

UNIVERSITY OF ZIMBABWE COLLEGE OF HEALTH
SCIENCES



**EVALUATION OF THE PREVALENCE OF
RETINOPATHY OF PREMATURITY AT
PARIRENYATWA GROUP OF HOSPITALS
AND HARARE CENTRAL HOSPITAL.**

BY

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DEDICATION

Family forms the foundation for all personages, I dedicate this work to mine.

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LIST OF ABBREVIATIONS

| | |
|------------------|--|
| BWT | Birth Weight |
| BEAT ROP | Bevacizumab Eliminates the Angiogenic Threat of ROP |
| CPAP | Continuous Positive Airway Pressure |
| CRYO ROP | Cryotherapy for Retinopathy of Prematurity |
| EGA | Estimated Gestational Age |
| GA | Gestational Age |
| GNI | Gross National Income |
| g | grams |
| HCH NNU | Harare Central Hospital Neonatal Unit |
| HIV | Human Immunodeficiency Virus |
| ICROP | International Classification of Retinopathy of Prematurity |
| IPPV | Intermittent Positive Pressure Ventilation |
| JREC | Joint Research Ethics Committee |
| kPa | Kilopascal |
| PaO ₂ | Partial Pressure of Oxygen in the blood |
| PGH NICU | Parirenyatwa Group of Hospital's Neonatal Intensive Care Unit |
| RDS | Respiratory Distress Syndrome |
| ROP | Retinopathy of Prematurity |
| SA | South Africa |
| SaO ₂ | Saturation level of Oxygen in haemoglobin |
| SUPPORT | Surfactant, Positive Pressure and Oxygenation Randomized Trial |
| tROP | Threshold Retinopathy of Prematurity |
| UK | United Kingdom |
| US | United States |
| VEGF | Vascular Endothelial Growth Factor |

| | |
|------|---------------------------|
| VLBW | Very Low birth weight |
| WHO | World Health Organization |

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ABSTRACT

Background: Retinopathy of prematurity is notably one of the causes of avoidable blindness. The risk factors for the development of ROP are very low birth weight (<1500g), low gestational age (GA) (<32 weeks) and duration of oxygen supplementation. The prevalence varies world over, with high income countries having higher figures than their low income counterparts. Zimbabwe is a low income economy, however Harare is urbanised and a significant number of preterm infants at risk of developing ROP do survive.

Objectives:

1. To establish the prevalence of ROP at PGH NICU and HCH NNU at 4-6 weeks chronological age.
2. To assess the prevalence of ROP requiring treatment and ROP not requiring treatment a 4-6 weeks chronological age.
3. To establish the risk factors associated with ROP as well as the ocular features of ROP in our neonatal units.
4. To assess the current oxygen delivery protocols for VLBW preterm babies in our neonatal units.

Study Design: Hospital based cross sectional analytical study.

Methodology: All neonates admitted in the neonatal units were screened weekly to identify patients that met the study inclusion criteria. These infants were enrolled into the study and examined at either the 4th, 5th or 6th week after birth. Ocular examination findings were noted as well as the risk factors for ROP that each neonate may have been exposed to. Details of supplementary oxygen for each neonate were documented, that is duration of oxygen delivery, mode and flow rate.

A self-administered questionnaire was completed by medical personnel working in the units, to assess their current knowledge concerning oxygen delivery in VLBW preterm infants.

Results: A total of 141 premature babies were enrolled into the study. Twenty infants died and 121 were examined. Six infants were diagnosed with ROP, therefore the prevalence of ROP at 4-6 weeks chronological age was 5.0%. All the infants diagnosed with ROP had spontaneous resolution making the prevalence of children with ROP requiring treatment 0.0%. Three out of 6 (50.0%) had stage 1 disease and 3(50.0%) had stage 2 disease. Location of the disease was as follows; Five out of 6 (83.3%) neonates had disease in zone 3 and 1 (16.7%) had disease in zone 2.

The risk factors associated with ROP in this study were, prolonged duration of oxygen supplementation >2 weeks, very low birth weight <1100g and EGA<30 weeks.

Seventy per cent of the medical personnel stated that they were aware of an oxygen delivery protocol. However the SaO₂ levels that they aim to maintain vary, with most personnel aiming to maintain in the 90-95% and 95-100% ranges.

Conclusions: There are VLBW preterm infants who survive and develop ROP in our neonatal units. It follows that the screening of all neonates at risk is essential. Current oxygen delivery protocols must be revisited & revised by medical personnel. Monitoring SaO₂ in VLBW preterm neonates would improve with more equipment for monitoring SaO₂ as well as more nursing staff.

1.0 INTRODUCTION

Retinopathy of prematurity (ROP) is a disease caused by the abnormal development of retinal blood vessels in premature infants. It is a potentially blinding disease, that occurs in very low birth weight (VLBW) premature babies (<1500 grams), who have been exposed to supplementary oxygen¹. Approximately 80% of ROP will resolve spontaneously¹. When it does not resolve, it can cause a retinal detachment and blindness¹. ROP is listed as one of the causes of avoidable childhood blindness in the Vision 2020 – “The Right to Sight” Programme².

Vision 2020 is a worldwide strategy aimed at reducing the number of cases of avoidable blindness. This strategy encompasses a joint effort by the World Health Organization (WHO) and the International Agency for the Prevention of Blindness.

Avoidable causes of childhood blindness can either be prevented, treated early or sight can be restored by appropriate intervention. ROP can be treated early to prevent blindness.²

There is a significant correlation between prevalence of ROP and socioeconomic development. ROP is more prevalent in high income and middle income countries where preterm babies have access to tertiary health care facilities, and therefore have a higher chance of survival.³ Unfortunately in most cases the exposure to high concentrations of oxygen, and poor oxygen saturation(SaO₂) monitoring increases the risk of developing ROP⁴.

In low income countries, ROP is not as prevalent because these babies do not have access to tertiary facilities and do not survive. However there are low income countries with urbanised areas which have the facilities to support VLBW babies. ROP does occur in these places⁵. ROP has been diagnosed at the Sekuru Kaguvi Eye Unit in Harare.

The rise of ROP in middle income countries and urbanised areas in low income countries has been termed the ‘Third Epidemic’ by Gilbert et al³.

I decided to carry out this study, to see how prevalent ROP is in Zimbabwe, as it is a low income country⁶, with urbanised areas capable of looking after VLBW preterm neonates.

Economies are defined based on gross national income (GNI) per capita. The following table shows the GNI for high, middle and low income countries.

Table 1: GNI per capita for high, middle and low income countries.⁷

| Economy | Gross National Income Per Capita |
|---------------------|---|
| High Income | >\$12 276 |
| Upper Middle Income | \$3,976 to \$12,275 |
| Low Middle Income | \$1006 to \$3975 |
| Low Income | <\$1005 |

Table 2 taken from the Bulletin of the WHO 2012, shows the order of prevalence of the top four conditions causing avoidable severe visual impairment and blindness in children, by level of socioeconomic development.

Table 2: The Top Four Conditions Causing Avoidable Visual Impairment in Children, by Socioeconomic Development.²

| High Income | Middle Income | Low-Income |
|--------------------|----------------------|-------------------|
| | | |
| ROP | Cataract | Corneal scarring |
| Teratogens | ROP | Cataract |
| Cataract | Glaucoma | Glaucoma |
| Glaucoma | Teratogens | Optic Atrophy |
| | | |

One of the specific disease control measures for vision 2020, is to ensure that all babies at risk of ROP have a fundus examination 6-7 weeks after birth, and that appropriate treatment should be provided for all those with threshold disease.²

2.0 LITERATURE REVIEW

2.1 Background and Pathophysiology

ROP is a proliferative retinopathy¹ which was first described in 1942 by Terry, who referred to the disease as retrolental fibroplasia⁸. He proposed many different etiologies. With time, several researchers presented retrospective and prospective studies that provided evidence that implicated oxygen as a causative factor⁹.

Diligent oxygen monitoring is very crucial. Even so, ROP will still occur, which supports the fact that prematurity itself and its associated low birth weight, contributes greatly to the pathogenesis of ROP¹⁰.

The pathophysiology of ROP is as follows; the retina does not have blood vessels until the fourth month of gestation. This is when the retinal vessels begin to extend towards the periphery. At 8 months gestation, these vessels reach the nasal periphery of the retina. In term neonates, the retinal blood vessels will only reach the periphery on the temporal side 1 month post-delivery. In preterm babies this peripheral temporal vascularisation takes much longer. This incompletely vascularised retina is especially liable to damage by supplementary oxygen in preterm neonates.¹

The neonate will initially experience hyperoxia due to postnatal oxygen administration, causing retinal vasoconstriction. The retinal vasculature stops growing and vascular endothelial growth factor (VEGF) will decrease. The peripheral maturing retina then becomes hypoxic, due to lack of perfusion, and VEGF increases causing neovascularisation¹¹. This is the Aston and Patz theory.

Kretzer and Hittner put forward a spindle cell theory. They believed that normal blood vessels form in utero in hypoxic conditions by canalization and endothelial cell differentiation. This occurs behind a sheet of migrating spindle cells. When the neonate is exposed to high oxygen concentrations it causes gap junctions to form between the spindle cells which subsequently interferes with the migration and canalization of blood vessels. The spindle cells then secrete angiogenic factors causing neovascularisation.¹²

2.2 Risk Factors

The risk factors for the development of ROP are notably very low birth weight (<1500g), low gestational age (GA) (<32 weeks) and duration of oxygen supplementation¹³.

