

PREVALENCE AND CAUSES OF ABNORMAL RED REFLEX TEST
IN NEWBORNS AT MUHIMBILI NATIONAL HOSPITAL

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SCHOOL OF MEDICINE

DEPARTMENT OF OPHTHALMOLOGY



**PREVALENCE AND CAUSES OF ABNORMAL RED REFLEX TEST IN
NEWBORNS AT MUHIMBILI NATIONAL HOSPITAL**

By

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**A Dissertation Submission in Partial Fulfillment of the Requirements for the
Degree of Master of Medicine (Ophthalmology) of
Muhimbili University of Health and Allied Sciences**

Muhimbili University of Health and Allied Sciences

October, 2021

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled **‘Prevalence and causes of abnormal red reflex test in newborns at Muhimbili National Hospital’** in (partial) fulfillment of the requirements for the Degree of Masters of Medicine (Ophthalmology) of Muhimbili University of Health and Allied Sciences.

Dr Suzan Mosenene
(Chief Supervisor)

Date -----

DECLARATION AND COPYRIGHT

I, **Hussein Abbas Tayebji**, declare that this **dissertation** is my original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature -----

Date -----

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DEDICATION

This dissertation is dedicated to my beloved parents, siblings, wife and daughter for their support and encouragement.

I also dedicate this work to all my teachers for constantly implanting me with confidence and commitment.

ABSTRACT

Background: The red reflex test is an assessment for the clarity of ocular media which is useful for early detection of preventable sight-threatening conditions like congenital cataract, congenital glaucoma and corneal opacity. Early detection and timely referral for ophthalmological review of patients with abnormal red reflex prevents visual impairment, amblyopia and even save life of newborns affected by retinoblastoma. Prevalence and causes of abnormal red reflex test remains unknown at Muhimbili National Hospital.

Aim: Screening newborns to determine the prevalence and causes of abnormal red reflex test at Muhimbili National Hospital.

Methodology: A hospital-based descriptive cross-sectional study was conducted at Muhimbili National Hospital in maternal and neonatal wards. Systematic sampling of 1,153 newborns was done to recruit 315 study participants. Red reflex test was performed using direct ophthalmoscope to detect causes of abnormal red reflex test. Collected data was captured on a structured questionnaire. Data was analyzed using Statistical Package for Social Sciences version 23. Statistical tables and charts were used to present the results.

Results: Abnormal red reflex test was observed in 101 (32.1%) and the most common cause was vacuolated lens seen in 26 (25.7%) newborns followed by 23 (22.8%) retinal hemorrhage and 21 (20.7%) persistent pupillary membrane. Other visually significant causes were refractive errors in 18 (17.8%) newborns followed by 4 (4.0%) retinopathy of prematurity and 3 (3.0%) congenital cataract.

Conclusion: The prevalence of abnormal red reflex test among newborns at Muhimbili National Hospital is high. The commonest causes of abnormal red reflex test were vacuolated lens followed by retinal hemorrhages and persistent pupillary membrane. Other fewer but significant causes of abnormal red reflex test were congenital cataract, refractive errors and retinopathy of prematurity. Red reflex test screening in newborns to early diagnose congenital ocular pathology and prevent amblyopia need to be emphasized at Muhimbili National Hospital.

TABLE OF CONTENTS

CERTIFICATION	ii
DECLARATION AND COPYRIGHT	iii
ACKNOWLEDGEMENT	iv
DEDICATION	v
ABSTRACT.....	vi
LIST OF TABLES	ix
LIST OF FIGURES	ix
DEFINITION OF TERMS	xii
1.0 INTRODUCTION	1
2.0 PROBLEM STATEMENT	4
3.0 CONCEPTUAL FRAMEWORK	5
4.0 RATIONALE.....	6
5.0 RESEARCH QUESTIONS	7
6.0 OBJECTIVES	8
6.1 BROAD OBJECTIVE.....	8
6.2 SPECIFIC OBJECTIVES	8
7.0 LITERATURE REVIEW	9
8.0 METHODOLOGY	12
8.1 STUDY DESIGN	12
8.2 STUDY SETTING	12
8.3 STUDY DURATION	12
8.4 STUDY POPULATION	12
8.5 SAMPLING TECHNIQUE.....	13
8.6 SAMPLE SIZE FORMULA	13
8.7 INCLUSION CRITERIA	13
8.8 EXCLUSION CRITERIA	14

8.9 VARIABLES	14
8.9.1 INDEPENDENT VARIABLES	14
8.9.2 DEPENDENT VARIABLES	14
8.10 DATA COLLECTION.....	14
8.10.1 DATA COLLECTION TOOLS	14
8.10.2 DATA COLLECTION PROCEDURE	15
8.10.2.1 RECRUITMENT.....	15
8.10.2.2 CLINICAL HISTORY	15
8.10.2.3 OPHTHALMIC EXAMINATION	16
8.10.3 DATA MANAGEMENT AND ANALYSIS.....	17
9.0 ETHICAL CLEARANCE.....	17
10.0 DISSEMINATION PLAN	17
11.0 RESULTS	18
12.0 DISCUSSION	24
13.0 CONCLUSION.....	29
14.0 RECOMMENDATIONS.....	30
REFERENCES	31
APPENDICES	33
Appendix I: QUESTIONNAIRE	33
Appendix II: Consent Form English Version.....	37
Appendix III: Consent Form Swahili Version	39

LIST OF TABLES

Table 1. Description of newborns screened using RRT at MNH	18
Table 2. Colors of the reflex in newborns with abnormal RRT	19
Table 3. Color of the reflex in different causes of abnormal RRT	20
Table 4. Laterality among the causes of abnormal RRT in newborns at MNH	22
Table 5. Grades of retinal hemorrhage in newborns at MNH	22
Table 6. Magnitude of refractive errors according to their gestation age	23
Table 7. Color variations of RRT among newborns with normal RRT	23

LIST OF FIGURES

Figure 1. Conceptual Framework	5
Figure 2. Newborns screened for red reflex test at MNH	19
Figure 3. Causes of abnormal RRT in newborns at MNH	21

ABBREVIATIONS

G/A	Gestation Age
MNH	Muhimbili National Hospital
NBs	Newborns
PPM	Persistent Pupillary Membrane
RH	Retinal Hemorrhage
RRT	Red Reflex Test
ROP	Retinopathy Of Prematurity
TVL	Tunica Vasculosa Lentis

DEFINITION OF TERMS

Congenital cataract: Clouding of the eye's natural lens that is present at birth which may or not lead to decrease in vision.

Congenital glaucoma: Seen at birth or during the first year of life. It is a heterogeneous group of diseases characterized by increased intraocular pressure leading to optic nerve damage due to abnormal development of the aqueous drainage system.

Newborn: Refers to a baby under twenty eight days of life.

Ophthalmoscope: An instrument for examining the interior structures of the eye especially the retina, consisting essentially of a mirror that reflects light into the eye and a central hole through which the eye is examined.

Red reflex: The red-orange reflection of light from fundus observed when using an ophthalmoscope or retinoscope.

Refractive error: Manifestation of the relationship between the optical components of the eye and the overall axial length of the eye.

Refraction: It is an objective and subjective eye examination that measures a person's prescription for eyeglasses or contact lenses.

Retinopathy of prematurity: Potentially blinding disease caused by abnormal development of retinal blood vessels in premature infants.

1.0 INTRODUCTION

Red reflex test is performed to detect opacity in ocular media and is vital for early detection of vision and potentially ocular threatening abnormalities such as cataracts, glaucoma, retinoblastoma, retinal abnormalities and systemic diseases associated with ocular manifestations. The test uses transmission of light from an ophthalmoscope through all the normal transparent parts of a subject's eye including the tear film, cornea, aqueous humor, crystalline lens, and vitreous humor. This light reflects off the ocular fundus, is transmitted back through the optical media and aperture of the ophthalmoscope which is imaged in an eye of the examiner [1] [2].

