diagnoses that appear on death certificates.[6] In these instances no autopsy is performed. On the other hand other studies have put more emphasis on the autopsy findings with complete neglect of the clinical findings and impressions. As some causes of perinatal death are of maternal origin, a significant number of primary causes of death may be missed.

Most studies by obstetricians tend to focus on maternal factors.[7] There is little emphasis on the clinicopathological processes within the baby. Until recently there has been a complete neglect of the examination of the placenta. This has led to a situation where most of the placental causes of fetal or neonatal loss are not included. As the placenta serves as an organ

for gaseous and nutritional exchange between the mother and the fetus, pathology in the placenta will adversely affect the outcome of that pregnancy.

From these observations it is clear that a comprehensive autopsy should include adequate clinicial information, placental examination and a good postmortem examination of the fetus or neonate.

In cases where autopsies are conducted the causes of death are not uniform.[5,8,9] In 1976 Joshi highlighted some shortcomings in the published series based on perinatal autopsy findings.[9] He raised the following concerns which make comparison of different studies very difficult:

i. Most studies are based on retrospective analysis
ii. Several authors fail to distinguish between primary and secondary causes of deaths
iii. Some studies do not include some important causes of deaths
iv. Most studies fail to show the breakdown of primary extrinsic causes of hypoxia
v. Some studies only include neonates without inclusion of antepartum deaths

As stillbirths still form a significant percentage of perinatal deaths, this omission is likely to lead to unreliable data, making comparison difficult.

Some authors have used less meaningful words for defining the different causes of death. Diagnoses like "anoxia" and "prematurity" have been used as primary causes of perinatal deaths. Davies et al discourages the use of these words as primary diagnoses.[8] The authors advocate that the primary causes of hypoxia should be sought and used to further define the cause of death. These should include maternal diseases such as gestational proteinuric hypertension (GPH), placental infarctions, abruptio placentae and umblical cord anomalies. In "premature" babies, the complications which lead to the infant's death should be regarded as the primary cause of death. These include hyaline membrane disease, necrotizing enterocolitis, intraventricular haemorrhage or neonatal infections. In this way a better classification of the causes of death can be realized.

In 1994 Albermau et al acknowledged the difficulties involved in classifying perinatal deaths in an informative way.[10] They suggested grouping of the causes, and further advocated a classification which should be compatible across the spectrum of stillbirths, neonatal and postnatal deaths. Their proposal was that of a multicause data system where all the contributing factors are taken into consideration.

Taha et al analysed determinants of neonatal mortality in Sudan.[11] They isolated a number of predictable determinants for perinatal mortality. These included low birth weight, prematurity, maternal infections, poor maternal nutrition and short birth spacing. These predictable factors can all be prevented through health education and good antenatal care.

Studies have shown that low birth weight babies, irrespective of the gestational age, contribute significantly to the high perinatal mortality in the developing countries.[3,12] These authors have stressed the need for improved facilities for the care of high risk low birth weight neonates in these countries.

Njokanma et al showed a male: female ratio of 1.16:1[3]. This equal ratio was also observed when stillbirths and neonates were analyzed independently. This observation shows that sex does not play a significant role in perinatal mortality.

Patients in the developing countries tend to present late and the majority of them are unbooked. In Nigeria more than 70% of the mothers are unbooked.[3] This usually leads to delivery of severely asphyxiated babies. Caesarian sections in these patients do not seem to improve the outcome. In Brazil, where 99% of the patients are booked, the perinatal mortality is very low. Van Roosmalen in Tanzania noted that 25% of their stillbirths were preventable deaths. The majority of their cases were due to cephalo-pelvic disproportion. Amniotic fluid infection was significant in the causation of fetal loss in this country. He advocated the use of partograms in the management of patients who are in labour. According to this author, similar measures were effective in reducing the perinatal mortality rate in Kenya (Machakos).

The causes of death differ significantly between the developed and the developing countries.[4,8] In developed countries, one of the main causes of death are congenital malformations. Hypoxic deaths and infections are rare. On the other hand hypoxic deaths and infections are the leading causes of perinatal deaths in developing countries.

In these countries the literacy rate is low and most of the patients do not attend antenatal clinics. These illiterate patients are often sceptical about western medical care.

Nakamura et al observed major malformations in 18.4% of their cases.[6] This is significantly higher than that observed by Adewunmi in Nigeria, where only 3.9% of their cases had major congenital anomalies. Naeye et al also observed more hypoxic deaths and less congenital malformations in their series where 30% of the cases were due to infections.

These differences in the pattern of disease warrant different approaches. In developing countries the emphasis should be on obstetrical factors which will be helpful in preventing the deaths. Such a decline has been witnessed in Malaysia.[13]

In this paper the author examines the causes of perinatal death in a periurban population. The results of this study are compared with what is known in both the developing and the developed world.

CHAPTER 4

MATERIALS & METHODS

Ga-Rankuwa Hospital is a tertiary institution serving as a referral centre for the communities around Soshanguve, Mabopane, Ga-Rankuwa and Winterveldt. It also serves as a referral centre for the Northern Province and part of the Mpumalanga Province. The labour ward handles about 6000 deliveries annually. There is an average of 5 stillbirths per week.

This autopsy study was conducted on consecutive stillbirths and neonatal deaths which occurred between May 1997 and April 1998 and where consent for an autopsy was sought and given. The bodies were usually preserved in refrigerators until the time of autopsy. The autopsy was conducted in accordance with the established guidelines[1,2] , involved external examination which noted the presence or absence of gross abnormalities, abrasions and evidence of birth trauma. The nostrils and the anus were routinely checked for patency.