Several studies have associated ROP with the following: blood culture positive neonatal sepsis, multiple blood transfusions¹⁴, artificial ventilation for more than 7 days, surfactant therapy, phototherapy for neonatal jaundice and maternal pre-eclampsia¹⁵. Neonates that have had frequent episodes of apnoea with mask and bag ventilation are also at a higher risk of developing ROP¹⁶. Hyaline membrane disease, intraventricular haemorrhage, prenatal betamethasone for lung maturation¹⁷, patent ductus arteriosus¹⁸, necrotising enterocolitis and the administration of postnatal glucocorticoids have also been identified as risk factors.¹⁹

A study done by Garg et al implicated hyperglycaemia as a risk factor, but they also implied that they were not sure whether the hyperglycemia seen in the neonates was pathophysiologically related to the ROP, or whether it was a marker of other illnesses experienced by the neonate for example neonatal sepsis²⁰.

On the other hand feeding of breast milk has been documented as having a prophylactic role in the development of ROP. Hylander et al found that infants who were exclusively human milk fed were less likely to develop ROP compared to those who were exclusively formula fed²¹. A study by Hittner et al states that vitamin E is prophylactic in the development of ROP if it is commenced within the first few hours of life and continued until there is complete vascularization of the retina²². This study did mention that in infants born with an EGA of less than 27 weeks, ROP may still develop despite vitamin E supplementation²². Conversely a study done by Schaffer et al did not agree with this view and stated that they found no significant effect of vitamin E on ROP²³.

In a study done by Monos et al with multiracial participants in the US, they found that babies with dark fundi had half the chance of developing ROP compared to patients with light or medium fundi. They speculated that

more melanin in the retinal pigment epithelium and choroid provided a protective role from developing ROP²⁴.

2.3 Staging

According to The International Classification of Retinopathy of Prematurity (ICROP), the Stages of ROP are as follows²⁵:

Stage 1 = demarcation line between normal and avascular retina.

Stage 2 = elevated ridge between normal and avascular retina.

Stage 3 = extraretinal fibrovascular proliferation on the ridge.

Stage 4a = tractional retinal detachment due to contraction of extraretinal fibrovascular proliferation, sparing the fovea

Stage 4b = tractional retinal detachment involving the fovea

Stage 5 = the detachment is funnel-shaped and described as open or closed anteriorly, and open or closed posteriorly.

To define location, the retina was divided into three zones with the optic disc as the centre, since retinal vascular growth proceeds from the disc towards the ora serrata²⁵.

The following figure shows the three zones used to describe the location of ROP.

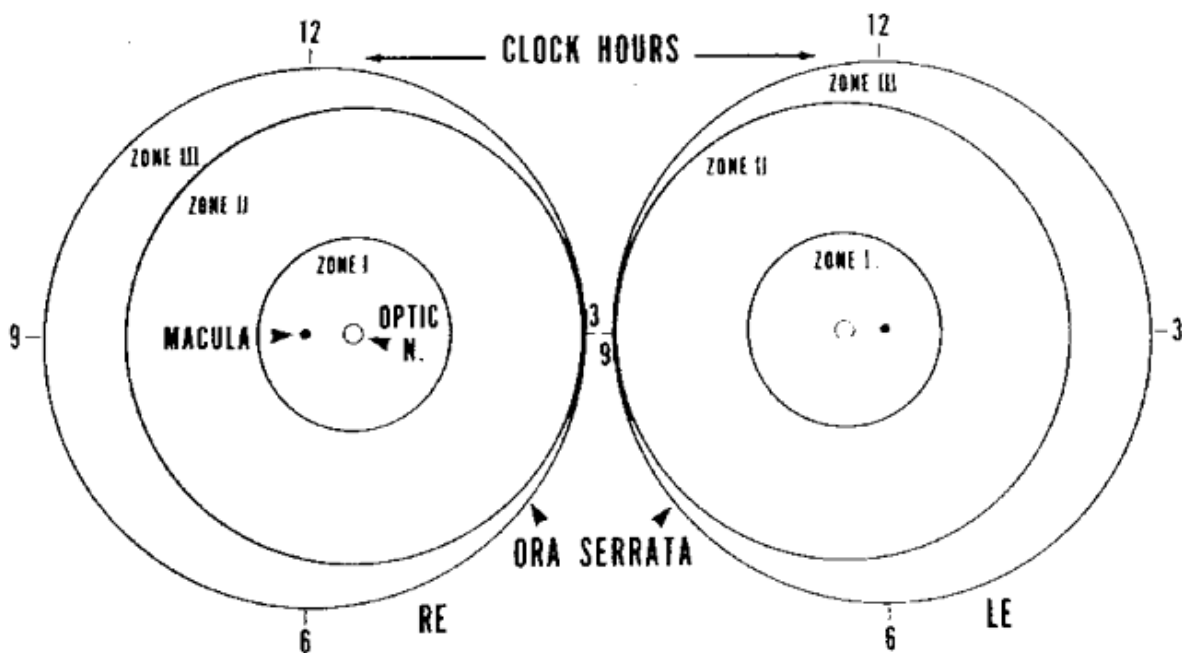


Figure 1: Defining The Location of ROP ⁽⁴⁾

Zone I consists of a circle, the radius of which extends from the disc, to twice the distance from the disc to the centre of the macula (twice the disc-fovea distance in all directions from the optic disc)²⁵.

Zone II extends from the edge of zone I peripherally, to a point tangential to the nasal ora serrata and around to an area near the temporal anatomic equator.²⁵

Zone III is the residual temporal crescent of retina anterior to zone II. This is the zone that is vascularized last in the premature eye, and it is the zone most frequently involved with ROP.²⁵

The extent of disease is specified as clock hours¹.

When the vessels are enlarged and tortuous in at least two quadrants, a plus sign is added to the ROP stage number.¹

The definition of threshold ROP (tROP) varies. In the multicentre trial of cryotherapy for ROP, (CRYO-ROP) study, done in the US, it was defined as the severity of ROP for which there was an equal chance of spontaneous regression or progression to an unfavourable outcome. That is the risk of blindness at threshold was predicted to be 50%. It was defined as at least five contiguous or eight cumulative 30-degree sectors (clock hours) of stage 3 ROP in zones I or II, in the presence of plus disease²⁶.

Although regression was not part of the classification, the committee recognizes that it is the most common outcome of ROP.

In the CRYO-ROP study the conclusion was that incidence and severity of ROP was higher in the VLBW and low gestational age categories. The average post conceptual age of onset was 37 weeks, with 95% of infants with ROP reaching threshold by 42 weeks.²⁶

2.4 Oxygen Delivery and Saturation

Oxygen delivery protocols have been set, in an effort to reduce the incidence of ROP. The South African (SA) guidelines recommend the following⁴;

- (1) Neonates receiving supplemental oxygen must have continuous pulse oximetry monitoring.
- (2) All babies receiving supplemental oxygen must be monitored with a pulse oximeter. Oxygen saturation should be recorded.
- (3) Humidified oxygen must be used.

Table 3 shows ideal oxygen partial pressure (PaO₂) and SaO₂ ranges according to the South African guidelines.

Table 3: Partial Pressure of Oxygen and SaO₂ Guidelines for Preterm Neonates Receiving Supplementary Oxygen⁴

| Infants | PaO ₂ (kPa) | Saturation Range | Alarm Limits |
|-------------------|------------------------|------------------|--------------|
| Preterm <36 weeks | 6.5-9.0 | 88-92% | 84-94% |

(iii) Nasal prong oxygen delivery: flow rate should be 0.5 - 1 l/min. Oxygen should be administered with a blender.⁴

(iv) Head box oxygen delivery: flow rate should be 2 - 3 l/kg/min. Head box oxygen is not recommended, but if it is used, SaO₂ of oxygen must be monitored⁴.

(v) For pulse oximetry, the upper alarm should never be set at 100% when babies are receiving oxygen⁴.

(vi) Oxygen saturation >93 - 95% in preterm infants must be avoided⁴.

Neonatal units in England identified 4 oxygen policies in neonates according to SaO₂ limits that were set at: (i) 70 - 90%; (ii) 84 - 94%; (iii) 85 - 95%; and (iv) 88 - 98%. Cryotherapy for tROP was indicated four times more often in the high SaO₂ group (88 - 98%)²⁷. This was confirmed in a study done by Anderson et al which found that babies nursed in an oxygen saturation >92% had more severe ROP than those nursed in oxygen saturations <93%.²⁸

In the Surfactant, Positive pressure and Oxygenation Randomized Trial (SUPPORT), also done in England, a target SaO₂ range of 85 - 89%, compared with 91- 95% increased mortality while significantly lowering the incidence of severe ROP among survivors in the higher saturation group. It follows that it is very important to exercise caution in levels of SaO₂ in the low range for preterm infants, as it may lead to increased mortality^{29,30}.

Many centres therefore aim for saturations of 88 - 92% and fluctuations with peaks in SaO₂ should be avoided⁴.

2.5 Screening Guidelines

Screening Guidelines have been made in several countries, for example by The American Academy of Paediatrics in the US, The British Royal College of Ophthalmologists in the United Kingdom (UK) and The ROP Working Group in SA. Table 4 compares the South African, British and American ROP Screening Guidelines.