The test is done using a direct ophthalmoscope set at zero lens power, held close to the examiner's eye and is focused on each pupil individually at approximately 30-45 cm from the eye. Both eyes are then viewed simultaneously. The red reflex seen in each eye individually should be round, bright reddish-yellow (or light gray in darkly pigmented, brown-eyed patients) and should be similar in both eyes. Dark spots in the red reflex, a blunted dull red reflex, lack of a red reflex, or presence of a white reflex are all indications for ophthalmology referral [3].

For the examiner not to miss any pathologies, the pupil has to be fully dilated and to maximize pupillary dilation the red reflex test may be preferably performed in a darkened room. If the test cannot be performed shortly after birth mostly due to edema of the eyelids, it is deferred to the second day of life [3].

The unique developmental physiology of the human visual system becomes sensitive to visual deprivation six weeks after birth following a latent period of visual immaturity hence, the red reflex screening is essential to be conducted within the first weeks of life in all newborns and infants [4]. The American Academy of Pediatrics has recently recommended that the red reflex test should be conducted in the newborn period to detect and treat ocular disorders as early as possible in order to prevent lifelong visual impairment and even save lives [2].

In order to detect eye pathology early and institute rapid referral and treatment, universal screening of newborns using the red reflex test is conducted in most countries. Red reflex testing may be performed simply and rapidly as part of the routine physical examination [2].

The prevalence of abnormal red reflex test is different from countries to countries due to the differences in prevalence of congenital ocular pathologies. There are no published studies in Tanzania to determine the prevalence and causes of abnormal red reflex test in newborns, hence an urge for this study.

Any factor that impedes or blocks the optical pathway will result in an abnormality of the red reflex, due to presence of mucus or other foreign bodies in the tear film, corneal opacities, aqueous opacities, iris abnormalities affecting the pupillary aperture, congenital cataracts, vitreous opacities, and retinal abnormalities including retinal tumors or chorioretinal colobomata. Unequal or high refractive errors and strabismus may also produce abnormalities or asymmetry of the red reflex [5].

Some of the rare causes of abnormal red reflex test includes vacuolated lens, retinal hemorrhage and persistent pupillary membrane. Vacuolated lens have not been extensively studied. They are described as clear, spherical and fluid-filled spaces within the lens cortex. The illumination of vacuoles suggests that they contain fluid of lower refractive index than the surrounding lens material which can cause low visual acuity. Vacuoles are transient in nature and that their disappearance have shown to be sometimes replaced by posterior subcapsular cataract mandating follow up of these newborns [6].

Retinal hemorrhage occurs as one of the cause of abnormal red reflex test which has been related to uterine contractions and narrow pelvic outlet canal that leads to increased intracranial pressure. These pressure elevations are transmitted along the intravaginal space to the newborns' optic nerve, retinal vein and result in venous stasis, ophthalmic vein engorgement, capillary rupture and hemorrhage. Retinal hemorrhage according to Egge's

classification is graded in type I, II and III. Grade III is known to affect vision due to its location in the macular area and needs early referral to ophthalmologist [7].

Early development of the crystalline lens at about the sixth week coincides with growth of the tunica vasculosa lentis (TVL) which nourishes it. The anterior portion of this is continuous with the pupillary membrane which draws its blood supply from. Dysfunction of macrophage invasion and phagocytosis is thought to play a role in the pathogenesis of persistent pupillary membrane. Pupillary membrane normally disappears by the 34th week of gestation and its persistence can occlude the visual axis and cause amblyopia [8].

Visual defects are but one of the many handicaps likely to affect newborns. Refractive errors, if allowed to persist uncorrected, can lead to amblyopia. Regarding emmetropisation after birth, the main change is from hypermetropia to emmetropia by the age of one year. There is no decrease in the incidence of hypermetropia among children from age 1 to 3.5 years [9]. Newborns with either superior or inferior crescent on red reflex test are found to be high hyperopia and myopia respectively and needs early referral to ophthalmology unit for further management.

This study has determined the prevalence and causes of abnormal red reflex test at MNH which will create awareness among obstetric, pediatric and ophthalmology departments about the importance of red reflex test in newborns.

2.0 PROBLEM STATEMENT

Red reflex test is an important part of newborns and infants screening in the first six weeks of life. The screening is best done in maternity and neonatal units which permits early diagnosis and proper referral to ophthalmologist and adequate visual development for an affected newborn. Unfortunately the screening for red reflex is not routinely practiced by health workers even in hospitals with well-established maternal and neonatal units like MNH since it is not included in the national guidelines as part of the neonatal assessment protocol.

Ocular pathologies like congenital cataract can be operated as early as six weeks of age in order to prevent amblyopia and have normal visual development. While other pathologies like retinoblastoma which can easily be detected by red reflex test and early referral to ophthalmologist may save the eye or even the life of affected neonates. Most children with retinoblastoma, cataract, glaucoma and refractive error present late at MNH ophthalmology clinic which might be a reflection of lack of screening program in their respective health facilities.

To the best of my knowledge there is no study done on the red reflex test in newborns at MNH. That is why there was a need to conduct a research on prevalence and causes of abnormal red reflex among newborns at MNH.