The weight of the body was determined to the nearest gram using an electronic weighing machine. The following measurements were determined:- head circumference, crown to rump length, crown to heel length and the foot length. X-ray examination was conducted only on those cases which showed external gross abnormalities or were available from the neonatal intensive care unit. The dissection involved a midline incision from the chin to the pubis. Subcutaneous fat thickness was measured at the level of the chest.

After exposure of the neck structures the sternum was removed by cutting through the cartilage. After the dissection of the thymus from the left internal jugular vein and superior vena cava, the major veins and the branches of the aortic arch were inspected in situ for any deviation from normality. The pulmonary veins were also inspected for any abnormal drainage. The abdominal organs were inspected for the position of the spleen and appendix. Their normal location confirmed the normal rotation of the bowel. The presence and nature of fluid within the abdominal, pleural and pericardial cavities was noted. The pericardium was opened to examine the root of the aorta and the pulmonary artery.

The evisceration was conducted in stages resulting in three blocks. The bowel was freed from its mesentery and transected at the rectum. The neck organs were mobilized and freed. After freeing the lungs, the aorta, inferior vena cava and the oesophagus were transected, resulting in the delivery of the chest block.

The mesentery was then freed from the posterior abdominal wall and separated from the adrenal glands. This results in the evisceration of the liver, spleen, pancreas and stomach block.

The renal block was delivered by dissecting the organs off the abdominal wall. After mobilizing the bladder and the rectum the urethra and the rectum were transected. The brain was removed by cutting along the suture lines and folding the vault outwards to expose the cerebral hemispheres. The brain was freed by transecting the nerves and the major blood vessels. The tentorium was cut away from the interior of the skull around its entire perimeter. The spinal cord was transected and the brain was removed. The spinal cord was removed by the anterior approach.

The tongue, trachea and lungs were inspected for any abnormalities. One longitudinal incision was made into each lung. The heart was opened in the standard manner to check for any congenital anomalies.

The spleen and kidneys were cut in half and the cut surfaces were noted. The adrenals were incised to allow better fixation. An incision was made into the liver. After noting all the abnormalities the organs were fixed in 10% formalin for a period of one to two weeks.

After the fixation period the dissection of the organs was completed. All the organs were weighed and their weights were compared with normal values. Standard blocks were taken from each organ.

The placenta, when submitted, was examined for any abnormality.[3] The membranes were evaluated as to whether they were complete or not. The umblical cord was examined and its length measured in centimetres. After the membranes were dissected off, the width and thickness of the placenta were determined.

During bread slicing of the placenta any anomalies were noted. Tissue blocks were taken from the proximal and distal cord, from a roll of the membranes, insertion of the cord and two random samples. More sections were taken from grossly abnormal areas. The blocks taken were processed in graded strengths of alcohol and embedded in paraffin wax. From these blocks 5μ sections were produced and stained with haematoxylin and eosin. Special stains were performed in selected cases.

Histological examination was carried out using a light microscope. This examination emphasized the abnormal areas and assessed the different organs for maturation. The rate of growth was also assessed by examination of the rib.

In Chapter 5 the results of this study will be discussed and an attempt will be made to assign each death to a specific cause or a group of cases.

CHAPTER 5

RESULTS

During the twelve months of study 100 perinatal autopsies were conducted.
There were 21 neonatal deaths and 79 stillbirths. Of the 21 neonates three were delivered by Caesarian section. There was no case involving instrumental delivery (forceps or vacuum suction). All the stillbirths were delivered vaginally. 45 stillbirths showed some degree of maceration and 34 cases were fresh stillbirths. The degree of maceration ranged from a few early blisters to a severe autolysis of the organs.

Analysis of the maternal age revealed a range of 19 to 36 years with a mean of 23 years. Most of the cases were seen in primigravida and those with high parity.

There were 52 males and 48 females in the study giving a male to female ratio of 1,08:1. 64 cases had birthweight of 2500g or less and 36 cases had a weight of more than 2500g. 18 cases weighed less than 1000g and 8 cases weighed in excess of 3500g. All the fetuses weighing less than 500g were excluded from the study.

Table I shows the different causes of death in the 100 cases studies.

CAUSES	**NO OF CASES AND %**
1. Congenital anomalies	9
2. Hypoxia	39
3. Infection	8
4. Intrauterine growth retardation	16
5. Unexplained deaths	13
6. Hyaline membrane disease	4
7. NEC	1
8. Intraventricular haemorrhage	7
9. Birth trauma	2
10. Twin transfusion syndrome	1
TOTAL	**100**

Congenital malformation constituted 9% of all the cases. The majority of cases (5) were attributed to hypoxia. Infection constituted 8% of all the cases. The infection

was either diagnosed in the placenta or in the fetus. 16 cases were attributed to intrauterine growth retardation. This group was characterized by weights which were low for gestational age and generalized reduction in organ sizes.

In this group the autopsy failed to reveal the immediate cause of death. In 13 cases the cause of death could not be established. The majority of these cases showed severe maceration, making pathological evaluation difficult. There was one neonate with neonatal necrotizing enterocolitis. The whole small bowel and part of the large bowel showed extensive gangrenous necrosis of the bowel wall.

Four cases of hyaline membrane disease were seen. All the four cases occurred in premature babies. Birth trauma accounted for 2 cases of fresh stillbirths. These cases involved large babies both of whom had an obstructed labour but were delivered vaginally. Both these cases showed massive subdural haematoma and a torn tentorium cerebelli could be demonstrated in one case.

A solitary case of twin transfusion syndrome was encountered. The donor twin weighed 250g and was not included in the study. The recipient twin weighed 1520g and was a macerated stillbirth.

The different types of congenital anomalies are tabulated in table II. In this group we only included those anomalies which are not compatible with life or to which death could be attributed. Minor anomalies, such as those affecting lung lobation, which are compatible with life were excluded.