Table 4: Comparison of the South African, British and American ROP Screening Guidelines^{4,31,32.}

| | <u>Who to screen?</u> |
|-------------------------|--|
| SA ⁴ | <ol style="list-style-type: none"> 1. All infants < 32 weeks GA. 2. All preterm infants with a birth weight (BWT) < 1500g. 3. Infants that weigh 1500-2000g with a history of multiple transfusions, cardiac arrest, severe hypoxic ischaemic encephalopathy or a family history of ROP, can be considered if oxygen monitoring has been sub-optimal. |
| UK ³¹ | <ol style="list-style-type: none"> 1. All infants < 32 weeks GA. 2. All preterm infants with a BWT < 1501g. |
| US ³² | <ol style="list-style-type: none"> 1. All infants 30 weeks GA or less. 2. All infants with a BWT of 1500g or less. 3. All infants with a BWT 1500-2000g or GA >30 weeks with an unstable clinical course including the need for cardiorespiratory support. |
| | <u>When to screen?</u> |
| SA ⁴ | <ol style="list-style-type: none"> 1. 4-6 weeks chronological age. 2. 31-33 weeks post conceptional age. <p>If GA is accurate then for neonates <28 weeks post conceptional age, screening should commence at 6 weeks after birth.</p> <p>Neonates >28 weeks post conceptional age at birth screening should commence at 4 weeks after birth.</p> |
| UK ³¹ | <ol style="list-style-type: none"> 1. If the infant is born at <27 weeks GA, screening should start at 30-31 weeks post menstrual age. 2. If the infant is born at 27-32 weeks or >32 weeks GA but weighs <1501g, screening should commence at 4-5 weeks post natal age. |
| US ³² | <p>If the infant is born at 27-32 weeks gestation, first examination is done at 4 weeks chronological age.</p> <p>If the infant is born at 26 weeks GA, the first examination is done at 5 weeks chronological age</p> <p>If the infant is born at 25 weeks GA, the first examination is done at 6 weeks chronological age.</p> |

Screening is commenced at 4-6 weeks and not earlier because 90% of ROP occurs between 34-42 weeks gestational age. There are also challenges with examining an infant before this period such as poor pupil dilation and vitreous haze. There is also

a higher chance that the infant will experience the side effects of the dilating drops such as cardiorespiratory problems. The child is also more likely to have apnoea or oculocardiac reflex during the examination before 4-6 weeks chronological age¹².

2.6 ROP in Africa

There are few studies that have been done on the incidence of ROP in Sub Saharan Africa. In these studies the incidence of ROP ranges from 15% to 47%.

In a study done by Delpont et al. at Kalafong Hospital Pretoria, 94 preterm babies with a BWT <1500g were screened over 10 months. ROP was diagnosed in 23(24.5%) infants. The incidence of tROP was 4.3% and correlated with published data from the US³³. All the participants in this study were black.

At Chris Hani Baragwanath Hospital in Johannesburg, a study was conducted by I Mayet and C Cockinos where 514 infants were screened over a two and a half year period. ROP was seen in 16.3% and threshold ROP in 1.6%⁵. They were unable to compare the incidence and severity in different racial groups because few babies with light coloured fundi took part in the study. The results from this study support conclusions from other studies that had a majority of black infants, for example the CRYO-ROP study, where they found a low incidence of ROP and advanced pathology, in black infants²⁶.

In Port Harcourt Nigeria, a study was done by Adio et al where 53 babies were examined over a 10 month period and 25 (47.2%) were diagnosed with ROP. This is notably a high prevalence. After follow up they found that 24/25 infants had regressed spontaneously. The one infant who developed sight threatening ROP died one week after the initial examination.³⁴

A much lower prevalence was found in Lagos Nigeria, in a study done by Fajolu et al. Of the 80 infants examined in the study from November 2011 to May 2014, 12 (15%) infants had ROP³⁵. Six (7.5%) had tROP. This study mentioned that most of the infants diagnosed with ROP were lost during follow up. The reason cited was that the parents did not realise the risk of blindness, specifically because the eyes looked normal. Ten out of the 12 infants with ROP were lost to follow up³⁵.

2.7 Treatment

Treatment is indicated when there is threshold disease. The definition of threshold disease varies with the different clinical trials. The definition given by the CRYO-ROP study has been mentioned in the literature review²⁶.

Indications for treatment according to the Early Treatment of ROP Trial (ETROP Trial) are for Type 1 ROP which was defined as follows:²⁹

Zone 1: any stage with plus disease;

Zone 1: stage 3 without plus disease;

Zone 2: stage 2 or 3 with plus disease.

Infants with Type 2 ROP are to be monitored more closely and treatment commenced if progression to Type 1 status occurs. Type 2 ROP was defined as:

Zone I: stage 1 or 2 with no plus disease or

Zone II: stage 3 with no plus disease

The time frame for treatment commencement according to the CRYO-ROP study is 72 hours²⁶, and 48 hours according to the ETROP Trial.²⁹

Treatment options currently include retinal ablation in the form of laser photocoagulation using argon or diode laser and intra-vitreous anti-VEGF agents¹. Laser photocoagulation replaced trans scleral cryotherapy because the visual outcomes were better with laser.¹

To compare the use of laser photocoagulation and anti-VEGF's for Stage 3+ ROP, a study was done called Bevacizumab Eliminates the Angiogenic Threat of Retinopathy of Prematurity trial, (BEAT-ROP Trial). It was carried out by the BEAT-ROP cooperative group. They found that ROP recurred in 4 infants that had received Bevacizumab and in 19 infants who had received laser. The benefit of treatment was more significant in Zone 1, than in Zone 2 disease.³⁶

It has also been noted that with Bevacizumab, although ROP is suppressed, there is delayed complete retinal neovascularisation. It follows that the infant would need prolonged follow up.³⁷

There still remains a lot of controversy on the safety of using Bevacizumab in treating ROP. It is known that VEGF is essential for developing brain, lungs and kidneys. The effect of the anti-VEGF's on these organs is not well studied. There also exists a lot of variability in how the anti-VEGF's are used. Further randomized control trials are needed, with a definite need to investigate the side effects of this therapy.

Surgical intervention for retinal detachment is controversial and based on the surgeons experience and expertise. A scleral buckle and lens sparing vitrectomy are recommended for partial detachments³⁸. In a study done by Yu et al in Korea, it was found that a lens sparing vitrectomy had motivating outcomes in correcting stage 4 ROP. Outcomes were poor when vitrectomy was performed for Stage 5 disease.³⁸

JUSTIFICATION

1. ROP is one of the causes of avoidable blindness². Knowing the prevalence of this disease in our neonatal units, would clarify the degree of the problem in our own setting. This may be a step forward in achieving one of the objectives of the Zimbabwe National Eye Health Strategy which is to reduce the prevalence of childhood blindness in Zimbabwe from 7/10 000 to 3/10 000 by 2018³⁹.
2. This study looked at the current oxygen delivery protocols in our neonatal units, and specifically looked at whether they meet the standards of recommended protocols.
3. This study provides a baseline for future comparison.

PROBLEM STATEMENT

The magnitude of ROP in very low birth weight babies (<1500g) in our neonatal units is not known.

HYPOTHESIS

In a population of preterm babies defined by an EGA <32 weeks and/or a BWT<1500g born at Parirenyatwa Group of Hospital's Neonatal Intensive Care Unit (PGH NICU) and Harare Central Hospital Neonatal Unit (HCH NNU), 20% will have ROP.

OBJECTIVES

Main:

1. To establish the prevalence of ROP at PGH NICU and HCH NNU at 4-6 weeks chronological age.

Sub-objectives:

1. To assess the prevalence of ROP requiring treatment and ROP not requiring treatment at 4-6 weeks chronological age.

2. To establish the risk factors associated with ROP as well as the ocular features of ROP in our neonatal units.

3. To assess the current oxygen delivery protocols for VLBW preterm babies in our neonatal units.

3.0 METHODOLOGY

3.1 STUDY DESIGN

A hospital based cross-sectional analytical study was done on very low birth weight infants (<1500g) who had been exposed to oxygen, and were between 4-6 weeks chronological age. The study was carried out over a 9 month period, from April 2015 to January 2016 at PGH NICU, and over a 4 month period from October 2015 to January 2016 at HCH NNU.

3.2 STUDY SETTING

PGH NICU and HCH NNU, which are the only two government neonatal units in Harare.

3.3 STUDY POPULATION

All infants born at <32 weeks gestational age or preterm infants with a birth weight <1500 g, born within the period of the study.

Inclusion Criteria:

Preterm babies at 4-6 weeks chronological age who meet the following criteria in PGH NICU or HCH NNU:

1. All neonates born <32 weeks gestation.

AND/OR

2. All preterm neonates weighing <1500g.

Exclusion Criteria:

1. Any fatal systemic disease.
2. Unilateral or bilateral retinal or choroidal disease (other than ROP).
3. A media opacity obstructing the fundal view (e.g. cataract).
4. Infants who were still highly dependent on oxygen and could not be removed from the incubator for examination

5. Refusal of initial consent by the parent/guardian.

3.4 SAMPLE SIZE

Calculation of the sample size was based on the Dobson formula. The proportion of children with ROP was based on a study done in Johannesburg by I Mayet and C Cockinos⁵.

$$n = \frac{p(1-p)Z^2}{d^2}$$

Where:

n= sample size

p= population proportion = 0.16

Z= at CI 95% (1.96)

d=precision (level of significance) of 5%

Thus $n = \frac{0.16(1-0.16)(1.96)^2}{0.05^2} = 217$

The minimum sample size required was 217.