3.0 CONCEPTUAL FRAMEWORK

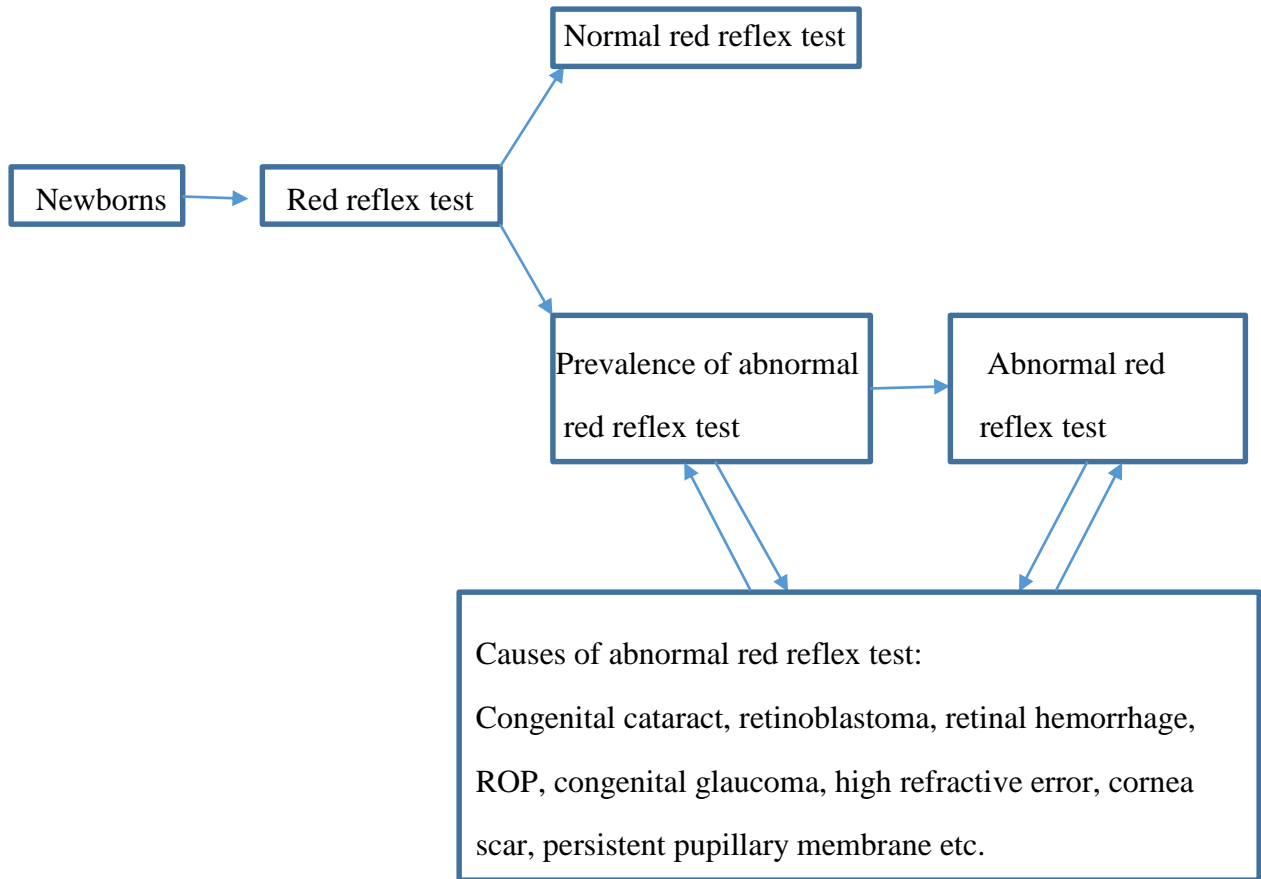


Figure 1: Framework for the analysis of factors associated with red reflex test in newborns.

4.0 RATIONALE

Identification of abnormal red reflex among newborns at MNH has provided baseline information which is important to emphasize on routine red reflex test in all newborns by health personnel working in maternal and neonatal units and early referral to ophthalmology unit for further management

This study has created awareness among obstetric, pediatric and ophthalmology units on the importance of red reflex test in newborns.

These findings will be used for development of newborns' ocular assessment protocol at MNH.

5.0 RESEARCH QUESTIONS

1. What is the prevalence of newborns with abnormal red reflex at MNH?
2. What are the causes of abnormal red reflex in newborn at MNH?

6.0 OBJECTIVES

6.1 BROAD OBJECTIVE

To determine the prevalence and causes of abnormal red reflex test in newborns at MNH.

6.2 SPECIFIC OBJECTIVES

- 1) To determine the prevalence of abnormal red reflex test in newborns at MNH during the study period.
- 2) To determine causes of abnormal red reflex test in newborns at MNH.

7.0 LITERATURE REVIEW

The prevalence of abnormal red reflex test

The prevalence of abnormal red reflex test differs from country to country, other countries have high prevalence while others has low depending on the causes. In a study on the red reflex conducted by Cassie A. Ludwig et al in Stanford University School of Medicine, Palo Alto, California, a total of 194 healthy term newborns were enrolled in the Newborn Eye Screening Test study at Lucile Packard Children's Hospital. The prevalence of abnormal red reflex was found to be 25.3% [10].

In a report of perinatal ocular examination which was performed on 3573 healthy full-term newborns by Li-Hong et al in Maternal and Children's Hospital, Kunming, China in August 2012, the prevalence of abnormal red reflex was 24.4% [11].

Another study which was done by Adriana Sousa Carvalho de Aguiar et al in the city of Fortaleza, state of Ceará Brazil, they conducted the study on 190 newborns in a public maternity hospital. A total of 187 infants presented no alteration and three presented abnormal results. The prevalence of abnormal red reflex was 1.58 % [12].

A similar study done by Érica Carine Rodrigues et al in four primary health care units in the city of Quixeramobim-Ceará, Brazil. It was a study to evaluate the results of the red reflex test in newborns. They recruited a sample of 32 newborns and found 94% (30) presented with normal red reflex and only 6% (2) of the newborns had abnormal red reflex test [13].

A study done by Saiju R et al in Kathmandu, Nepal which was carried out due to the childhood blindness being a major problem in the developing world including Nepal that needed to be addressed. They believe that more than 90% of blindness would be avoidable through access to ophthalmic health services and pediatric eye screening. In this study a total of 172 patients were enrolled, out of which 13.4% (23) showed abnormal red reflex test [14].

A two year study period which included 11,500 newborns done by Smadar Eventov-Friedman et al in Jerusalem, Israel. They found only 0.04% (5 newborns) with abnormal red reflex [3]. Due to different prevalence of congenital ocular pathologies, there are different proportion of abnormal red reflex in different countries. There are no published studies done in Tanzania to determine prevalence of abnormal red reflex in newborns.

Causes of abnormal red reflex test

The causes of abnormal red reflex vary with different study location. In a report of perinatal ocular examination which was done by Li-Hong et al in Maternal and Children's Hospital, Kunming, China. They found majority of abnormalities were due to retinal hemorrhages. Out of 3573 newborns screened, 871 abnormal cases were found. The majority of abnormal exams were 769 (21.52%) retinal hemorrhages. Of these, there were 215 cases of significant retinal hemorrhage, possible sight threatening or amblyogenic, representing 6.02% of the total. In addition, 67 cases (1.88%) involved macular hemorrhage. The other 107 cases (2.99%) with abnormal ocular findings included congenital microphthalmos, congenital corneal leukoma, posterior synechia, persistent pupillary membrane, congenital cataract, retinal hamartoma, retinoblastoma, optic nerve defects and non-specific peripheral retinopathy [11].

In a study on the red reflex conducted by Cassie A. Ludwig et al in Stanford University School of Medicine, Palo Alto, California, the red reflex exam was conducted in 194 newborns. Abnormal red reflex which were 49 out of 194 subjects screened, thirty one had macular hemorrhages, two optic nerve flame hemorrhages, four grouped pigmentation, four choroidal nevus in the macula, two choroidal nevus elsewhere in the retina, one choroidal pigmentation, one albinotic appearance of the choroid, one polar bear tracks, one pigmentary retinopathy and one focal depigmentation of the retinal pigmented epithelium [10].

A study done by Saiju R et al in Kathmandu, Nepal, a total of 172 patients were enrolled, out of which 23 showed abnormal red reflex test. Their diagnoses included 9 congenital cataracts, 4 retinoblastomas, 1 hyphema, asymmetric refractive error, congenital enophthalmos, nebular scar and strabismus. This study displayed that the red reflex test is an effective and suitable screen in identifying conditions such as cataracts, strabismus and ocular tumors in the developing world [14].

The total newborns evaluated using the red reflex test in the city of Fortaleza and the State of Ceará, Brazil, 187 (98.42%) had normal homogeneous reflex. Only 3 (1.58%) of the newborns were diagnosed to have retinopathy of prematurity [12].

In a study done by Smadar Eventov-Friedman et al in Jerusalem, Israel, during 2007–2008, 5 infants were identified with congenital cataracts at days 2–6 of life prior to discharge from hospital. Surgery was performed at age of 2 months and all infants underwent a thorough follow-up. The incidence of congenital cataract in their center was 1:2300. Less than half of the neonatal departments performed the red reflex test routinely [3].

Furahini G. Mndeme et al in Kilimanjaro, Tanzania, studied sensitivity of RRT in comparison with other diagnosing tools to diagnose pediatric cataract and retinoblastoma in less than five years old children which was found to be more sensitive compared to torch examination [15]. To the best of my knowledge no any study has been done to determine the causes of abnormal red reflex test in newborns at MNH, hence there was need for this study to be carried out.

8.0 METHODOLOGY

8.1 STUDY DESIGN

Hospital based descriptive cross sectional study.

8.2 STUDY SETTING

The study was conducted at Muhimbili National hospital (MNH) in maternal and neonatal wards. MNH is a tertiary hospital serving as a National referral and teaching hospital. The hospital is located in Kalenga street, Ilala district, Dar-es-Salaam, Tanzania, with the city population of about six million people as per 2019 data.

The eye department have several clinics including adult general ophthalmology clinic, retina, paediatric, retinoblastoma, squint, glaucoma and oculopalastic clinic. MNH maternity block has one obstetric theatre, obstetric wards in which all pregnant women more than 28th week gestation are admitted. There is one labour ward where on average 15 deliveries per day and 450 deliveries per month takes place. There are three post delivery wards.