RESULTS (TABLE II)
CONGENITAL ANOMALIES

1. G I T	4
2. CNS	2
3. Cardiac	2
4. Head and Neck	1
TOTAL	**9**

The majority of the anomalies were found in the gastrointestinal tract. These included 2 cases of gastroschisis (see figure 1), one case of body-stalk anomaly

(figure 2) and a case of duodenal atresia. There was a complete interruption of the bowel and a defect in the mesentery in the atretic case. This was classified as type III atresia.

The two cases of central nervous system anomalies were anencephaly (figure 3). One case was a fresh stillbirth whereas the other was macerated. The two cases of cardiac anomalies were identical. They both presented with cyanosis from birth. Dissection revealed a severely hypoplastic pulmonary trunk (figure 4). The right ventricle was underdeveloped in each case and there was a large ventricular septal defect.

There was one case of otocephalus. This syndrome is characterized by mandibular aplasia (agnathia), ventromedial displacement of the external ears (synotia), microstomia and hypoplasia or aplasia of the tongue (see figure 5). All these features were observed in our case.

In Table III the different types of hypoxic death are further subclassified with an attempt to assign to them a specific cause of death.

RESULTS (TABLE III)
ANOXIA/HYPOXIA

Intrinsic	- RDS	4
Extrinsic	- Placental insufficiency	10
	- IVH	7
	- Cord anomalies	3
	- Unexplained	26
TOTAL		**50**

The intrinsic causes were those associated with hyaline membrane disease which has been discussed earlier. In 10 cases the causes were found in the placenta. Seven cases had extensive placental infarcts. Two cases showed massive perivillous fibrin deposition. The tenth case was an abruptio placentae with a massive retroplacental haematoma.

The seven cases of intraventricular haemorrhage were seen in premature neonates. The intraventricular haemorrhages in these patients were of a severe degree. All the cord anomalies were of a mechanical nature. There was a case of cord prolapse and in two cases knots were identified in the cords. These cords were swollen and oedematous and are unlikely to have been the causes of death. There was, however, no evidence of haemorrhage or infections in these cases.

There were 26 cases of hypoxic death which could not be explained. In these cases the placenta had not been submitted for pathological examination. These cases were characterized by petechial haemorrhages in the thymus, lungs, heart and liver. The adrenals were congested and in 4 cases massive haemorrhages were seen in the adrenal glands.

The different types of infections encountered in this study are listed in Table IV. Five cases of pneumonia were seen. There were two cases of bronchopneumonia characterized by a patchy consolidation in both lungs. Viral pneumonia was seen in 3 cases. The septae were thickened and contained scattered mononuclear inflammatory cells. Two cases of parvovirus infection were seen in this study. The placental examination revealed nucleated red cells, some with intranuclear inclusions.

RESULTS (TABLE IV)
INFECTIONS

1. Bronchopneumonia	2
2. Viral pneumonia	3
3. Parvovirus	2
4. Chorioamnionitis	1
TOTAL	**8**

A case of grade 3 chorioamnionitis was seen in this study. This was characterized by a transmural acute inflammation of the chorion plate and the placental membranes.

In Chapter 6 these results will be discussed and compared with similar studies elsewhere.

CHAPTER 6

DISCUSSION

Very few studies have been done on the fetus with more emphasis being given to the infant mortality.[1] The reason for the low perinatal autopsy rates has been alluded to in earlier chapters.

The predominance of stillbirth was noted in our material. A similar observation was made by Ross et al.[1] They had a stillbirth: neonatal death ratio of 1.7:1. This figure is lower than our figure of 3.8:1. The selection bias of neonatal cases should account for the difference. An autopsy was done only in those cases where the clinicians were uncertain of the diagnosis.

Kishan et al, in Libya, found a predominance of neonatal death with a ratio of 0.8:1.[2]

The predominance of young and multiparous women was observed by other investigators.[2] There were equal numbers of males and females amongst the cases in our study with a male to female ratio of 1:0.9. This is comparable to that of China with a ratio of 1:0.95.[3] In Malaysia, however, the ratio was 0.85:1 with predominance of females being observed. Njokanma et al had a figure of 1.16:1; comparable to ours.[4]

The majority of our cases (64%) had a weight of 2500g or less, an observation also made by other authors.[2] In this study 61% of perinatal deaths occurred in cases with a birthweight of 2500g or less.

In our material congenital malformation constituted 9% of all the cases. This figure is higher than the 4.8% figure observed in Malaysia[3] and the 3.9% observed in Ibadan.[5]

In the developed countries congenital malformation accounts for higher proportions of deaths these third world figures. In Japan 18.4% of cases had major congenital malformation.[6,7] In Libya a figure of 37% is quoted.[2] This figure sounds exaggerated in a study which did not involve the performance of autopsies. The

other explanation for this high figure may be the fact that this hospital serves as a referral centre for the region. In San Diego Wallace et al gave a figure of 27%.[8]

These high figures in the western world are a reflection of the low incidence of infections in these countries. A possibility of increased exposure to teratogens in developed countries should also be explored.

Hypoxia was observed to be the main cause of perinatal death constituting 50% of the cases examined. This high figure is caused by the poor antenatal and perinatal care in the surrounding clinics and medical centres. Similar observations were made by Van Roosmalen in Tanzania[9] and Taha et al in Sudan.[10]

In their papers they advocated an improvement in the antenatal care and perinatal care. Van Roosmalen, on review of the patients' charts found that 25% of all the perinatal deaths were preventable.