3.5 STUDY TOOLS

1. Data collection sheets.
2. Questionnaire for medical personnel working in PGH NICU and HCH NNU.
3. A Binocular Indirect Ophthalmoscope.
4. A 20 dioptre lens.
5. Topical anaesthetic drops – Benoxinate 0.4%
6. Dilating drops – Cyclopentolate 0.5% with phenylephrine 2.5%
7. Infant wire Speculum
8. Scleral Depressor
9. Methylated spirit

The data collection sheets that were developed for this study contained three sections. The first section was used to collect infant and maternal demographic data on the day of enrolment into the study. (See Appendix 1)

The second section was used to collect information about the duration of oxygen the infant was exposed to, as well as the mode of delivery; whether by nasal prongs, head box or face mask. This section was also used to collect data about potential risk factors that the baby was or was not exposed to.

The third section was used to record examination findings.

3.6 PROCEDURE

1. Screening of Babies for Enrolment

- During the period of the study, the researcher with the help of an ophthalmic nurse went weekly to the neonatal units to screen all the babies in the wards. This was to find neonates who met the study inclusion criteria. PGH NICU was screened every Monday and HCH NNU every Thursday. After consent was obtained, all babies that fulfilled the inclusion criteria (BWT < 1500g or GA < 32 weeks) were enrolled into the study by convenience sampling.
- The ophthalmic nurse was trained on how to screen for ROP and to assist in the data collection before the study commenced.

2. Enrolment into the Study

- A yellow sticker was attached onto the notes for easy identification of all enrolled babies.
- The enrolment form (section 1 of the data collection sheet) was completed by the researcher. (See Appendix 1)
- Each baby was booked for an examination at a later date. This date was noted on the enrolment form as well as in the researcher's diary.
- Each baby would be booked for an examination at either the 4th, 5th or 6th week chronological age⁴.

3. Examination

- The examinations were carried out weekly by the researcher, on Fridays at PGH NNU and on Wednesdays at HCH NNU, with the assistance of an ophthalmic nurse.
- On the day of the examination all mothers of the babies for examination were informed of the time for the examination in the morning, so that they could be present.

- Before instilling dilating drops the babies were pre-treated with Benoxinate 0.4% to minimize discomfort. After this 1 drop of cyclopentolate 0.5% with phenylephrine 2.5% was instilled into each eye followed by punctal occlusion for 1 minute to minimize systemic absorption⁴. This was repeated every 15-20mins until the pupils were fully dilated. A maximum of 3 doses was given in each eye⁴⁰.
- Once the pupils were fully dilated, the baby was wrapped in warm linen and taken to the nearby resuscitation room with the mother for examination, or was examined in the ward if this was not possible.
- Another drop of 0.4% Benoxinate was instilled into the both eyes 20-30 seconds before inserting the paediatric wire speculum. Anterior segment examinations were done using the hand held slit lamp.
- Posterior segment examinations were done using the indirect ophthalmoscope, 20 dioptre lens and the scleral depressor when necessary.
- Consultations for examinations were done with an ophthalmology Senior Registrar.
- All findings would be noted on section 3 of the data collection sheets.
- On completing the examination of each eye, the paediatric wire speculum would be sterilised in methylated spirit.
- The medical personnel in the neonatal units and the mother were informed to monitor for signs of systemic absorption such as restlessness, tachycardia, fever and apnoea for up to 12 hours after the examination.

4. Noting of Oxygen Supplementation and Potential Risk Factors

- After all the babies for a given day had been examined, the researcher with the help of an ophthalmic nurse, went through the notes and records of all the examined babies, noting all details pertaining to oxygen delivery and potential risk factors.
- The maternal variables that were reviewed were age, whether antenatal steroids administered to mother or not, and whether or not the mother was diagnosed with pre-eclampsia.
- Perinatal-neonatal variables that were reviewed were; BWT, EGA, Apgar 1 and 2 scores, gender, multiple birth or singleton, delivery mode and duration of oxygen supplementation as well as flow rate. Whether or not the infant had mechanical ventilation and the type. Whether or not the infant experienced severe apnoea and had mask and bag ventilation. We also reviewed whether or not the infant was clinically diagnosed with any of the following diseases; hyaline membrane disease, neonatal sepsis, necrotising enterocolitis and patent ductus arteriosus. It was also noted whether or not the infant had any

of the following; multiple transfusions, phototherapy for neonatal jaundice, surfactant therapy, administration of postnatal steroids and hyperglycemia.

- This information was filled onto section 2 of the data collection sheet.

5.Follow Up

- All infants diagnosed with ROP were referred to the Sekuru Kaguvi Eye Unit ROP screening team after the examination, and followed up according to the suggested schedule based on the retinal findings, according to the ICROP.

1 week or less follow-up

- Stage 1 or 2 ROP in zone I
- Stage 3 ROP in zone II
- 1 - 2 weeks follow-up
- Immature vascularisation in zone I (no ROP)
- Stage 2 ROP in zone II
- Regressing ROP in zone I
- 2 weeks follow-up
- Stage 1 ROP in zone II
- Regressing ROP in zone II
- 2 - 3 weeks follow-up
- Immature vascularisation in zone II (no ROP)
- Stage 1 or 2 ROP in zone III
- Regressing ROP in zone III.

Questionnaire for Medical Personnel

The questionnaire for medical personnel at both neonatal units contained three questions. This questionnaire assessed the medical personnel's knowledge regarding the oxygen delivery protocol in their unit, as well as monitoring of oxygen saturation in preterm infants. The reliability of this questionnaire was

validated by pre testing it on 20 medical personnel. The necessary corrections were made before it was used in the final study.

The questionnaire was given to medical personnel in the neonatal unit by the ophthalmic nurse. The personnel were at different levels of training ranging from student nurse to senior registrar. It was completed anonymously.

DATA MANAGEMENT AND ANALYSIS

A database was created in Microsoft Excel was transferred to Stata 12.0 for analysis.

ETHICAL APPROVAL

Ethical approval to carry out the study was obtained from the Clinical directors and the Joint Research and Ethics Committees (JREC) of Parirenyatwa and Harare Central Hospitals.

4.0 RESULTS

A total of 141 premature babies were enrolled into the study. Sixty four (45.4%) of them were enrolled from HCH NNU , and 77(54.6%) from PGH NICU. Out of all the neonates, eighteen (12.8%) were from multiple births and 123 (87.2%) were singleton births. Eighty (56.7%) were females. The median birth weight was 1 190 g (range: 500 – 1 760 g) and the mean gestational age at birth was 29.5(SD±2.6) weeks, (range 23 – 35 weeks).

The mean Apgar scores were 6.6 ± 1.6 and 7.9 ± 1.6 at 1 minute and 5 minutes of birth respectively. A total of 121(85.8%) neonates were examined for ROP. Age at examination was between 4 and 6 weeks (chronological age). Ninety seven (68.8%) were delivered vaginally while 44(31.2%) were by caesarean section.

4.1 Prevalence of ROP

Although 141 infants were enrolled, 20 died before they could be examined for ROP between 4 and 6 weeks chronological age. The mean BWT for these infants was 820 grams with a range from 500-1130 grams.

Of the 121 babies who were examined, 6(5.0%); (95% Confidence Interval (CI): 1.2 – 9.4%) were noted to have bilateral ROP. Stages 1 and 2 were present in the 6 infants. All 6 infants had spontaneous resolution.

Table 5 below shows the difference in proportions of characteristics between those diagnosed with ROP versus those who did not have ROP. Six infants had ROP, 115 did not as shown in the table below.

Table 5: Comparison of Characteristics Between Those with ROP and Those Without

| Characteristic | With ROP | No ROP | p - value |
|--|------------------|-------------------|-----------|
| | n = 6 | n = 115 | |
| Median birth weight, grams (IQR) | 1000(990 - 1050) | 1210(1100 - 1390) | 0.013 |
| Weight categories (grams), n(%) | | | |
| 600 – 1100 | 5 | 32 | 0.010 |
| 1101 - 1800 | 1 | 83 | |
| Gender, n(%) | | | |
| Male | 3 | 47 | 0.690 |
| Female | 3 | 68 | |
| Mean gestational age, weeks. (IQR) | 27.3(25 - 30) | 29.9(24 - 35) | 0.011 |
| Hospital, n(%) | | | |
| Harare | 1(16.7) | 48(41.7) | 0.399 |
| Parirenyatwa | 5(83.3) | 67(58.3) | |
| Delivery Mode, n(%) | | | |
| Normal Vaginal Delivery | 4(66.7) | 81(70.4) | 1.000 |
| Caesarean Section | 2(33.3) | 34(29.6) | |
| Mean Apgar1, (IQR) | 5.3(4 - 8) | 7.0(6 - 9) | 0.003 |
| Mean Apgar2, (IQR) | 7.0(6 - 8) | 8.2(6 - 10) | 0.012 |
| Mean maternal age, years. | 22.3 | 26.1 | 0.05 |

The proportion of infants with ROP was significantly higher in those with lower birth weight of 1100 g or less (5/6(83.3%), p=0.010).

4.2 Ocular Features

Anterior Segment

All the anterior segment examinations were normal.

