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Prevalence and Determinants of Retinopathy of Prematurity Among High-Risk Newborn Children in a Rural and Tertiary Care Centre

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Abstract

Background: Aim of this study is to calculate the prevalence and its various determinants associated with Retinopathy of Prematurity. To study demographic features, infant risk factors, association of stage of retinopathy with gestational age.

Material and Methods:A prospective analytical study of all high-risk newborns admitted to Kamineni Institute of Medical Sciences, Narketpally, from October 2020 to September 2022. Our study included 50 patients meeting the inclusion criteria. On 21st day or 1 month after birth, initial eye examinations were done.

Results: In present study, low gestational age, low birth weight, neonates with respiratory distress syndrome, surfactant therapy and oxygen therapy were found to be independent risk factors for development of ROP and no significant relationship found between gender and prevalence of ROP.

Conclusion: From the present study we conclude that the prevalence of Retinopathy of Prematurity was 42%, the data of this study suggest that, immature retina of preterm neonates are susceptible to insults that disrupt neurovascular growth, leading to Retinopathy of prematurity.

Keywords: Retinopathy, prematurity, newborn children, rural, Tertiary care centre.

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Introduction

Retinopathy causes preventable childhood blindness. Scar tissue behind the neonate lens and retinal detachment have caused the two major "epidemics" of blindness in neonates in contemporary times. Mid-1950s and late 1970s outbreaks occurred 25 years apart. Over the last 60 years since this disease was first correlated with prematurity by Terry in 1942, a plethora of literature has emerged on Retrolental Fibroplasia (RLF) and retinopathy of prematurity, what actually triggered the beginning of first epidemic was unmonitored oxygen supplementation in the late 1940's and 1950's in Europe and North America.[1-3] After this incident, overuse of oxygen was stopped and careful administration of oxygen was recommended. Second epidemic was faced by the developed countries, in premature and low birth weight babies (< 1000 gms at birth).[4]

India and the other developing countries come under the third epidemic which is characterized by severe retinopathy in bigger premature babies.[5] The reason again being

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lack of proper neonatal care and improper oxygen administration. Hence there is a need for strict guidelines of oxygen administration and monitoring and neonatologist play a major role in this aspect.

ROP is characterized by abnormal neovascular development in the retina of premature infants. These abnormal blood vessels are fragile and can leak or bleed, scarring the retina and pulling it out of position. This causes a tractional retinal detachment, which is the main cause of visual impairment and blindness in ROP.[6]

Aims and Objectives

Aim of this study is to calculate the prevalence and its various determinants associated with Retinopathy of Prematurity.

Objectives

To study demographic features, infant risk factors, association of stage of retinopathy with gestational age.

Material and Methods

A prospective analytical study of all high risk newborn admitted in NICU during the period of October 2020 to September 2022 at Kamineni Institute of Medical Sciences, Narketpally. For the purpose of our study 50 patients with Retinopathy of Prematurity fitting under the inclusion criteria of retinopathy were taken. Initial eye examinations – 21st day or within 1 month of birth was done. If weight is <1200gm or gestational age 24-30weeks then first screening was done at 2-3 weeks after birth.

Initial eye examinations – as soon as reference was given (32-35 weeks). Those with Retinopathy of Prematurity were examined every week or 2 weeks till regression occurred or till they reached threshold. Infants with normal vascularization up to the periphery are not examined again.

Study was carried out after approval by the Institutional ethical committee. Informed consents were obtained from the parents of the subjects. All infants were examined regularly by the ophthalmologist at 1-2 weeks intervals from the 4th postnatal week onwards. The eyes were dilated with a combination of cyclopentolate 0.1% and phenylephrine 0.1% eye drops applied one hour before the examination. Indirect ophthalmoscopy was performed with20 diopter lens aided with speculum and scleral depressor.

RESULTS

Out of 50 neonates screened; 27 were males, of which 13 (49%) had ROP and 23 were females, of which 8(34%) had ROP.

Among 50 neonates screened, 23 were between 28-32 weeks of gestation, out of which 14(61%) had ROP. 27 neonates were between 33-36 weeks of gestation, out of which 7(26%) had ROP

Table 1: birth weight & presence of retinopathy (n=50)

Retinopathy of prematurity	751-1000gms	1001-1250gms	1251-1500gms	1501-1750gms	1751-2000gms
Present	2(67%)	7(87.5%)	9(60%)	2(22%)	1(7%)
Absent	1(33%)	1(12.5%)	6(40%)	7(78%)	12(93%)
Total	3	8	15	9	15

Among 50 neonates screened between 751-1000gms,(67%) had retinopathy, between 1001 – 1250 gms,(87.5%) had retinopathy, between 1251-1500gms, (60%) had retinopathy, between 1501-1750 gms, (22%) had retinopathy, between 1751 – 2000 gms, (7%) had retinopathy.