At MNH maternity block, soon after delivery, newborns who have no complications are transferred from the labour ward with their mothers to the post natal wards: 35, 38 and 39; while all preterm newborns are admitted to ward 37 and term newborns with any neonatal complications are admitted to ward 36. Data was collected from all the above mentioned wards.

8.3 STUDY DURATION

Duration of the study was from June to December 2020.

8.4 STUDY POPULATION

The study population included all newborns at MNH during the study period.

8.5 SAMPLING TECHNIQUE

Systematic sampling technique was used for this study, whereby the list of newborns delivered / admitted (the sampling frame) was obtained on daily basis during study period and all newborns with odd numbers in the list were recruited in the study until the sample size was reached.

8.6 SAMPLE SIZE FORMULA

$$n = \frac{z^2 p(100 - p)}{\varepsilon^2}$$

Where

n = minimum required sample size

z = percentage point of normal distribution corresponding to the level of confidence

ε = maximum likely error/ margin of error (5%)

p = expected proportion with the characteristic of interest

Using prevalence of 24.4% in a study which was done in China, the sample size becomes

$$n = \frac{24.4 \times 1.96^2 (100 - 24.4)}{5^2}$$

$$n = 283$$

Suppose 10% of the patient will not respond, then adjusted sample size will be

$$n' = n \times \text{Adjusted factor}$$

$$\text{Adjusted factor} = (100\% / 100\% - f\%)$$

$$n' = n \times (100\% / 100\% - f\%)$$

$$n' = 283 \times (100\% / 100\% - 10\%)$$

$$n' = 315 \text{ patients}$$

Therefore sample size required was 315 patients

8.7 INCLUSION CRITERIA

All newborns at MNH during the study period.

8.8 EXCLUSION CRITERIA

Newborns with eyelid abnormalities which does not permit eye opening even with speculum eg. ankyloblepharon, cryptophthalmos and with bilateral anophthalmia were excluded. Those newborns who were critically ill, and mothers who were unwilling to provide consent were excluded too.

8.9 VARIABLES

8.9.1 INDEPENDENT VARIABLES

These were age, sex, birth weight, gestation age, infections during pregnancy, hereditary ocular conditions and causes of abnormal red reflex

8.9.2 DEPENDENT VARIABLES

Abnormal red reflex

8.10 DATA COLLECTION

8.10.1 DATA COLLECTION TOOLS

- Semi structured questionnaire composed of demographic characteristics, clinical history and ophthalmic examination sections
- Direct ophthalmoscope (Riester No.2020 Ophthalmoscope- Germany) for red reflex test
- Indirect ophthalmoscope (Model:AAIO, By Appasamy Assocaites, Chennai, India) for indirect funduscopy
- 20D Volk lens (double aspheric, Made in USA) for indirect funduscopy
- Eyelid speculum to open the eyelids
- Scleral depressor for indirect ophthalmoscope to view peripheral retina
- 0.4% tropicamide + 2.5% phenylephrine Hydrochloride dilating eye drops for dilation of the pupil.
- For newborns with retinal hemorrhage, Egge's classification was used where Grade 1 is a small retinal hemorrhage confined to the area around the optic nerve head, associated with dot or fine linear bleeding. Grade 2 is a patchy, dot, blot or flame-shaped hemorrhage, the size of which does not exceed the optic disc diameter.

Grade 3 are retinal hemorrhages more than the diameter of the optic disc area or a line of flame-shaped hemorrhage along vessels or macular hemorrhage

8.10.2 DATA COLLECTION PROCEDURE

Systematic sampling technique was used. The sampling frame was the list of all newborns delivered / admitted within 24 hours depending on the day of admission of each respective wards, was obtained on daily basis from Monday to Sunday; and all newborns with odd numbers in the list were recruited into the study until the sample size of 315 was reached. The principal investigator did the interviews, clinical examinations and recording on the questionnaires. Examination findings were cross checked by investigator assistances and pediatric ophthalmologists.

8.10.2.1 RECRUITMENT

Prior to recruitment, all newborns delivered/ admitted during the study period whose mothers were willing to provide consent were recruited in this study. All the mothers agreed for their newborn to participate into the study. We excluded newborns who were critically ill and those with eyelid abnormalities. Consent form were signed by newborn's mother, demographics, clinical history and detailed ophthalmic examination were recorded by principal investigator on the questionnaire. Newborns found to have abnormal red reflex test were referred to pediatric ophthalmology unit for further management.

8.10.2.2 CLINICAL HISTORY

A semi structured questionnaire was used to collect data on relevant history related to the study. Demographic characteristics and history was taken from each mother of a newborn which included sex, gestation age, birth weight, history of fever, rash and severe infection during pregnancy and information on family history of ocular diseases was also collected.

8.10.2.3 OPHTHALMIC EXAMINATION

All newborns were screened for the presence of red reflex by the principal investigator. The red reflex test was performed by holding a direct ophthalmoscope close to the examiner's eye with the ophthalmoscope lens power set at "0". In a darkened room, the ophthalmoscope light was projected onto both eyes of the newborn simultaneously from approximately 18 inches away.

A normal red reflex was one that emanated from both eyes and was symmetric in character. Dark spots in the red reflex, a markedly diminished reflex, the presence of a white reflex or asymmetry of the reflexes (Bruckner reflex) were all abnormal reflexes and the newborns indication for referral to an ophthalmologist. The exception to this rule was a transient opacity from mucus in the tear film that was mobile and completely disappeared with blinking / crying or with irrigating solution.

All newborns had undergone thorough examination of the anterior and posterior segment by indirect ophthalmoscope using 20D lens in order not to miss any minute pathology of which could have been missed with direct ophthalmoscope. Prior to examination, all newborn pupils were dilated with 0.4% tropicamide + 2.5% phenylephrine hydrochloride. This is a diluted formulation and its use is safe in newborns. Topical anaesthetic, the tetracaine eye drops was instilled in an examined eye. Followed with the use of eyelid speculum to facilitate opening of eyelid and scleral depressor was used to visualize peripheral retina. Plain antibiotic drop was instilled after examination. The examination findings were crosschecked by research assistants and the ophthalmologist. Findings obtained were captured using structured questionnaire.

Newborns who were found to have abnormal RRT were referred to the pediatric ophthalmologist for further management. For refractive errors, cycloplegic refraction was done and an appropriate prescription was prescribed. For extensive persistent pupillary membranes, atropine eye drops were prescribed. Intravitreal avastin injection was given for newborns who had macular hemorrhage and type 1 ROP. Newborns with congenital cataract underwent lens washout, posterior capsulotomy and anterior vitrectomy.

Newborns with congenital glaucoma, underwent trabeculotomy with trabeculectomy to reduce the intraocular pressure.

8.10.3 DATA MANAGEMENT AND ANALYSIS

Data was transferred into a computer software and analyzed with the help of the Statistical Package for Social Sciences (SPSS) software program version 23 which was used to analyze the data. Mean, mode, frequencies and percentages were used to summarize the data. Statistical charts and frequency tables were used to present the results.

9.0 ETHICAL CLEARANCE

Ethical approval was granted by Senate Research and Publication Committee of Muhimbili University of Health and Allied Sciences (MUHAS). Permission to conduct the study was sought from Executive Director of MNH. Written consent of all the participants included in the study was taken after fully explaining the purpose and procedure of the study to the mothers of newborn. There was no risk associated with participating in the research and participant's information was kept confidential. All newborns who participated in the study were fully examined and treated accordingly after their diagnosis. The researcher had no conflict of interest.