Posterior Segment

All 6 babies diagnosed with ROP had bilateral disease. Three out of 6 (50.0%) had stage 1 no plus disease and 3/6 (50.0%) had stage 2 no plus disease. Five out of

6 (83.3%) neonates had disease in zone 3 and 1 (16.7%) had disease in zone 2. Table 2 below shows the staging of ROP seen in the diagnosed infants and the posterior segment zones involved.

Table 6: Staging of ROP and involved Zones

| Zones | Stage1 n(%) | Stage2 n(%) | Stage 3 | Stage 4 | Stage 5 | Total |
|--------------|----------------|----------------|---------|---------|---------|----------|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 1(16.7%) | 0 | 0 | 0 | 0 | 1(16.7%) |
| 3 | 2(33.3%) | 3(50.0%) | 0 | 0 | 0 | 5(83.3%) |
| Total | 3(50.0%) | 3(50.0%) | 0 | 0 | 0 | 6 |

Five out of 6 (83.3%) of the infants with ROP had disease localised in Zone 3, one (16.7%) had disease in Zone 2 and no babies were diagnosed with disease in Zone 1.

None of the babies examined had severe disease (stage 4 or 5) and none were diagnosed with tROP. Therefore, the prevalence of ROP that did not require treatment was 100%, and the prevalence of ROP requiring treatment was 0% at 4-6 weeks chronological age.

4.3 Risk factors associated with ROP in this Study

The risk factors associated with ROP in this study were low birth weight <1100g, a low gestational age <30 weeks and prolonged supplementary oxygen for more than 2 weeks.

The following chart shows the percentages of infants with ROP according to gestational age categories. Four out of the six infants with ROP, were in the 24-28 weeks GA category.

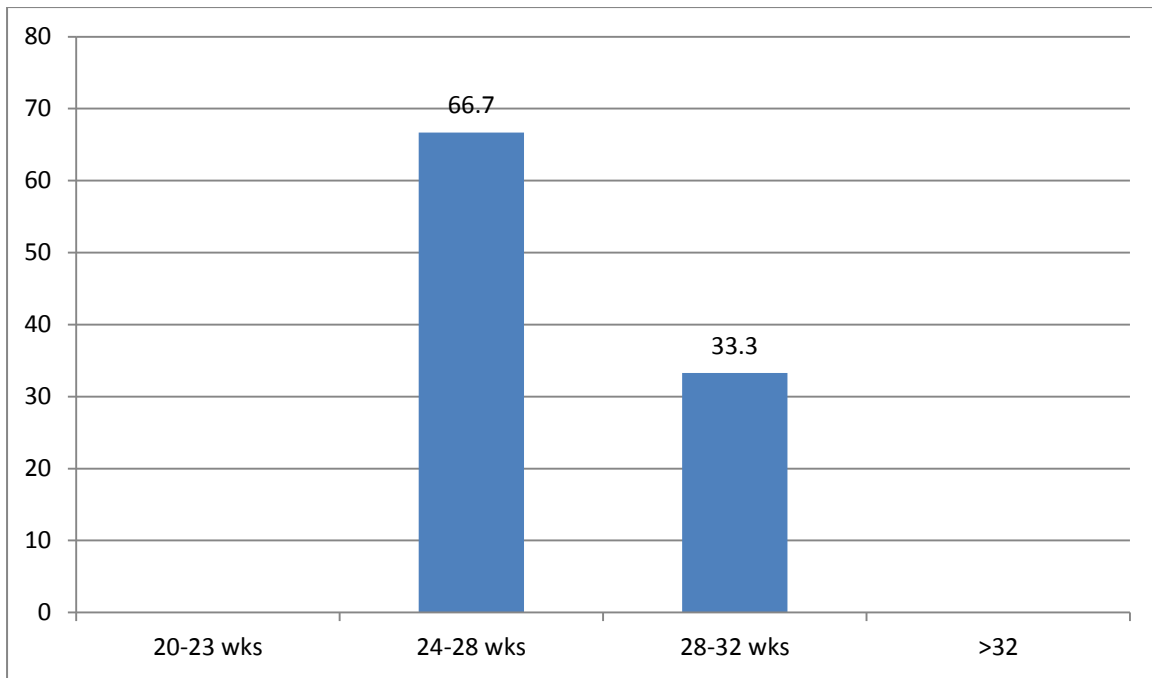


Figure 2: Percentages of Infants with ROP According to Gestational Age

The following chart shows the percentages of infants with ROP according to birth weight categories. Five out of six infants with ROP were in the 1000-1249g category.

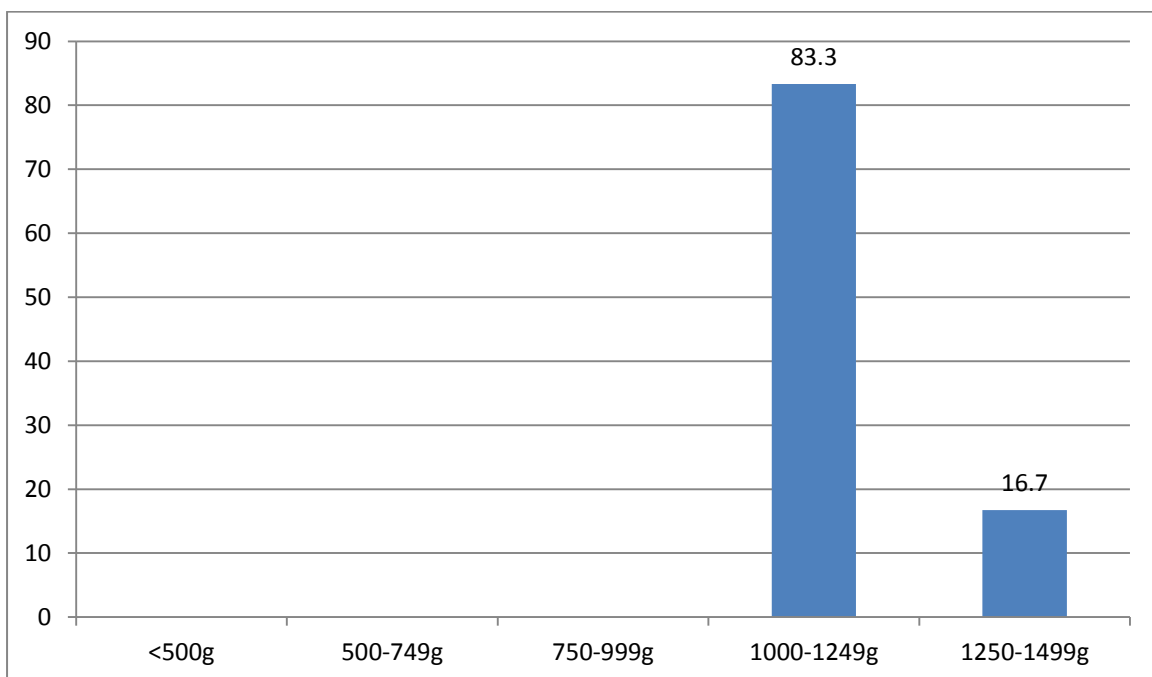


Figure 3: Percentages of Infants with ROP According to Birth Weight

The risk factors associated with ROP in this study were evaluated using multiple logistic regression models. Table 7 shows the risk factors that were associated with ROP in our study when controlled for other factors.

Table 7: Risk factors associated with ROP

| Risk Factor | Univariate | | | Multivariate | | |
|-------------------------------|------------|-------------|---------|--------------|-------------|---------|
| | OR | 95% CI | p-value | OR | 95% CI | p-value |
| Oxygen Exposure, (wks) | | | | | | |
| > 2 | 23.8 | 2.6 – 214.5 | 0.01 | 13.0 | 1.2 – 147.7 | 0.04 |
| ≤ 2 | 1 | | | | | |
| Gestational Age, (wks) | | | | | | |
| < 30 | 8.7 | 1.1 – 76.9 | 0.01 | 12.7 | 1.1 – 160.1 | 0.05 |
| ≥ 30 | 1 | | | | | |
| Birth Weight, (grams) | | | | | | |
| < 1100 | 23.6 | 2.6 – 214.5 | 0.01 | 23.9 | 2.0 – 285.3 | 0.01 |
| ≥ 1100 | 1 | | | | | |

Neonates with a GA less than 30 weeks were 12.7 times more at risk of developing ROP [95% CI: 1.1 – 160.1, p=0.05], compared to those with GA ≥ 30 weeks.

Infants with a birth weight of ≤ 1100 g had a significantly increased risk of developing ROP, [OR=23.6; 95% CI: 2.0 – 285.3, p=0.01] compared to those with higher birth weight.

Very low birth weight neonates exposed to supplementary oxygen (>2weeks) were 13 times more at risk of developing ROP [95% CI: 1.2 – 147.7, p=0.04].

4.4 Current Oxygen Delivery Protocol

The questionnaire for medical personal (See Appendix 2) was filled out by 40 participants. The results from the analysis of the responses showed that 12/40 (30%) of the personnel, stated that they were not aware of any oxygen delivery protocol from the time they started working in the unit.