In his outstanding paper, Joshi VV advocated the need for a specific diagnosis.[11] He suggested subdivision of the hypoxic factors into intrinsic and extrinsic causes. A similar suggestion was made by Alberman et al who proposed a hierarchial classification of causes of infant deaths.[12] The high figure of unexplained hypoxic death can be explained by the neglect of placental examination. This organ was available only in 20 cases of stillbirths. In other centres, it is now mandatory to examine the placenta in all cases of stillbirth.

Infection constituted 8% of all our cases. This figure is high compared to the figures published from the developed world. Davies et al quotes a figure of 1%.[7] Ross et al found a high infection rate of 30% in their material. A similar figure, 29% was reported by Taha et al in Sudan. This observation is a reflection of poor obstetrical care in the developing countries. In our study, placental examination and amniotic fluid culture would have increased the figure of 8%.

Nakamura, in Japan, noted a figure of 35.8%. This figure is high for a country with a low mortality rate. This bias towards infections can be explained by a low incidence of hypoxic deaths as the antenatal care in this country is good.

CHAPTER 7
CONCLUSION AND RECOMMENDATIONS

This study has shown that the causes of perinatal death are no different from the other third world countries. They are characterized by predominance of hypoxic deaths and infective deaths.

Both these causes can be prevented by a good antenatal and perinatal management.

This can be improved by taking the following steps:

a. Screening for maternal infections during pregnancy
b. Introduction of safe motherhood programmes
c. Improved delivery care
d. Improving the maternal nutritional status
e. Introduction of good communication between the clinics and the central hospital
f. Examination of placentas in all pregnancies with problems
g. Microbiological examination of the amniotic fluid

The impetus of this study should be maintained by continuing with the regular performance of autopsies on stillbirths and neo-natal or perinatal deaths.There should be regular interaction with obstetricians and midwives at perinatal mortality meetings.

The pathologist has a role in educating these people and in instilling an ethos of sending the placentas for pathologic examination.

This kind of survey also helps to identify those centres or clinics where unnecessary deaths are occurring and where the provision of additional resources would significantly benefit the community.

REFERENCES

CHAPTER 1

1. Muthuphei M. N. The value of perinatal autopsy in medical practice. *Pedmed* July/August 1998 : 15-18.

CHAPTER 2

1. Chiswick M. Perinatal and infant postmortem examination. Difficult to ask but potentially valuable. *British medical Journal* 1995; **310**: 141-142.
2. Cartilidge P. H., Dawson A. T., Stewart J. H. et al. Value and quality of perinatal and postmortem examinations : cohort analysis of 400 consecutive cases. *British medical Journal* 1995; **310:** 155-158.
3. Roberts W.C. The Autopsy : Its decline and suggestion for its revival. *New England Journal Of Medicine1978*; **299:** 232-238.
4. Kaschula R.O.C., Sinclair Smith C.C., de Jongh G. Neonatal autopsy : International academy of Pathology : Short course no 40.
5. D'Costa G., Khot S., Duga S.R. The value of neonatal autopsies. *Journal of Tropical Pediatrics.* 1995; **41:** 311-313.
6. Porter H.J., Keeling J.W. Value of perinatal autopsy examination. *Journal of Clinical Pathology.* 1987; **40:** 180-184.
7. Prutting J. Autopsies – Benefits for clinicians. *American Journal of Clinical Pathology.* 1978; **69:** 223-225.
8. Reynolds R.C. Autopsies – Benefits for the family. *American Journal of Clinical Pathology.* 1978; **69:** 220-222.
9. Harman W.H. Contributions of the Autopsy to Medical Education. *American Journal of Clinical Pathology.* 1978; **69:** 228-229.
10. Anderson R.E. The Autopsy – Benefits to the society. *American Journal of Clinical Pathology.* 1978; **69:** 239-241.
11. Trump B.F., Mergner W.J., Jones R.T et al. The use and application of autopsy in research. *American Journal of Clinical Pathology.* 1978; **69**: 230-234.
12. Guerri C. Neuroanatomical and Neurophysiological mechanisms involved in central nervous system dysfunctions induced by prenatal alcohol exposure. *Alcoholism, Clininical and Experimental research* 1998; **22**: 304-312.

13. Roebuck T.M, Mattson SN, Riley EP A review of neuroanatomical findings in children with fetal alcohol syndrome or prenatal exposure to alcohol. *Alcoholism, Clinical and Experimental Research* 1998; **22:**339-344

14. Gantner G. Autopsy and the Law *American Journal of Clinical Pathology 1978;* ***69:****235-238.*

15. Rushton D.I. Should perinatal postmortems be carried out by Specialist Pathologists? British Journal of Obstetics and Gyaenacology 1995; ***102****:182-185*

CHAPTER 3

1. Ross S.M., Macpherson T.A., Naeye R.L. et al. Causes of fetal and neonatal mortality in a South African black community. *South African Medical Journal .* 1982**; 61:** 905-908.

2. Kishan J., Soni A.L., Elzonki A.Y. et al. Perinatal mortality and neonatal survival in Libya. *Journal of Tropical Pediatrics.* 1988; **34:** 32-33.

3. Njokanma O.F., Sule-Odu A.O. Akesode F.A. Perinatal mortality at the Ogun State Hospital, Sagame, Nigeria. *Journal of Tropical Pediatrics.* 1994; **40:** 78-81.

4. Adewunmi O.A., Dawodu A.H., Marinho A.O. Perinatal mortality in an African teaching hospital : the influence of clinicopathologic and other factors on perinatal deaths. *East African Medical Journal.* 1984; 61: 779-786.

5. Van Roosmalen J. Perinatal mortality in rural Tanzania. *British Journal of Obstetrics and Gynaecology.* 1989; 96: 827-834.