10.0 DISSEMINATION PLAN

The final report has been presented to the department of ophthalmology at Muhimbili. It will be submitted to the Muhimbili University of Health and Allied Sciences as part of fulfilment for the award of the Master of Medicine (Ophthalmology) degree online repository. Finally it will be presented at MUHAS conferences and for publication in scientific journals.

11.0 RESULTS

A total of 315 (27.3%) newborns were recruited out of 1,153 who were born / admitted during the study period. One newborn was excluded due to bilateral anophthalmia. There were more males 178 (56.5%). The age ranged from 1-27 days with the mean of 5.9 days (SD 5.6). Majority were born at term. The birth weight with highest frequency was 2800g. Description of newborns by red reflex test according to age, gestation age, sex, birth weight and mode of delivery are shown in Table 1.

Table 1: Demographic characteristics of newborns according to red reflex test at MNH (N= 315)

Characteristics	Red reflex test			
	Normal N (%)	Abnormal N (%)	Total	
Newborn age (days)	1 – 9	178 (74.5%)	61 (25.5%)	239 (100%)
	10- 19	34 (52.3%)	31 (47.7%)	65 (100%)
	20- 27	2 (18.2%)	9 (81.8%)	11 (100%)
Gestation age	Pre term	42 (56.8%)	32 (43.2%)	74 (100%)
	Term	169 (71.6%)	67 (28.4%)	236 (100%)
	Post term	3 (60.0%)	2 (40.0%)	5 (100%)
Sex	Male	120 (67.4%)	58 (32.6%)	178 (100%)
	Female	94 (68.6%)	43 (31.4%)	137 (100%)
Birth weight	<2000g	39 (58.2%)	28 (41.8%)	67 (100%)
	2000g- <2500g	41 (75.9%)	13 (24.1%)	54 (100%)
	≥2500g	134 (69.1%)	60 (30.9%)	194 (100%)
	Mode of delivery	SVD	124 (68.9%)	56 (31.1%)
	C/S	90 (67.7%)	43 (32.3%)	133 (100%)
	Vacuum	0 (0.0%)	2 (100%)	2 (100%)

An abnormal red reflex test was found in 101 (32.1%) screened newborns (Figure 2).

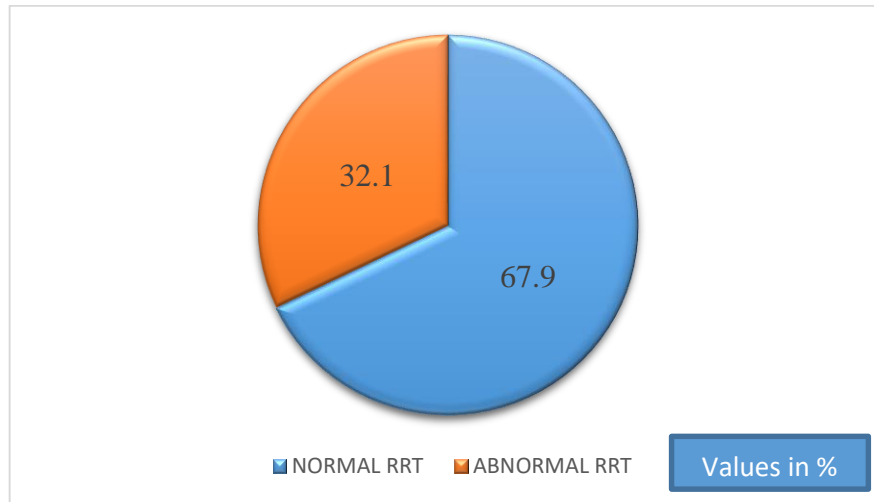


Figure 2: Newborns screened for red reflex test at MNH (N- 315)

Table 2: Colors of the reflex in newborns with abnormal RRT (N=101)

Colors of the reflex	Newborns
	N (%)
Grey / orange with black spots	26 (25.7%)
Grey / orange with black strips	21 (20.7%)
Grey - red	17 (16.9%)
Grey / orange with superior crescent	11 (10.9%)
Grey / orange with inferior crescent	7 (6.9%)
Orange - red	6 (5.9%)
No reflex	5 (5.0%)
Light yellow	4 (4.0%)
Pale / ischemic	4 (4.0%)
Total	101(100%)

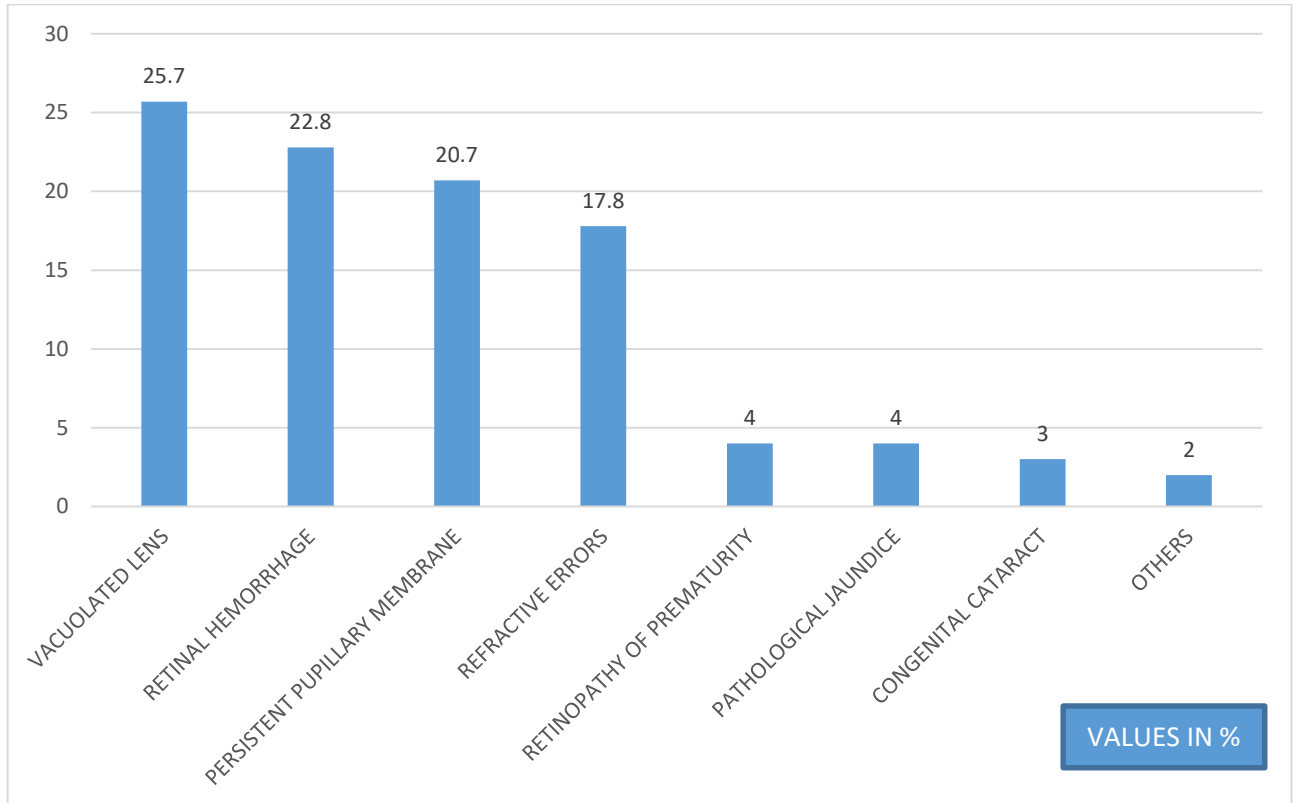
The most common abnormal red reflex test among all the newborns was grey/ orange with black spots accounting for 26 (25.7%) – Table 2.

Table 3: Color of the reflex in different causes of abnormal RRT (N=101).