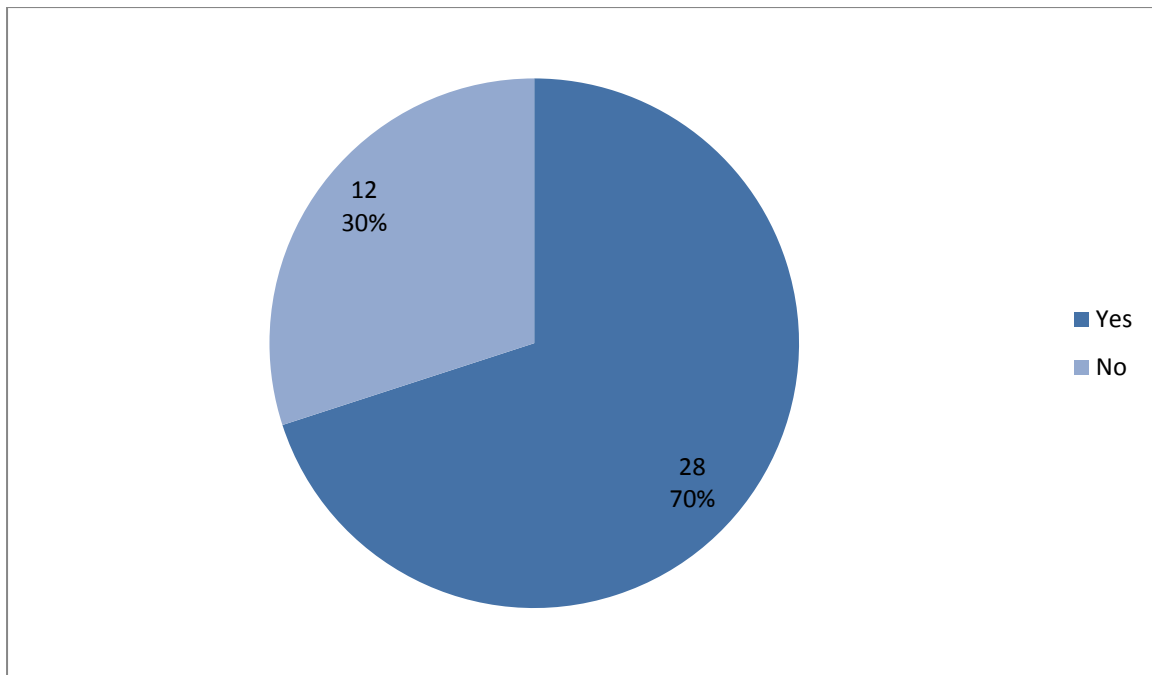


Figure 4: Were You Made Aware of an Oxygen Delivery protocol?

Of the 12, 8/12 (66.7%) were Junior Doctors (Senior Resident Medical Officers) who were rotating through the units. All the Junior Doctors who filled out the questionnaire stated that they were not aware of an oxygen delivery protocol for very low birth weight babies.

Based on these findings it would be of benefit to ensure that all new Junior Doctors working in the neonatal units, have a session with a more senior doctor, where they are informed about the oxygen delivery protocol for VLBW neonates as it can affect the neonate in terms of ROP.

The other personnel who stated that they were not aware of the protocol were Senior House Officers, 2/12 (16.7%) and 2 student nurses 2/12 (16.7%). All Registered Nurses, Midwives and Registrar's who completed the questionnaire, stated that they were made aware of an oxygen delivery protocol in VLBW infants.

When the medical personnel were asked the reasons why they could not constantly monitor the SaO₂ the reasons mentioned were, insufficient pulse oximeters and a shortage of nursing staff.

The last question on the questionnaire asked the medical personnel which SaO₂ range they aim to maintain in preterm babies with an EGA < 36 weeks. Three

options were given; 88-92%, 90-95% and 95-100%. The following figure shows the participants responses.

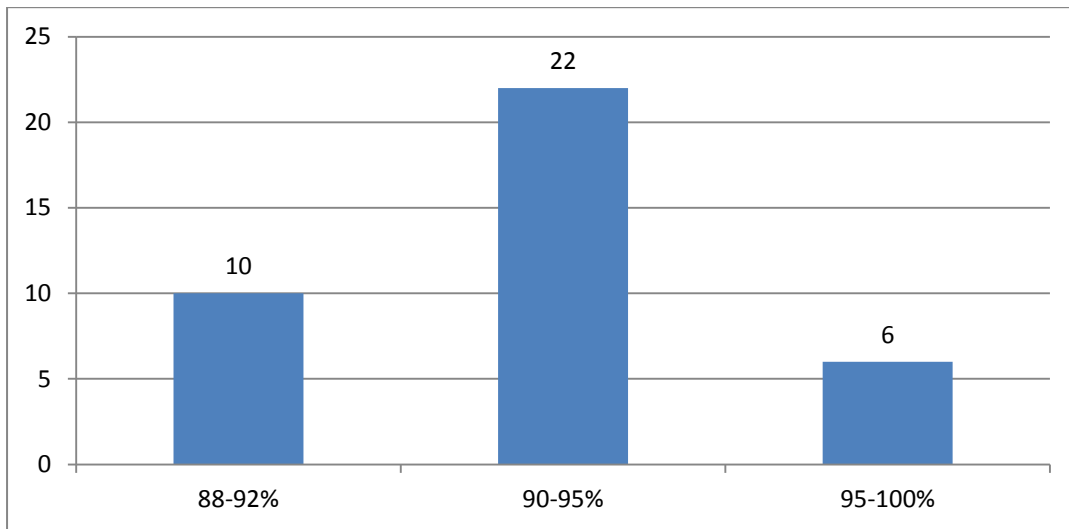


Figure 5: SaO2 Ranges All Medical Personnel Aim to Maintain

More than half of the personnel 22/40 (55%) said they aim to maintain SaO2 at 90-95%, 10/40 (25%) aim to maintain at 88-92% and 6/40 (15%) aim for 95-100%.

It is clear from these findings that the SaO2 range that personnel aim to maintain differs.

Although 70% (28/40) of the personnel stated that they were informed about an oxygen delivery protocol, the range at which they aim to maintain the SaO2 differs as well. The following figure shows the responses of the informed personnel.

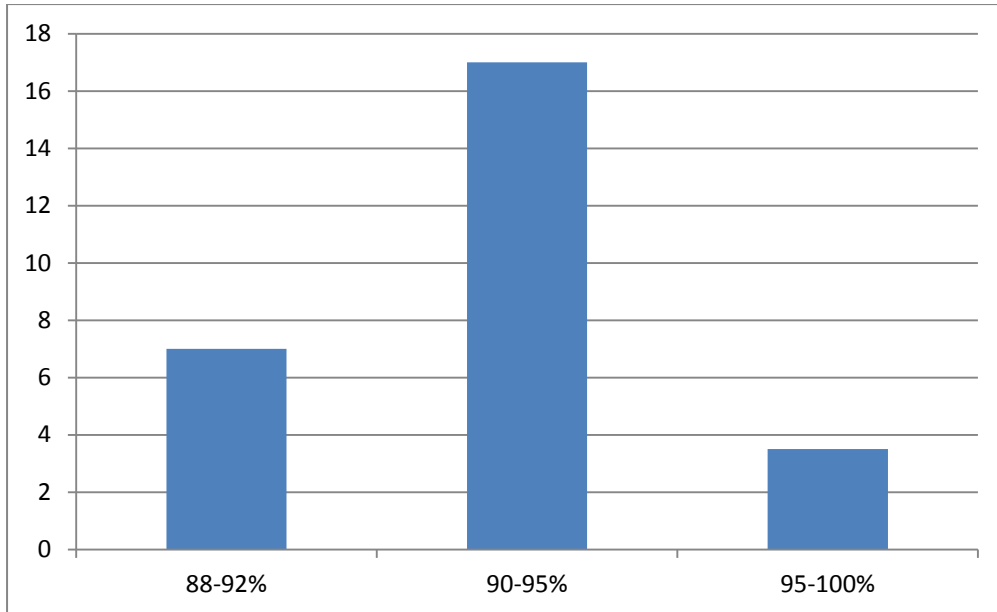


Figure 6: SaO2 Ranges Personnel Informed of a Protocol Aim to Maintain

When analysing the responses of the informed personnel, 17/28 (60.7%) aim to maintain at 90-95%, 4/28 (14.3%) aim to maintain at 95-100% and 7/28 (25%) aim to maintain at 88-92%.

According to the SA guidelines infants <36 weeks EGA should avoid being maintained at SaO2 ranges above 93%⁴. In this study 21/28 (75.0%) of the informed personnel aim to maintain in either the 90-95% range or the 95-100% range. This may be so because of a concern of increasing the mortality rate at the lower SaO2 ranges.

4.5 DISCUSSION

Assessment of Data

This study assessed the prevalence of ROP at 4-6 weeks chronological age, at the two government neonatal units in Harare. ROP has been diagnosed at SKH but the magnitude of this disease in our neonatal units was not known. To the author's knowledge there are no published studies that have investigated the prevalence or incidence of ROP in our neonatal units.

In view of the nature of the pathology of ROP, an incidence study would provide a clearer picture of the magnitude of this disease in our setting. ROP can occur in preterm babies as long as the temporal retina is not completely vascularised, as this avascular retina is prone to hypoxic damage¹.

4.5.1 Prevalence of ROP

The prevalence of ROP at 4-6 weeks chronological age according to this study is 5%; all diagnosed babies did not require treatment.

This is less than the 16.3% incidence found in a study done by I Mayet and C Cockinos at Chris Hani Baragwanath hospital in SA⁵. Contrary to our setting, this study did have neonates in the 800-1000g BWT category surviving, and some of these neonates developed ROP. A higher survival rate of VLBW neonates may account for the higher incidence of ROP in their study.