6. Nakamura Y., Hosokawa H., Yano H. Primary causes of perinatal death : An autopsy study of 1000 cases in Japanese infants. *Human Pathology.* 1982; 13: 54-61.

7. Hey E.N., Lloyd D.J., Wigglesworth J.S. Classifying perinatal death : fetal and neonatal factors. *British Journal of Obstetrics and Gynaecology.* 1986; **93:** 1213-1223.

8. Davies B.R., Arroyo P. The importance of primary diagnosis in perinatal death. *American Journal of Obstetrics and Gynecology.* 1985; **152:** 17-23.

9. Joshi V.J. Primary causes of Perinatal mortality. *Archives of Pathology and Laboratory Medicine.* 1976; **100:** 106-109.

10. Alberman El, Botting B., Blatchley N. et al. A new hierarchical classification of causes of infant deaths in England and Wales. *Archives of Diseases in Childhood.* 1994; **70:** 403-409.
11. Taha T.E., Gray R.H., Abdelwhab M.M. Determinants of neonatal mortality in central Sudan. *Annals of Tropical Paediatrics.* 1993; **13:** 359-364.
12. Wallace H.M., Micik S., Wise P. Community study of infant mortality in San Diego. *Journal of Tropical Pediatrics.* 1994; **40**: 172-178.
13. Yadav H. Infant mortality in rural Malaysia : An analysis and their causes. *Journal of Tropical Pediatrics.* 1986; **32:** 244-248.

CHAPTER 4

1. Kaschula R.O.C., Sinclair-Smith C.C., de Jong G. The neonatal autopsy. *I.A.P. short course No 40. 1986.*
2. Brief Manual for placental examination Red Cross Hospital.
3. Stocker J.T. The Pediatric Autopsy. In J. Thomas Stocker., L.P. *Pediatric Pathology. JB Lippincott. 2st edition 1992.*

CHAPTER 6

1. Ross S.M., Macpherson T.A., Naeye R.L. et al. Causes of fetal and neonatal mortality in a South African black community. *South African Medical Journal.* 1982; **61:** 905-908.
2. Kishan J., Soni A.L., Elzonki A.Y. et al. Perinatal mortality and neonatal survival in Libya. *Journal of Tropical Pediatrics.* 1988. **34:** 32-33.
3. Yada V.H. Infant mortality in rural Malaysia : An analysis and their causes. *Journal of Tropical Pediatrics.* 1986; **32:** 244-248.
4. Njokanma O.F., Sule-Odu A.O., Akesode F.A. Perinatal mortality at the Ogur State University Hospital, Sagamu, Nigeria. *Journal of Tropical Pediatrics.* 1994; **40:** 78-81.
5. Adewunmi O.A., Dawodu A.H., Marinho A.O. Perinatal mortality in an African Teaching Hospital. *East African Medical Journal.* 1984; **61**: 779-786.
6. Nakamura Y., Hosokawa Y., Yano H. Primary causes of perinatal death : An autopsy study of 1000 cases in Japanese infants. *Human Pathology.* 1982; **13:** 54-61.
7. Davies B.R., Arroyo P. The importance of primary diagnosis in perinatal death. *American Journal of Obstetrics and Gynecology.* 1985; **152:** 17-23.

8. Wallace H.P., Micik S., Wise P. Community study of infant mortality in San Diego. *Journal of Tropical Pediatrics.* 1994; **40:** 172-178.

9. Van Roosmalen J. Perinatal mortality in rural Tanzania. *British Journal of Obstetrics and Gynaecology.* 1989; **96:** 827-834.

10. Taha T.E., Gray R.H., Abdelwachab M.M. Determinants of neonatal mortality in Central Sudan. *Annals of Tropical Paediatrics.* 1993; **13:** 359-364.

11. Joshi V.V. Primary causes of perinatal mortality. *Archives of Pathology and Laboratory Medicine* 1976; **100:** 106-109.

12. Alberman E., Botting B., Blatchley N. et al. A new hierarchical classification of causes of infant deaths in England and Wales. *Archives of Diseases in Childhood.* 1994; **70**: 403-409.

LEGENDS TO THE FIGURES

Figure 1 A case of gastroschisis. Note the small bowel protruding through a small defect in the abdominal wall.

Figure 2 A case of body-stalk anomaly

Figure 3 A case of anencephaly. Note the absence of the cranium and brain

Figure 4 Hypoplastic pulmonary artery(see the probe)

Figure 5 A case of otocephalus. There is ventromedial displacement of the ears and microstomia.