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Table 2: Distribution based on treatment with supplemental oxygen (n=50)

Retinopathy of prematurity	Oxygen given	Oxygen not given	Total
Present	15 (60%)	6 (24%)	21
Absent	10 (40%)	19 (76%)	29
Total	25	25	50

Among 50 neonates screened 25 were given supplemental oxygen therapy, of which 15(60%) had retinopathy, 25 were not given supplemental oxygen therapy, of which 6 (24%) had retinopathy.

Table 3: Distribution based on treatment with exchange transfusion (n=50)

Retinopathy of prematurity	Exchange transfusion given	Exchange transfusion not given	Total
Present	4 (57%)	17 (60%)	21
Absent	3 (43%)	2 (40%)	29
Total	7	43	50

Among 50 neonates screened, 7 were treated with transfusion therapy, of which 4(57%) had retinopathy, 43 were not treated with transfusion therapy, of which 17(40%) had retinopathy.

Table 4: Distribution with respect to respiratory distress syndrome (n=50)

Retinopathy of prematurity	Respiratory distress syndrome present	Respiratory distress syndrome absent	Total
Present	15 (68%)	7 (25%)	22
Absent	7 (32%)	21 (75%)	28
Total	22	28	50

Among 50 neonates screened, 22 developed respiratory distress syndrome, of which 15 (68%) had retinopathy, 28 did not develop respiratory distress syndrome, of which 7(25%) had retinopathy.

Table 5: Distribution based on treatment with surfactant (n=50)

Retinopathy of prematurity	Surfactant given	Surfactant not given	Total
Present	15 (68%)	7 (25%)	22
Absent	7 (32%)	21 (75%)	28
Total	22	28	50

Among 50 neonates screened, 22 were treated with surfactant, of which 15 (68%) developed retinopathy, 28 were not treated with surfactant, of which 7 (25%) developed retinopathy.

Table 6: Severity of retinopathy of prematurity (n=50)

Stage of retinopathy of retinopathy	28-32 weeks	33-36 weeks
1	6 (48.2%)	3 (43%)
2	8 (57.1%)	4 (57%)
Total	14	7

Among 21 neonates who developed retinopathy; 14 were between 28-32 weeks, of which 6 (42.8%) were in stage 1, 8 (57.1%) were in stage 2. 7 were between 33-36 weeks, of which 3 (43%) were in stage 1, 4(57%) were in stage 2.

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DISCUSSION

Prevalence

Sno.	Studies	N	Prevalence
1	Oscar onyango et al (2018)	103	41.7%
2	Viviane levy lermann et al (2013)	114	27.2%
3	SK.vander merve et al (2013)	356	25.4%
4	Present study	50	42%

The prevalence of present study is 42%, which is similar to the prevalence in the study of OSCAR ONYANGO et al =41.7%

In our study, low-gestational age, low birth weight, oxygen therapy, respiratory distress syndrome and surfactant therapy were found to be risk factors for development of retinopathy independently.

Low gestational age:

S no.	Studies	Year	n	P value
1	Milad Azami et al	2018	226	<0.001
2	ALAA.A.nugudet al	2019	163	<0.0001
3	Anamika Dwivedi et al	2019	763	<0.001
4	Q.keraan et al	2017	313	<0.002
5	Present study	2021	50	0.01

As regard the effect of low-gestational age on occurrence of retinopathy, we found it as the most important risk factor in development of retinopathy.

Low Birth Weight

S.no	Studies	YEAR	N	p value
1	Sk.vander merve et al	2013	356	=0.0381
2	Q. keraan et al	2017	313	<0.001
3	Milad azami et al	2018	226	<0.001
4	Present study	2021	50	0.009

According to the present study among the 50 neonates screened, 3 were between 751-1000gms of birth weight, out of which 67% developed retinopathy and 33% did not develop retinopathy. In our study we found low birth weight to be significantly associated with development of retinopathy.

Supplemental Oxygen Therapy:

S.no	Studies	Year	N	p value
1	Milad Azami et al	2018	226	<0.05
2	Alaa. A. Nugud et al	2019	163	<0.0001
3	Present Study	2021	50	0.0099

Oxygen therapy was an independent risk factor for the development of retinopathy. Present study found a significant relationship between the occurrence of retinopathy and use of oxygen therapy. This has been supported by the studies of Abdel. H .A. A. Hakeem et al, Milad Azami et al, Alaa. A. Nugud et al.(Ref)

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Blood Transfusions:

S.no	Studies	Year	n	p value
1	Joao Borges Fortes Filho	2009	353	0.01
2	Abdel H.A.A Hakeem et Al	2012	172	0.03
3	Present Study	2021	50	0.38

Present study shows an insignificant relationship between blood transfusions and development of retinopathy which was supported by study HARESH KIRPALANI (p=0.25)
But this was in disagreement with other studies like ABDEL.H.A.A.HAKEEM et al, DEEPAK et al, JOAO BORGES FORTES FILHO et al.
While Hirano et al. stated that it is controversial and iron overload rather than number of transfusions may contribute to the development of retinopathy. [15]
Exchange transfusions has mixed reviews in developing retinopathy. Early studies have shown that neonates receiving exchange transfusions or multiple blood transfusions were at a higher risk of developing retinopathy. In present study out of 21 neonates who developed retinopathy only 4 received exchange transfusions.
Thus, the present study doesn't not show any significant relationship between exchange transfusions and development of retinopathy.