Fajolu et al in Lagos Nigeria, reported an incidence of 15.0% with 4.3% with tROP³⁵. This was similar to the incidence found by I Mayet and C Cockinos. Delport et al at Kalafong Hospital in Pretoria, reported a higher incidence of 24.5% with 4.3% requiring treatment³³.

In a study done by Hwang JH et al in Korea, the incidence of ROP was 34.1% and 11.5% of the infants required treatment¹⁸. This higher incidence may be due better survival of VLBW neonates as well as the racial profile of the participants in their study. In the study done by I Mayet and C Cockinos at Chris Hani Baragwanath hospital, the incidence was also significantly lower (16%)⁵ compared to the findings in Korea.

Most of the participants in the study at Chris Hani Baragwanath Hospital were black, which is similar to our setting and may explain the relatively low incidence. In the US, Monos et al found that neonates with dark fundi had half the chance of developing ROP²⁴.

Most of the studies that have been done on ROP are incidence studies. The incidence varies in different populations.

An incidence of 27.2% found in a study done by Lerman et al in Brazil⁴¹, Rasoulinejad and Montazeri in Iran did a study with an incidence of 45%⁴². Larsson et al reported an incidence of 36.4% in Sweden⁴³, the CRYO-ROP multicentre study done in the US found an incidence of 65.8%, while the Early treatment for Retinopathy of Prematurity Study reported a similar incidence of 68%⁴⁴. Darlow et al in New Zealand reported an incidence of 21.5%, Chaudhari et al in India found a higher incidence of 22.3%⁴⁵ and Shah et al in Singapore reported an incidence of 29.2% with 8% of the infants with tROP¹⁷.

The prevalence of 5% at 4-6 weeks chronological age is difficult to use to compare with the mentioned incidence studies, as it is difficult to predict what the incidence in our setting would be. Albeit a prevalence of 5% is relatively low. The twenty infants who died before they could be examined had very low birth weights (mean BWT of 820 grams). These infants may have developed ROP had they survived.

Infants who were in incubators and highly dependent on oxygen were also excluded from the study. These infants may also have developed ROP.

An incidence of 5% was found in Ibadan, southwest Nigeria in 1998, when the survival rates for VLBW infants was still low⁴⁶. This shows that a low survival rate of VLBW neonates translates to a low incidence of ROP.

The incidences reported in Africa (16.3% Johannesburg, 24.5% Pretoria and 15% Lagos) are lower than those found in the 1st world countries (Sweden 34.5%, the US 68%). This may support the notion by T Monos et al that pigmented fundi are less prone to developing ROP²⁴.

In Europe and in the US, they are able to take care of infants who are much younger and these very low birth weight infants survive. Most very low birth weight infants

are not well catered for in our setting, mainly due to limited resources. If the mortality of very low birth weight infants decreased in our units, the prevalence of ROP would be higher.

4.5.2 Birth Weight

Shah et al found an inverse relationship between the incidence of ROP and BWT. They found that the incidence was 17.3% in infants between 1001g and 1500g, 55.4% in infants <1000g and an even higher incidence of 76.5% in infants <750g¹⁷. In the study done by Delport et al, 21/23 infants diagnosed with ROP had a birth weight of <1250g³³. The CRYO-ROP study found an incidence of 81.6% in infants <1000g²⁶ and the ETROP study reported an incidence of 82.5% in infants <1000g²⁹.

In this study 5 out of the 6 infants (83.3%) diagnosed with ROP had a BWT of <1100g. The prevalence of ROP at BWT <1100g was 4.35% and at BWT >1100g was 0.8%. All babies born with an extremely low BWT <750g, in this study, did not survive to be examined. This was indicative of the fact that we are currently unable to take care of these babies who are most likely to develop ROP.

4.5.3 Estimated Gestational Age

There is an inverse relationship between incidence of ROP and gestational age¹. In a study done by Yang et al the incidence in infants <24weeks was 94%, in infants 25-27weeks it was 78% and infants 28-30 weeks it was 47%. The mean EGA of infants with ROP was 26.9 weeks and for those without it was 30.3 weeks⁴⁷.

The mean EGA of infants that were screened in this study was 29.5 (SD +/- 2.6) weeks. This is similar to the studies done by Shah et al¹², and by Gobles et al²⁸, where the mean EGA's were 29.7 and 29.1 weeks respectively.

In this study low gestational age was also associated with a higher prevalence of ROP. The infants with an EGA of <30weeks had a higher chance of developing ROP with a univariate odds ratio of 8.7 (p value= 0.01).

Severe disease is usually seen in babies with an EGA<26 weeks⁴⁸. In a study by Mathew et al all the infants who developed tROP were <900g and had an EGA<26weeks.

Infants with a lower EGA tend to require mechanical ventilation for longer than babies with a higher EGA, and this is a known risk factor for the development of ROP⁴⁷. This association was not seen in this study.

4.5.4 Duration of oxygen supplementation

Hussain et al in Connecticut, noted that the duration of supplementary oxygen was proportionally related to the risk of developing ROP⁴⁹. This was also noted by Y.S Liu et al in Taiwan⁵⁰

In this study 5/6 infants who developed ROP had been on supplementary oxygen for >2 weeks. Using multivariate analysis the odds ratio was 13.0, p value=0.4.

The method of delivery, whether via head box or nasal prongs did not seem to affect the risk of developing ROP.

4.5.6 Current Oxygen Delivery Protocol

Oxygen Saturation

Most centres, for example those in SA, have set guidelines to maintain SaO₂ range between 88-92%⁴. In our setting monitoring as well as maintaining SaO₂ is a challenge, as both neonatal units have only one pulse oximeter each. SaO₂ is checked on admission and during routine rounds, for example drug rounds by the nurses. Management of oxygen therapy is essential in preventing the development of ROP⁴ and more pulse oximeters in our neonatal units would enable this.

It is also clear from this study that the medical personnel are not clear on the oxygen delivery protocol in our units.

LIMITATIONS OF THE STUDY

1. This is a cross sectional study. An incidence study with follow up of all enrolled infants up until complete retinal vascularisation would provide a clearer picture of the magnitude of ROP in our neonatal units.
2. The sample size was not achieved in this study. Some of the neonates that were enrolled did not survive and some infants were likely missed during the screening process. This may have affected the results, as a low prevalence was found. A study for a longer duration would be required to achieve a sample size of 217.
3. The GA was an estimate for most of the infants, from the maternal history and by the Ballard Score. Infants with an actual GA of >32 weeks may have been enrolled in the study.

RECOMMENDATIONS

1. An incidence of ROP study needs to be initiated, to show the full extent of the pathology in our setting.
2. Induction courses to teach the oxygen delivery protocols in our neonatal units, to ensure all medical personnel working in the units are well informed, and that all personnel are targeting the same SaO₂ ranges.
3. More pulse oximeters need to be acquired for both units to enable constant SaO₂ measurement and monitoring.
4. All Junior Doctors rotating in the neonatal units should be taught the oxygen delivery protocol for VLBW infants at the beginning of their rotation.
5. An increase in the number of nursing staff in the units to enable better monitoring of oxygen saturation in the VLBW infants.
6. All infants at risk of developing ROP in both units should be screened; with clear documentation that screening has been done. This may be incorporated on the Road to Health baby card.

7. Efforts must be made to increase the survival rate of VLBW neonates in out units. This may be addressed by acquiring better equipment and by having more nursing staff.

5.0 CONCLUSIONS

The Prevalence of ROP at 4-6 weeks age was 5% and the prevalence of ROP requiring treatment was 0%. Current oxygen delivery protocols must be revisited & revised by personnel. There is a need for advocacy for the surveillance of ROP and the issue of nursing staff shortages needs to be addressed. There is a need for more equipment for monitoring O2.

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APPENDIX 1 – DATA COLLECTION SHEET

Section 1: Enrolment

Research Number:

Patient Information

1. Hospital number:
2. Date of birth:
3. Hospital booked at:
4. Birth weight (g):
5. Gestational age at birth:
6. Apgar Score:
7. Mode of Delivery:
8. Sex:
9. Multiple births (1, 2, 3):
10. HIV-exposed/-unexposed/unknown:

Maternal Information

1. Maternal Age:
2. Antenatal Steroids taken: Y/N
If yes, duration: Type: Dose:
3. Diagnosed with Pre-eclampsia: Y/N
4. HIV Status:

Indication for ROP screening in this patient: please tick appropriate box:

Weight <1 500g

Gestational age <32 weeks at birth

Date booked for examination:

Age at Examination:

Section 2: Date Of examination:

1. Current age of infant:

2. Duration of oxygen (days):

Head box:

Nasal prongs:

Face mask:

Flow Rate:

Flow Rate:

Flow Rate:

3. Has the infant had mechanical ventilation since birth? Y/N

IPPV:

CPAP:

4. Has the infant had severe apnoea with mask and bag ventilation? Y/N

5. Has the infant been diagnosed with hyaline membrane disease/RDS? Y/N

6. Has the infant been diagnosed with neonatal sepsis? Y/N

7. Has the infant been diagnosed with necrotising enterocolitis? Y/N

8. Has the infant been diagnosed with patent ductus arteriosus? Y/N

9. Has the infant had multiple blood transfusions (>2)? Y/N

If yes, how much blood was transfused?