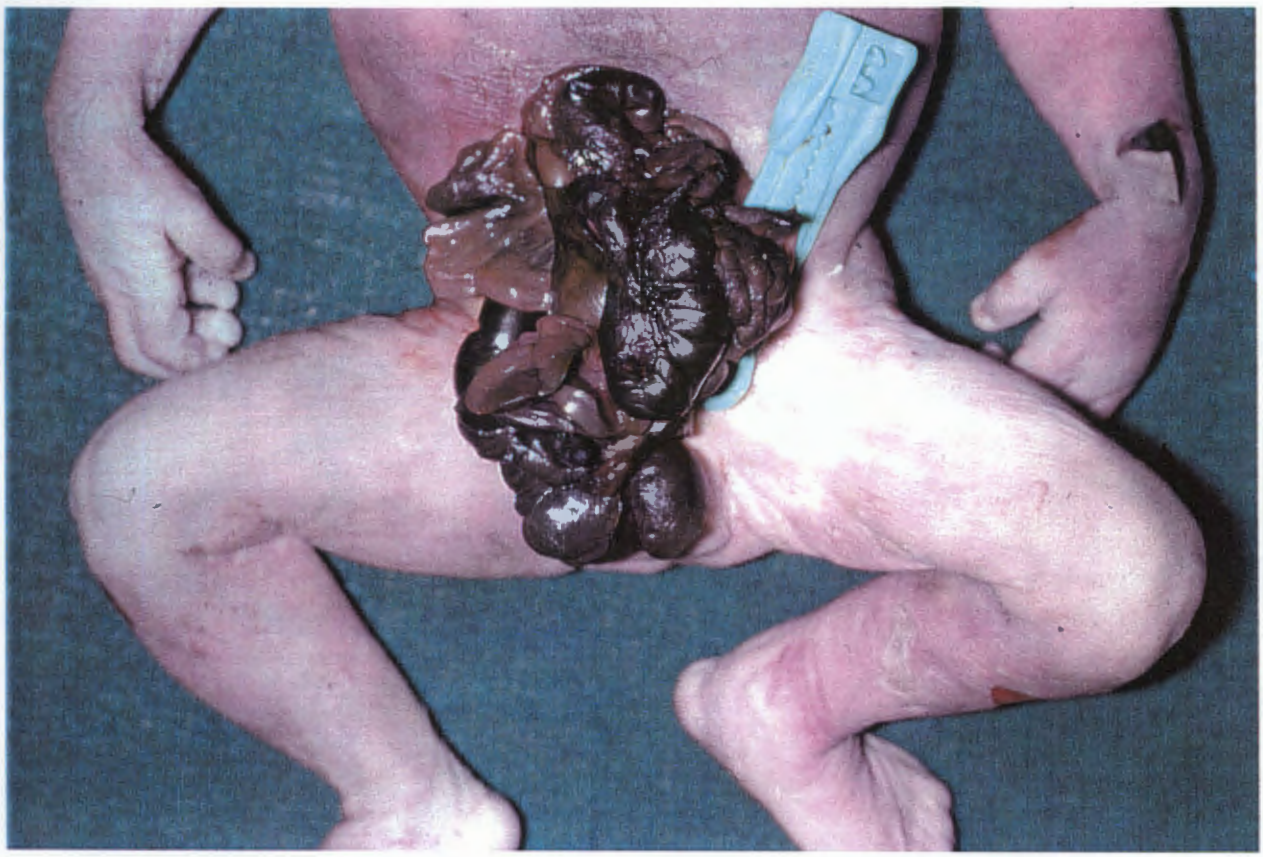

FIG 1

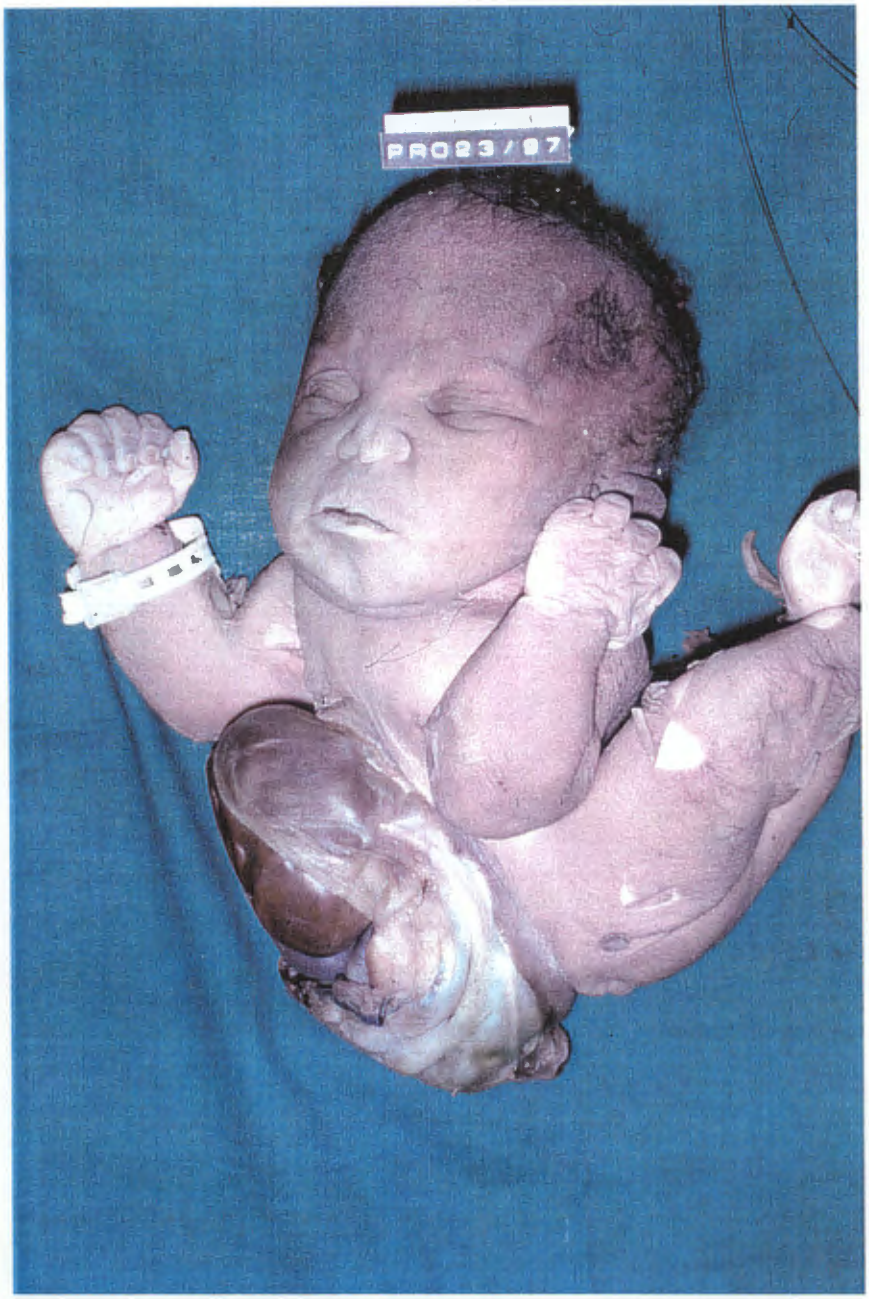