Respiratory distress syndrome:

S. No	Studies	Year	N	P Value
1	Abdel.H.A.A et al	2012	172	0.312
2	Milad Azami et al	2018	226	0.036
3	Anamikadwivedi et al	2019	763	0.09
4	Present Study	2021	50	0.002

A significant association was found between development of retinopathy and neonates with respiratory distress syndrome. In present study, among 22 neonates who were developed respiratory distress syndrome, 68% developed retinopathy32% did not develop retinopathy. Out of 50, 28 neonates did not develop respiratory distress syndrome, among which 7 neonates developed retinopathy. The same was supported by other studies of MILAD AZAMI et al, ANAMIKA DWIVEDI et al, and related this to the fact that systemic hypoxia results in retinal hypoxia and more need for oxygen therapy.

Surfactant Therapy:

S. No.	Studies	Year	n	p value
1	J.U. mtermote et al	2005	275	0.02
2	ALAA.A.nugud et al	2009	163	<0.05
3	Joao borges fortes filho et al	2009	353	0.09
4	Present study	2021	50	0.002

Present study found a significant association between surfactant therapy and development of retinopathy, which is supported by studies JUM TERMOTE et al, JOAO BORGES FORTES FILHO et al. In present study among 50 neonates, 22 were treated with surfactant therapy, out of which 68%developed retinopathy. 28 neonates were not treated with surfactant therapy, of which 25% developed retinopathy. Hence showing that treatment with surfactant therapy has a significant relationship with development of retinopathy.
Retinopathy was seen in 67% of infants between 751,1000gms, 87.5 % of neonates between 1001,1250gms, 60 % of neonates between 1501,1750gms, and 7% of neonates between 1751,2000gms.

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Fifteen of the fifty neonates tested had retinopathy; of the twenty-five who had supplemental oxygen therapy, sixty percent did; of the twenty-five who did not, twenty-four percent did. Of the 50 neonates tested, 7 received transfusion therapy, and 4 (57%) had retinopathy. Of the remaining 43 neonates, 17 (40%) had retinopathy but did not get transfusion therapy. From the initial group of 50 neonates, 22 were diagnosed with RDS and 15 (68%) had retinopathy; of the remaining 28 newborns, 7 (25%) were found to have retinopathy.

Fifteen of the twenty-two newborns who received surfactant treatment (68%) and seven of the twenty-eight who did not (25%) acquired retinopathy during the screening. Sixty-two percent (62%) of the 21 neonates with retinopathy were diagnosed between 28 and 32 weeks of age; among them, eight were diagnosed at the Stage 2 level (57 weeks). Three (43%) were in stage 1, and four (57%) were in stage 2, among the seven who were between 33 and 36 weeks.

The current study found that 67% of the neonates tested who had a birth weight between 751, 1000 gms and 33% of those who had a birth weight below 751, 1000 gms acquired retinopathy. We found that a substantial correlation existed between low birth weight and the onset of retinopathy. There was a correlation between oxygen therapy and retinopathy, but it was not a causative factor. In the current investigation, researchers discovered a strong correlation between retinopathy and the administration of oxygen. The research of Abdel. H.A. A. Hakeem et al., Milad Azami et al., and Alaa. A. Nugud et al. supports this.

The present study shows a statistical correlation between the development of retinopathy of prematurity and low gestational age, low birth weight, neonates having respiratory distress syndrome and those who received oxygen therapy and surfactant therapy, on performing chi-square test. Other factors like exchange transfusions and severity of retinopathy of prematurity were also considered in this study which did not show any significant statistical correlation with the development of retinopathy.

CONCLUSION

From the present study we conclude that the prevalence of retinopathy in this study was 42%, the data of this study suggest that low gestational age, low birth weight, oxygen therapy, surfactant therapy, respiratory distress syndrome are independent risk factors in the development of retinopathy. The immature retinas of preterm neonates are susceptible to insults that disrupt neurovascular growth, leading to retinopathy of prematurity. Suppression of growth factors due to hyperoxia and loss of the maternal-fetal interaction result in an arrest of retinal vascularization. The analysis of risk factors for retinopathy development will help to understand and predict it in severe preterm infants. Since retinopathy may produce serious sequelae up to complete blindness, all efforts must be made to prevent the development of advanced retinopathy through the elimination of preterm births, changes in the neonatal care, and improvement in detection of threatening retinopathy markers. The timely retinal screening of high-risk preterm infants is important to prevent the development of advanced retinopathy.

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