Causes of abnormal RRT	Color of reflex	Newborns N (%)
Vacuolated lens	Grey / orange with black spots	26 (25.7%)
Retinal hemorrhage	Grey – red or orange – red	23 (22.8%)
Persistent pupillary membrane	Grey / orange with black strips	21 (20.7%)
Refractive errors - Hyperopia	Grey / orange with superior crescent	11 (10.9%)
- Myopia	Grey / orange with inferior crescent	7 (6.9%)
Pathological jaundice	Light yellow	4 (4.0%)
Retinopathy of prematurity	Pale / ischemic	4 (4.0%)
Congenital cataract	No reflex	3 (3.0%)
Congenital glaucoma	No reflex	1 (1.0%)
Sclerocornea	No reflex	1 (1.0%)
Total		101(100%)

The reflex in eyes with retinal hemorrhage was alternating between grey and red or orange in 23 (22.8%) newborns (Table 3).

The most common cause of abnormal RRT was vacuolated lens 26 (25.7%) - Figure 3.



*Others include congenital glaucoma and sclerocornea

Figure 3: Causes of abnormal red reflex test in newborns at MNH (N=101)

Table 4: Laterality among the causes of abnormal RRT in newborns at MNH (N=101)

Causes of abnormal RRT	Unilateral eyes	Bilateral eyes	Newborns
	N (%)	N (%)	N (%)
Vacuolated lens	18 (69.2%)	8 (30.8%)	26 (100%)
Retinal hemorrhage	3 (13.0%)	20 (87.0%)	23 (100%)
Persistent pupillary membrane	5 (23.8%)	16 (76.2%)	21 (100%)
Refractive errors- Hyperopia	4 (36.4%)	7 (63.6%)	11 (100%)
- Myopia	1 (14.3%)	6 (85.7%)	7 (100%)
Pathological jaundice	0 (0.0%)	4 (100%)	4 (100%)
Retinopathy of prematurity	0 (0.0%)	4 (100%)	4 (100%)
Congenital cataract	1 (33.3%)	2 (66.7%)	3 (100%)
Congenital glaucoma	0 (0.0%)	1 (100%)	1 (100%)
Sclerocornea	0 (0.0%)	1 (100%)	1 (100%)
Total	32 (31.7%)	69 (68.3%)	101(100%)

Bilateral congenital ocular anomalies accounted for 69 (68.3%) in newborns with abnormal RRT (Table 4).

Table 5: Grades of retinal hemorrhage according to Egge's classification in newborns at MNH (N=23)

Retinal Hemorrhage	Newborns N (%)
Grade I	2 (8.7%)
Grade II	9 (39.1%)
Grade III	12 (52.2%)
Total	23 (100%)

Grade III was the most common classification observed among newborns with retinal hemorrhage (Table 5).

Table 6: Magnitude of refractive errors according to gestational age of newborns tested for red reflex at MNH (N=18)

Gestation age	Refractive error (D), Frequency (%)				Total
	$\leq +2$ D to $+5$ D	$> +5$ D	≤ -3 D to -6 D	> -6 D	
	Low to moderate hyperopia	High hyperopia	Low to moderate myopia	High myopia	
Pre-term	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	2 (100%)
Term	0 (0.0%)	8 (57.1%)	0 (0.0%)	6 (42.9%)	14(100%)
Post-term	0 (0.0%)	2 (100%)	0 (0.0%)	0 (0.0%)	2 (100%)

Among those with refractive errors, high hyperopia / myopia were commonly seen in term babies (Table 6).

Table 7: Color variations of RRT among newborns with normal reflex (N= 214)

Color of RRT	Newborns N (%)
Light Grey	159 (74.3%)
Orange	53 (24.8%)
Red	2 (0.9%)
Total	214 (100%)

Light grey reflex accounted for 159 (74.3%) newborns with normal RRT (Table 7).

Among 214 newborns with normal RRT, their skin color had range of reflexes, 159 (74.3%) newborns with dark brown to black skin had light grey reflex. Fair skin to light brown 53 (24.8%) newborns had orange reflex and 2 (0.9%) had red color reflex.

12.0 DISCUSSION

This study involved 315 newborns who were screened for the red reflex test among which 56.5% were males. This is in line with the study by Saiju R et al in Nepal [14] and Furahini G. Mndeme in Kilimanjaro [15] which showed a similar proportion of males in their studies. The age range was 1-27 days old and the commonest age was 2 days with a mean of 5.9 days (SD 5.6). This is different from the study done in Kilimanjaro, Tanzania, the mean age was 33.4 months with age range of 2.0–60.0 months [15]. Another study done in Nepal their mean age was 14.4 ± 10.6 months with the average months of 14.7 [14]. These difference in age range, mean and mode could be attributed to differences in study population; this study was performed in newborns only while other studies included infants and older children. Moreover, the difference in age range indicates that the test can be done to any child less than 5 years of age.

The color of reflex has been related to the skin color in newborns and different colors have been associated with the presence of pigmentation. Newborns with a dark skin are known to have more pigmentation making the color of the reflex to be light grey [3] which is the case in the current study whereby the light grey reflex was the commonest normal reflex observed.

The prevalence of abnormal RRT in newborns at MNH during the study period was 32.1%. This was slightly higher than in other studies. In a study done in Kuming, China [11] the prevalence of abnormal reflex was 24.4% and the study in Palo Alto, California, was 25.3% [10]. However in Nepal [14] they had lower prevalence of 13.4% while in Quixeramobim-Ceará, Brazil [13] and in Fortaleza, Brazil [12] they had prevalence of 6% and 1.58% respectively. This difference could be attributed to different causes of abnormal RRT and the study population whereby some pathologies are not visible at the later age. In our setting the prevalence of abnormal RRT is high, indicating the different pathologies some of which have effect on visual development. Hence, the need for screening every newborns at birth and follow up visits.

Findings from this study have revealed vacuolated lens as the most common cause of abnormal RRT which accounted for 23 (22.8%) of the newborns. Vacuolated lens are potentially amblyogenic. They can regress, remain stationary or develop into posterior subcapsular cataracts (PSC) which impair vision. Such newborns need early identification and referral to pediatric ophthalmology for close follow up and early management.

Vacuoles have previously been considered to be a component of PSC and the link between presence of vacuole and subsequent cataract surgery in the first decade of life could be explained by the association between vacuoles and PSC. It has been studied that vacuoles are transient in nature and that their disappearance was sometimes replaced by PSC [6]. Whether vacuoles are consistent precursors of clinical PSC remains to be clarified. This creates an area of further study of vacuolated lens in newborns to its follow-up outcome in the first decade of life.

Retinal hemorrhage (RH) in this study was observed in 23 (22.8%) newborns, this is comparable to the study done by Li-Hong Li [11] in China (21.5%), but lower proportion than what was found by Michael Vaughn at Yale University in US which was 34% [7]. Other studies [16, 17] had much lower proportions of retinal hemorrhages as compared to our study. Variation in reported proportions may be due to different patient demographics and variable time periods between birth and initial examination. In this study the use of pupillary dilation, eyelid speculum, scleral depressor and indirect ophthalmoscope facilitated viewing of posterior and peripheral retina where even a subtle retinal hemorrhage was identified. Those with RH, 91.3% were full term and 8.7% were preterm newborns. This is in line with the mechanism of cranial compression for RH that has been supported by the finding of lower incidence of RH in preterm infants because they have smaller heads and therefore less compression [7].

A total of 52.2% newborns had third degree RH and 2 newborns having macular involvement who needed urgent referral to pediatric ophthalmologist for early intervention. Grade III RH is known to have a long term impact on vision and if not detected early can cause blindness to affected newborns. However; grade I and II RH dissipate quickly and absorbed without leaving a trace causing no significant effect on visual development. Most

neonatal RH is neither discovered nor reported as normal newborn ocular examination is not widely carried out. However it is necessary to understand, recognize, monitor incidence and variation of ocular disease in newborns in order to minimize its impact on the development of normal visual function.