Fig 2

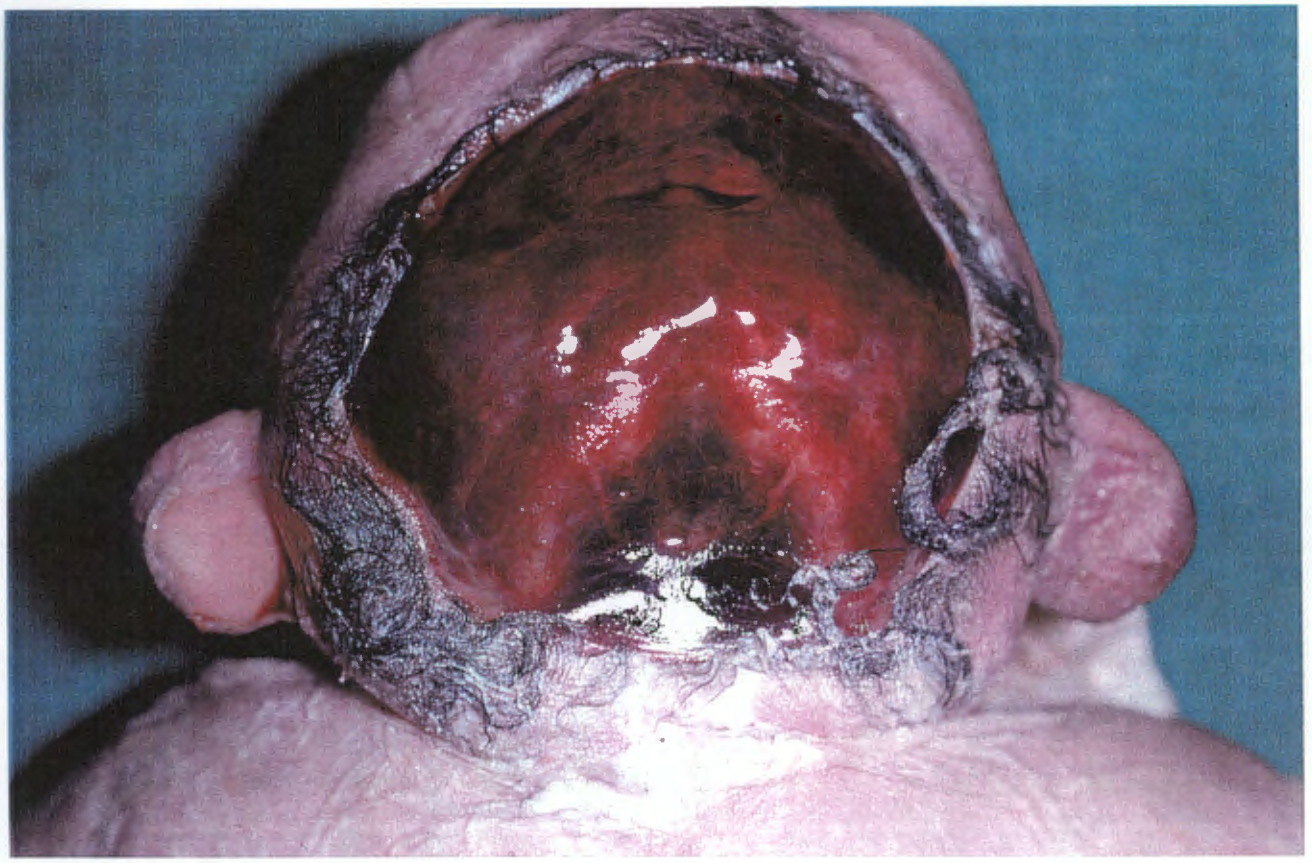

FIG 3