10. Has the infant had phototherapy for neonatal jaundice? Y/N

11. Has the infant received surfactant therapy? Y/N

12. Have postnatal steroids been given to the baby: Y/N

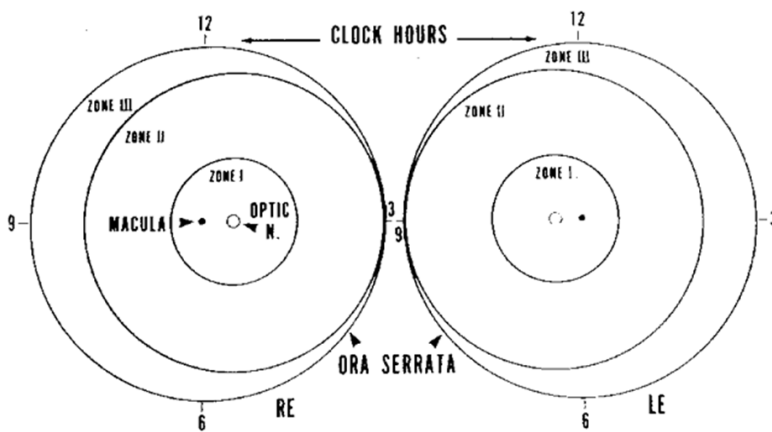
If yes, duration: Type: Dose:

13. Has the infant had hyperglycaemia? Y/N

Section 3: Examination Findings

Anterior segment:

Fundus:



Stage Right eye:

Stage Left Eye:

APPENDIX 2

Questionnaire for Medical Personnel working in Parirenyatwa NICU and HCH NNU.

Good day, my name is Dr N Mataswa. I am carrying out a study on the prevalence of Retinopathy of Prematurity, as well as the current oxygen delivery protocols in our neonatal units. The aim of this questionnaire is to assess current oxygen delivery protocols in our units.

Please do not put your name on this paper, but kindly answer the following questions.

Thank you.

Please circle your response.

1. I am a Jnr Doctor/SHO/Registrar/Snr Registrar/Sister In Charge/Registered Nurse/Student Nurse
2. Were you made aware of an oxygen delivery protocol in very low birth weight preterm babies? Y/N
3. Is it possible to constantly monitor oxygen saturation with a pulse oximeter in these infants? Y/N

If no, why?

4. What oxygen saturation do you aim to maintain in preterm babies <36weeks?
 - a. 88%-92%
 - b. 90%-95%
 - c. 95-100%

APPENDIX 3: CONSENT FORM

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Avondale
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Telephone: 791631 ext. 2454
Fax: (263) (4) 791995
Telex: 26580 UNIVZ ZW
Email: ophthalmologysecretary@gmail.com



COLLEGE OF HEALTH SCIENCES
DEPARTMENT OF OPHTHALMOLOGY

UNIVERSITY OF ZIMBABWE

PARTICIPANT INFORMED CONSENT

PROTOCOL TITLE: Prevalence of Retinopathy of Prematurity (ROP) in low birth weight infants (<1500g) born at Parirenyatwa Group of Hospitals (PGH) and Harare Central Hospital (HCH).

NAME OF RESEARCHER: Dr Ngaatendwe Mataswa

PHONE: 0773072569

PROJECT DESCRIPTION: A study will be done on very low birth weight infants (<1500g) who have been exposed to oxygen and are at 4-6 weeks chronological age. These infants are at risk of developing ROP.

YOUR RIGHTS

Before you decide whether or not to volunteer for this study, you must understand its purpose, how it may help you, the risks to you, and what is expected of you. This process is called informed consent.

PURPOSE OF RESEARCH STUDY

To determine the prevalence of ROP in low birth weight infants (<1500g) as well as to assess the incidence of ROP requiring treatment and ROP not requiring treatment. As oxygen increases the risk of developing ROP, this study also aims to note the current oxygen delivery protocols for preterm babies in our neonatal units.

If ROP is diagnosed, your infant will be booked at the Sekuru Kaguvi Eye Unit and followed up and treated accordingly, as this disease may cause severe visual impairment and blindness.

PROCEDURES INVOLVED IN THE STUDY

Instillation of anaesthetic drops, followed by dilating drops (cyclopentolate with phenylephrine), into your infants eyes in order to enable examination. A wire speculum will be placed in the infant's eye to keep it open.

An examination will be done to deduce whether the infant has ROP or not.

DISCOMFORTS AND RISKS

Systemic side effects of mydriacyl: drowsiness, weakness, restlessness, seizures, skin rash, vasodilation and syncope.

Ocular side effects: Ocular pain, eye irritation

Apnoea during examination.

All examinations will be carried out in an environment where there is close monitoring and equipment for resuscitation.

POTENTIAL BENEFITS

Prevention of progression of ROP if present.

STUDY WITH DRAWAL

You may choose not to enter the study or withdraw from the study at any time without loss of benefits entitled to you.

CONFIDENTIALITY OF RECORDS

All records are to be kept by the researcher and all participants to be identified by research numbers. Information about patients is not to be disclosed to anyone without consent.

PROBLEMS/QUESTIONS

Please ask questions about this research or consent now. If you have any question in future please ask.

AUTHORIZATION

I have read this paper about the study or it was read to me. I understand the possible risks and benefits of this study. I know being in this study is voluntary. I choose to be in this study: I know I can stop being in the study and I will not lose any benefits entitled to me. I will get a copy of this consent form. (Initial all the previous pages of the consent form)

Parent/Guardian's Signature

Date

Parent/Guardian's Name (Printed)

Researcher Signature

Date

Witness Signature

Date

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Gwaro Rebvumirano

MUSORO: Chirwere chinonzi retinopathy of prematurity, chinokuwadza maziso evana vanenge vazvarwa nguva yavo isina kusvika, chirikuwanikwa muvana vangani vanozvarwa paParirenyatwa ne pa Harare Hospital.

Zita remuongorori: Dr Ngaatendwe Mataswa

Runhare: 0773072569

KODZERO YENYU

Munokurudzirwa kunzwisisa zviri pamusoro pegwaro musati manyora, zvinobatsira nezvino kwanisa kuitika pakuongorora mwana wenyu.

Tirikuongorora maziso evana vakazvarwa nguva isati yakwana, avo vakambochengetedzwa vachiwedzerwa mweya wekufema. Vana vanenge vazvarwa vachirema <1500g, nevese vanozvarwa nhumbu isati yasvitsa mavhiki makumi matatu nemaviri, ndivo vanenge vachiongororwa maziso avo.

Vana ava ndovanokwanisa kuita chirwere chinonzi retinopathy of prematurity. Maziso avo anenge achiongororwa kana mwana asvitsa mavhiki mana, mashanu kana matanhatu.

Tinoziva kuti mweya wekuwedzera wekufema (oxygen), unobatsira mwana kurarama, asi unokwanisa kukanganisa maziso ukapiwa nemwero wakawandisa. Tinenge tichizobvunza vanopa oxygen yacho kuti, varikuipa sei uye nemwero upi.

Kana taona vana vanenge vaine chirwere, tichada kuona kuti vanorapika nevasingarapike vangani.

Mwana wenyu kana aine chirwere tinomuendesha kune avo vanorapisa.

ZVINOTEVEDZERWA PAKUITA BASA

Maziso emwana anotanga adonedzerwa mushonga wekuti maziso ake asarwadze pakumuongorora. Umwe mushonga unozowedzerwa wekuti maziso emwana avhurike mukati tione kumashure kwemaziso, nokuti ndopanowanikwa chirwere chacho. Maziso emwana anovhuriswa nemaoko kana kuti nemaretractors, muongorori otarisa owona kuti, mwana anechirwere here kana kuti haana.

ZVINOGONA KUITIKA PAKUDONEDZA MUSHONGA

Kuneta, kugwinha, kumerera kwemapundu, kurwadza nekuvava kwemaziso, kuneta pakufema kunokwanisa kuwanika, asi hazvi wanzowanikwa.

Vana vanozvarwa nguva isati yasvika vanogona kuneta kufema chero vasiri kuongororwa. Zvikadai mwana anobatsirwa kufema. Ongororo yese inoitwa panzimbo inezvekushandisa zvakakwana pakumubatsira kufema zvikaitika.

ZVIPUNDUTSO ZVEONGORORO

Kutumidzirwa kwevanorwara kuchipatara chemaziso akabatwa nechirwere kutiabatsirwe. Ndokuti chirwere chisaenderere mberi, kuona kwemwana kuchengetedzwe.

Makasununguka kuongoresa kana kusaongoresa mwana, uyezve kana mabvuma kuti aongororwe munokwanisa kumubvisa pahuongororo chero nguva. Mwana wenyu anobatsirwa chero maramba kuita izvi.

Ruziwo rwese rwaka chengeteka kunachiremba chete. Hapana munhu anoudzwa nezve mwana wenyu, musina kubvuma.

Makasununguka kubvunza mibvunzo.

Ndaverenga/ndaverengerwa, ndanzwisisa kutindinogona kubvuma, kana kuramba kuti mwana wangu aongorerwe. Ndanzwisisa zvipundutso nezvese zvinokwanisa kuitika kune mwana pakuongororwa. Ndanzwisisa kuti ndika zoramba kuti mwana aongororwe, anokwanisa kubatsirwa chero ndaita izvi. Ndichapiwa pepa rebvumirano rakafanana neiri.

Ndobvumirana nezviri mugwaro.

Zita remubereki -----

Zuva

Zita remuongorori-----

Zuva