Third most common cause of abnormal RRT was persistent pupillary membrane (PPM) which contributed 20.7% among all the causes. There are only few case reports that have been reported on PPM which shows a very rare finding in research studies. A study by Li Hong Li et al in China [11], PPM was mentioned among the other causes (2.9%) of abnormal RRT which is much lower than what was found in our study. This difference may be accounted for by screening both preterm and term babies in our study while they studied healthy full term newborns only.

The impact is that, in our setting we get a number of newborns with PPM which may interfere with visual development especially in a small pupil. Poor vision in newborns is a stimulus for amblyopia. These newborns need referral to an ophthalmologist for treatment with mydriatics and follow up monitoring to see whether the membranes shrink and undergo spontaneous resolution or continue to persist. If there is clear evidence that the membranes are shrinking over the first few weeks of life then it may be reasonable to wait for spontaneous resolution [8].

This study found 18 (17.8%) newborns with an abnormal red reflex due to high refractive errors amounting to hyperopia of $> +5$ DS and high myopia of > -6 DS with cycloplegic refraction. It included more hyperopia in full term newborns with equal amount of hyperopia and myopia in preterm newborns. This was a different finding from the study done in Ludhiana [9] in which preterm babies were found to be more myopic. It may be accounted for by few preterm newborns in our study but they studied refractive errors in preterm newborns only and myopia was the commonest refractive error. Hence RRT becomes an important test for early diagnosis of refractive error and referral to an ophthalmic unit for further management. These findings can act as a baseline knowledge for further study on the pattern of refractive errors in newborns.

Congenital cataracts were found in 3 (3%) newborns among all the causes of abnormal RRT. This was much lower proportion compared to the study done in Nepal [14] where they had 39% of cataract among all the causes of abnormal red reflex. This can be explained by the age group inclusion till the age of 5yrs and also included both congenital and developmental cataract. Another study in Jerusalem [3] had 0.04% of congenital cataract which can be explained by lower prevalence in Jerusalem due to different social economic lifestyle.

The developmental physiology of the human visual system is sensitive to visual deprivation 6 weeks after birth following a latent period of visual immaturity and late presentation to hospital leads to amblyopia [3]. Therefore, delayed surgery for significant congenital cataracts may result in abnormal visual development with irreversible amblyopia. To achieve favorable long-term visual outcome the recommended best practice for treatment of cataracts that obscure the visual axis include early surgical intervention, possibly within the first 3 months of life and as early as 6 weeks in unilateral disease [3]. In our study, one newborn had unilateral and two newborns had bilateral congenital cataract who were prone to deep amblyopia, hence early detection of congenital cataract by RRT was helpful and surgical intervention was conducted on time.

Congenital glaucoma was found to be in 1 (1%) newborn among all the causes of abnormal RRT. An article in Germany mentioned primary congenital glaucoma was seen in 1 out of 10,000–18,000 newborns in European populations [18]. This is a rare disease among newborns and affected neonates present with cloudy cornea, and hazy media with no reflex on RRT which was the case of our current newborn. Early referral to ophthalmology unit and appropriate management was done. Most cases without cloudy corneas are diagnosed late, either by the family members or less frequently, by an ophthalmologist or pediatrician at a routine neonatal examination. Even after the condition has been suspected, the mean interval between detection and first presentation was still 2.2 months according to a recent study in Germany despite adequate access to ophthalmic care [18]. This shows importance of performing RRT in all newborns.

Other causes of abnormal red reflex were ROP, pathological jaundice and sclerocornea. There were 4 (4.0%) newborns with ROP who were incorporated into eye ROP clinic for further management. This shows the importance of screening of premature babies and prevent them from going blind by early identifying and treating these infants. This findings was similar to study done in Fortaleza, Brazil [12] where only 3 (1.58%) of the newborns were diagnosed to have ROP.

This study didn't find any case of retinoblastoma (RB) which is one of the common causes of abnormal RRT and can be explained by small sample size as the disease is rare occurring in 1:20,000 births. Moreover, retinoblastoma is common in children aged six months and above. It is therefore important to keep performing the RRT in infants and older children in order to detect those ocular pathologies that cannot be detected at first screening at birth. Our study has therefore showed the importance of newborn screening using RRT to identify early congenital ocular anomalies and early referral for the treatment in order to avoid amblyopia.

13.0 CONCLUSION

The prevalence of abnormal RRT among newborns at MNH is high indicating the different pathologies some of which have effect on development of vision. The most common causes of abnormal RRT were vacuolated lens, retinal hemorrhage and persistent pupillary membranes. Other less frequent but significant causes of abnormal RRT were congenital cataracts, congenital glaucoma and ROP. This shows the importance of RRT screening in newborns to early diagnose ocular pathology, early referral to ophthalmology unit for appropriate management in order to prevent amblyopia and subsequent childhood visual impairment.

14.0 RECOMMENDATIONS

Trained nurses/ interns/ registrars/ residents working in maternal and neonatal units should be encouraged to perform RRT in all newborns before discharge from hospital.

RRT should be incorporated in newborns' ocular assessment protocol at MNH in order to identify the abnormality early.

Prospective study on vacuolated lens in newborns to elicit long term outcomes is recommended.

A multi- centered study on RRT in newborns can be carried out in order to identify different ocular pathologies for early management.

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APPENDICIES

Appendix I: QUESTIONNAIRE

Prevalence and causes of abnormal red reflex test in newborns at Muhimbili National Hospital

PATIENT IDENTIFICATION

Registration number Date of interview /..... /.....

SECTION A: DEMOGRAPHIC CHARACTERISTICS

(Fill or tick where applies)

1. Sex of newborn

a) Male	b) Female
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2. Age in days 3. Mode of delivery.....

4) Birth weight in grams.....

5) Gestation age

a) Preterm	b) Full term	c) Post term
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6). District of residence

a) Ilala	b) Kinondoni	c) Temeke	d) Ubungo	e) Kigamboni	f) Others
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7) PMTCT status of the mother

a) One	b) Two	c) Others
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SECTION B.HISTORY

(Fill or tick where applies)

8) What is the reason for delivering at MNH?

a) Previous Scar	b) Multiple pregnancy	c) Hypertension in Pregnancy
d) Prolonged labor	e) Anemia in pregnancy	f) Others

9) History of fever, rash and any severe infection during pregnancy

a) Yes	b) No
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10) Any ocular condition which is hereditary in family

b) Yes	b) No
--------	-------

11) If yes, which condition?

a)RB/ocular malignancy	b) Squint	c) Congenital cataract
d) Congenital glaucoma	e) Anophthalmia	f) Microphthalmia
g) Others		

12) Who had /has the above condition related to newborn?

a) Parent (s)	b) Grandparent (s)	c) Sibling (s)
d) Aunt / Uncle	e) Others	

13) Was newborn eye examination done?

b) Yes	b) No
--------	-------

14) General skin color of newborns

.....