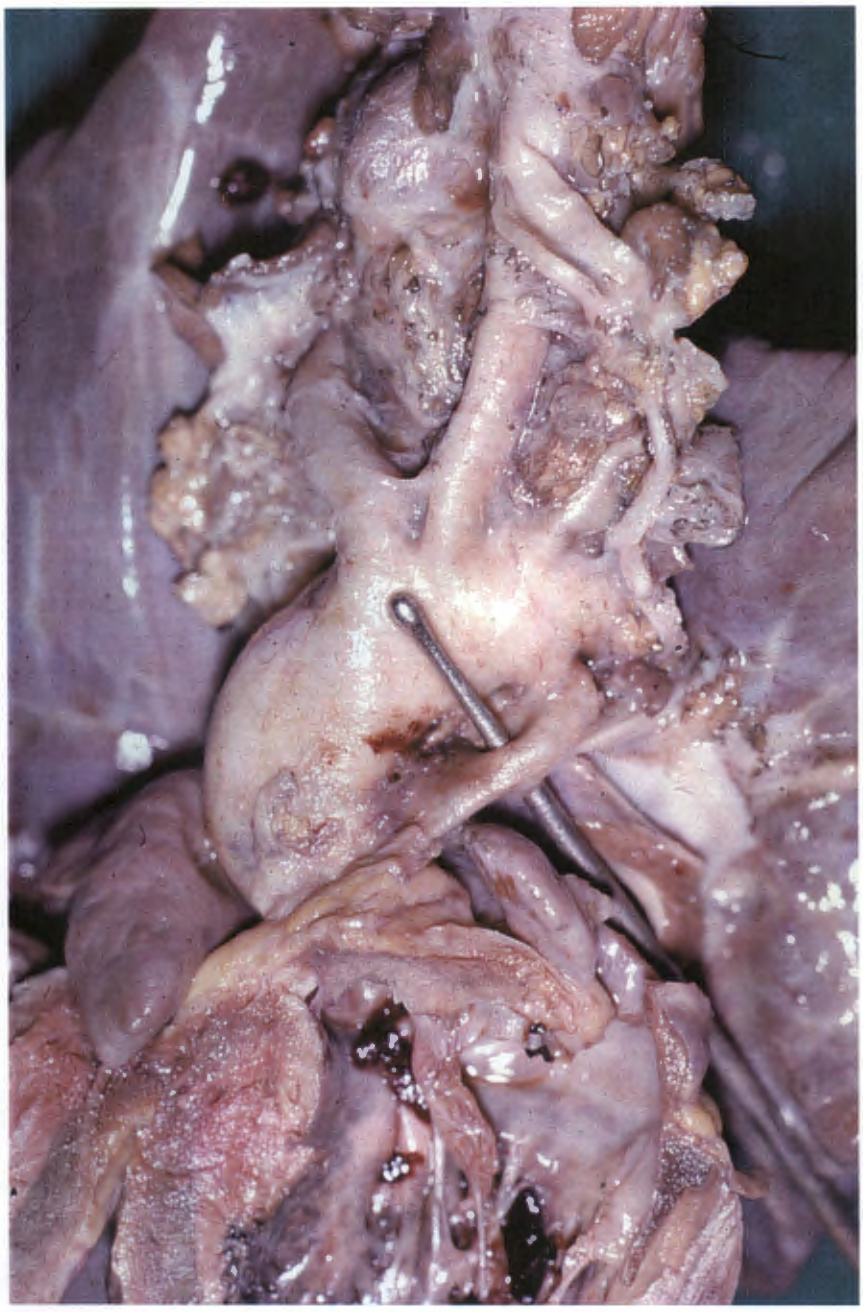

Fig 4

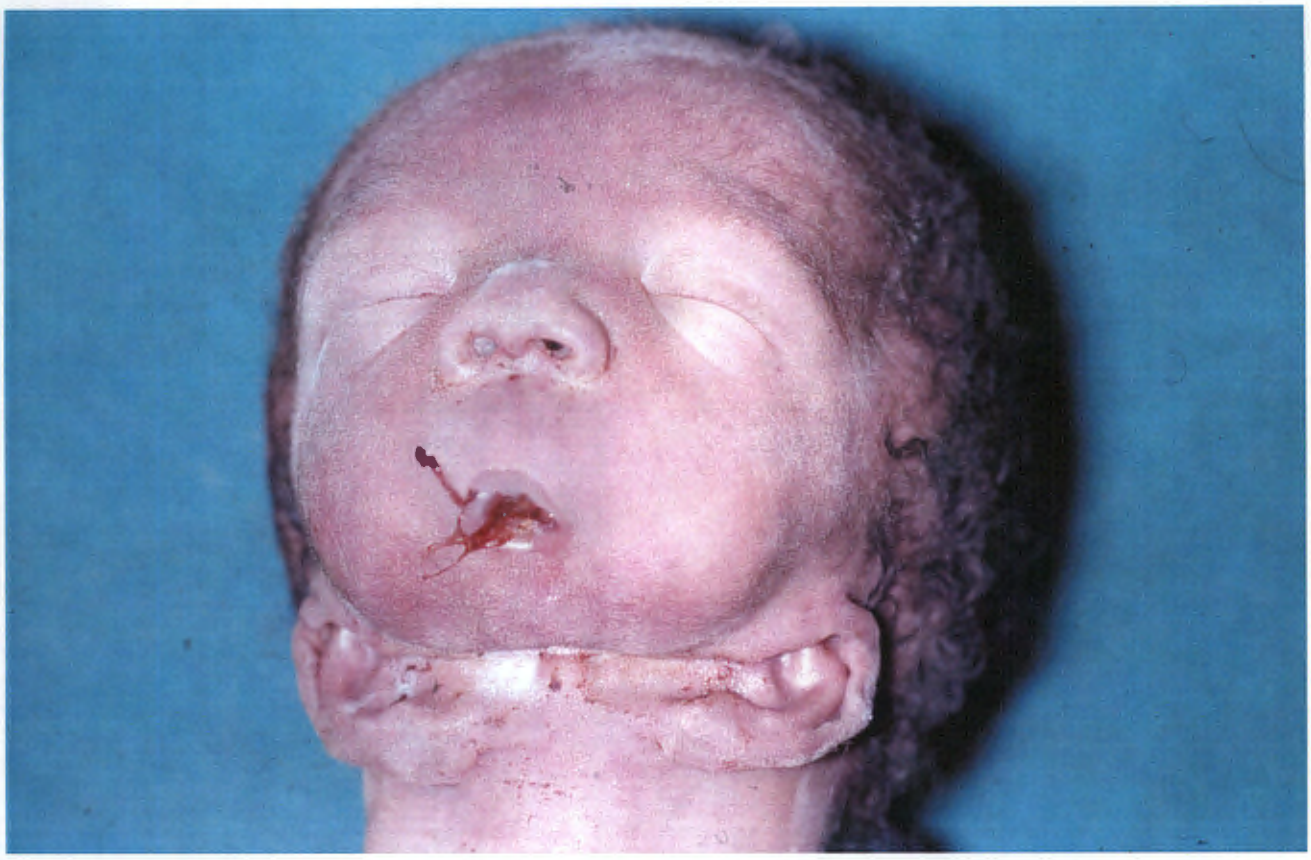

FIG 5