SECTION C: OCULAR EXAMINATION

(Fill or tick where applies)

15) Is red reflex

a) Normal	b) Abnormal
-----------	-------------

16) Color of red reflex in R.E

a) Red	b) Orange	c) Orange- red	d) Light yellow
e) Light grey	f) Grey/ orange with black spots	g) Grey/ orange with black strips	h)Grey/ orange with superior crescent
i)Grey/ orange with inferior crescent	j) Leucokoria	k) No reflex	l) Grey -red
m) pale/ ischemia			

17) Color of red reflex in L.E

a) Red	b) Orange	c) Orange- red	d) Light yellow
e) Light grey	f) Grey/ orange with black spots	g) Grey/ orange with black strips	h)Grey/ orange with superior crescent
i)Grey/ orange with inferior crescent	j) Leucokoria	k) No reflex	l) Grey –red
m) pale/ ischemia			

18) Comparison between two eyes

a) Symmetry and homogenous	b) Asymmetry
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19) Indirect ophthalmoscopy findings for abnormal red reflex patients

Right eye

Eyelids	a)Normal position and function b) bruises c) edematous
Media	a)clear b) hazy
Conjunctiva	a)translucent b) sub conjunctival hemorrhage c)diffuse hyperemia d) ciliary injection
Cornea	a)transparent b) hazy
Iris	a)Normal b) incomplete regression of TVL c) others d) NVI
Lens	a)transparent b)vacuolated c)punctate opacity d)total opacity e)superior crescent f)inferior crescent g)others h)incomplete regression of TVL
Vitreous	a)clear b) Hazy
Disc	a)normal/pink b)blurred c)peripheral hemorrhage d)papilledema e)remnant of fetal hyaloid artery f)pale
Posterior pole blood v.	a)normal b)poorly developed c)perivascular bleeding d)dilated/torsuity
Macula	a)normal b)hemorrhage c)immature d)dysplastic e)pale/jaundiced
Peripheral retina	a)normal b)hemorrhage c) immature d)immature with ROP stage e) discrete pigmental lesion f) atrophic /pale/ ischemic
Additional findings	a)anophthalmia b) others c)no additional findings

Left eye

Eyelids	a)Normal position and function b) bruises c) edematous
Media	a)clear b) hazy
Conjunctiva	a)translucent b) sub conjunctival hemorrhage c)diffuse hyperemia d) ciliary injection
Cornea	a)transparent b) hazy
Iris	a)Normal b) incomplete regression of TVL c) others d) NVI
Lens	a)transparent b)vacuolated c)punctate opacity d)total opacity e)superior crescent f)inferior crescent g)others h)incomplete regression of TVL
Vitreous	a)clear b) Hazy
Disc	a)normal/pink b)blurred c)peripheral hemorrhage d)papilledema e)remnant of fetal hyaloid artery f)pale
Posterior pole blood v.	a)normal b)poorly developed c)perivascular bleeding d)dilated/torsuity
Macula	a)normal b)hemorrhage c)immature d)dysplastic e)pale/jaundiced
Peripheral retina	a)normal b)hemorrhage c) immature d)immature with ROP stage e) discrete pigmental lesion f) atrophic /pale/ ischemic
Additional findings	a)anophthalmia b) others c)no additional findings

20) What is the cause of abnormal red reflex?

a) persistent pupillary membrane	b) vacuolated lens	c) retinal hemorrhage grade 1 / 2 / 3
d) congenital cataract	e) Sclerocornea	f) congenital glaucoma
g) retinoblastoma	h) anophthalmia	i) syndromic baby
j) Vitreous hemorrhage	k)congenital hypertrophy RPE	l) ROP
m) Pathological jaundice	n) refractive error hyperopia/ myopia	o) bergmister papillae
p) others	q) normal RRT	

THANK YOU FOR YOUR PARTICIPATION

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES**Appendix II: Consent Form English Version****MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES****DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS****ID-NO.....****CONSENT TO PARTICIPATE IN THE STUDY**

My name is Dr. Hussein Abbas Tayebji; a resident in the department of Ophthalmology at MUHAS. I am conducting a study aimed at knowing the prevalence and causes of abnormal red reflex test in newborns at MNH.

STUDY PURPOSE

The study will determine the prevalence and causes of abnormal red reflex test in newborns seen at MNH. This is important for early diagnosis and intervention of ocular conditions that can lead to permanent visual disability if not detected and treated on time.

HOW TO BE INVOLVED

Mothers of newborns willing to participate in this study will be required to sign the consent form, then interviewed and followed by examination of the newborns.

CONFIDENTIALITY

The information obtained from the patient will be confidential. No name will appear on any document of this study instead identification numbers will be used therefore participation in this study will be anonymous.

PARTICIPATION AND RIGHT TO WITHDRAW

Involvement in this study is voluntary. You can participate or refuse to participate from this study. Refusal to participate from this study will not interfere with your treatment or that of your newborn baby.

BENEFITS

The information that you will provide, will help us in determining the proportion and causes of abnormal red reflex among newborns at MNH. Newborns found to have abnormal red reflex will be referred immediately to the ophthalmologist for further management.

For any concern please, contact personally to any of the following:

If you ever have questions about this study, you should contact the Principal Investigator, Dr. Hussein Abbas Tayebji, MUHAS, P. O. Box 65001, Dar es Salaam. Tel. +255713 584777. In case you have questions about your rights of participation in this study you may contact the Director of Research and Publications Committee, Dr. Bruno Sunguya, Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam. Tel: +255222150302. Dr. Suzan Mosenene who is the supervisor of this study. Tel. +255 689527952.

Participant agreement

Ihave read the contents in this form. My questions have been answered. I am willing to participate in this study.

Signature of mother..... Date..... Mobile no.....

Signature of Researcher Date.....

CHUO KIKUU CHA AFYA NA SAYANSI SHIRIKISHI MUHIMBILI



Appendix III: Consent Form Swahili Version

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho -----

RIDHAA YA KUSHIRIKI KWENYE UTAFITI

Naitwa Dkt. Hussein Abbas Tayebji, mwanafunzi katika idara ya macho chuo kikuu cha MUHAS, nafanya utafiti kuhusu muundo wa kuungaa macho tofauti kwa watoto waliozaliwa ndani ya mwezi mmoja na kujua nini iliyosabababisha huu tofauti na kuokoa upofu mapema katika Hospitali ya Taifa ya Muhimbili.

DHUMUNI LA UTAFITI

Dhumuni la utafiti huu ni kujua chanzo cha kusababisha macho kungaa tofauti na nini iliyosababisha huu tofauti ya kungaa. Pia kupatia matibabu mapema kuokoa upofu cha watoto wachanga

JINSI YA KUSHIRIKI

Ukikubali kushiriki katika utafiti huu, utaweka sahihi kwenye fomu ya idhini na utasajiliwa. Kisha utatakiwa kujibu maswali kutoka kwenye dodoso lililo andaliwa na baadaye utaendelea na uchunguzi na tiba kama kawaida.

USIRI

Taarifa zote zitakazo kusanywa kupitia dodoso hili zitakuwa ni siri. Jina lako halitatumika, badala yake tutatumia namba ya utambulisho kwahivyo ushirikaji wako kwa utafiti huu utakuwa haujulikani.

UHURU WA KUSHIRIKI NA HAKI YA KUJITOA

Kushiriki kwenye utafiti huu ni hiari. Unaweza kushiriki au kukataa kushiriki na hii haitakuondolea wewe au mtoto wako haki ya kupata matibabu yako.

MAWASILIANO

Kama una maswali kuhusiana na utafiti huu, wasiliana na mtafiti mkuu, Dkt. Hussein Abbas Tayebji, Chuo Kikuu cha Afya na Sayansi shirikishi Muhimbili, S. L. P. 65001, Dar es Salaam. Simu +255713 584777. Na kama una maswali kuhusu haki zako za kushiriki katika utafiti huu unaweza kuwasiliana na Dr. Bruno Sunguya, Mwenyekiti wa kamati ya Utafiti na Uchapishaji, Chuo kikuu cha Afya na Sayansi shirikishi Muhimbili, S.L.P 65001, Dar es Salaam. Simu +255222150302

Au msimamizi wa utafiti huu Dkt. Suzan Mosenene, Simu +255 689527952

Kama umekubali kushiriki weka sahihi

Mimi..... nimesoma maelezo ya fomu hii nimeyaelewa na nimekubali kushiriki katika utafiti huu.

Sahihi ya mama mzazi.....

Tarehe ya kutia sahihi.....

Namba ya simu

Sahihi ya mtafiti.....

Tarehe ya kutia sahihi.....