



ORIGINAL ARTICLE

## Oxygen administration for the prevention of retinopathy in prematurity: knowledge and care of the nursing staff\*

### Administración de oxígeno para la prevención de retinopatía en el prematuro: conocimientos y cuidados del personal de enfermería

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#### ABSTRACT

**Introduction:** retinopathy of prematurity is an alteration of the blood vessels of the immature retina, which appears in premature newborns during the first weeks of life, and causes ocular alterations that partially or totally impede visual development.

**Objective:** to analyze the relationship between the level of knowledge about oxygen administration and nursing care for the prevention of retinopathy of the premature neonate.

**Methods:** an observational, descriptive, cross-sectional study was carried out between the months of July-October 2021 in the Neonatology service of a health institution of the Autonomous City of Buenos Aires. The sample consisted of 32 nurses. It was used as the instrument proposed by Rosales Sandoval. A set of nursing records were analyzed and a checklist was applied to determine the nursing care in the prevention of retinopathy in the premature neonate.

**Results:** a prevalence of the female sex was evidenced with 78,1 %. The average age was  $44,09 \pm 13,12$ , with the mode at 50. 46,9 % of the respondents had a Bachelor's degree in Nursing. 43,75 % of those surveyed obtained at least 60 % of the correct answers. 68,75 % of the sample met all the indicators in the checklist of nursing records.

**Conclusions:** In light of these results, we can affirm that the institution does not have a trained staff that allows the development of a nursing role for the prevention of retinopathy, however, the quality of the nursing records was not deficient, which that did not have a significant correlation between the level of knowledge and the quality of the records.

**Keywords:** Knowledge; Nursing Care; Retinopathy of Prematurity.

#### RESUMEN

**Introducción:** la retinopatía del prematuro es una alteración de los vasos sanguíneos de la retina inmadura, que aparece en recién nacidos prematuros durante las primeras semanas de vida, y provoca alteraciones oculares que impiden el desarrollo visual parcial o totalmente.

**Objetivo:** analizar la relación que existe entre el nivel de conocimiento sobre administración de oxígeno y el cuidado de enfermería para la prevención de la retinopatía del neonato prematuro.

**Método:** se realizó un estudio observacional, descriptivo, de corte transversal entre los meses de julio-octubre de 2021 en el servicio de Neonatología una institución de salud de la Ciudad Autónoma de Buenos Aires. La muestra se conformó con 32 enfermeros. Se utilizó como instrumento propuesto por Rosales Sandoval. Se analizaron un conjunto de registros de enfermería y se les aplicó una lista de cotejo para determinar el cuidado de enfermería en la prevención de la retinopatía en el neonato prematuro.

**Resultados:** se evidenció una prevalencia del sexo femenino con el 78,1 %. La edad promedio fue de  $44,09 \pm 13,12$ , con la moda en 50. El 46,9 % de los encuestados tenía el título de Licenciatura en Enfermería. El 43,75 % de los encuestados obtuvo al menos el 60 % de las respuestas correctas. El 68,75 % de la muestra cumplió con todos los indicadores en la lista de cotejo de los registros de enfermería.

**Conclusiones:** a la luz de estos resultados podemos afirmar que en la institución no cuenta con un personal capacitado que permiten el desarrollo de un rol de enfermero para la prevención de retinopatía, no obstante, la calidad de los registros de enfermería no fue deficiente, lo que no tuvo una correlación significativa entre el nivel de conocimiento y la calidad de los registros.

**Palabras clave:** Conocimiento; Cuidado de Enfermería; Retinopatía del Prematuro.

## INTRODUCTION

Retinopathy of prematurity (ROP) is an alteration of the blood vessels of the immature retina, which appears in premature newborns during the first weeks of life, and causes ocular alterations that partially or totally prevent visual development.<sup>(1)</sup>

When a premature birth occurs, normal retina vasculogenesis may be altered. A multiplicity of factors can cause a preliminary disruption, and then an abnormal growth of the retinal vessels producing ROP.

ROP was first described in 1940 by Terry as Retrolental Fibroplasia and then in 1950, Heath reaffirmed the term ROP because the trigger factor for that pathology was directly related to oxygen (O<sub>2</sub>). In the sixties and eighties there were major progress in Neonatology service, regarding oxygen therapy and implementing a highly effective instrument as the pulse oximeter.<sup>(2)</sup>

Retinopathy of prematurity is a vasoproliferative disease which affects preterm newborns (PTNB) and occurs at the time of vascular development and maturation. In the 1950s, this pathology was associated with a high and uncontrolled oxygen supply consequently, that fact led to a strict control of oxygen by restricting the use of it in the Neonatology Units. PTNB incidence rate decreased drastically by administering a controlled oxygen supply. However, the number of neonatal deaths increased due to respiratory and neurological complications. In the 1980s, advances in neonatal care techniques and methods have allowed a higher survival of less gestational age (<27 weeks) and lowest birth weight (<1.000 g) PTNB. Therefore, those premature babies are at greater risk of RP. Although some studies pointed out an increase in the prevalence of the most severe forms of RP. In some developing countries a decrease in incidence, severity and disease progress was shown in recent studies.<sup>(3)</sup>

The International Classification of Retinopathy of Prematurity (ICROP) described the degrees of RP severity based on four parameters: localization, stage, spread and the presence of plus disease. That classification, which was examined and slightly modified in the year 2021, unified criteria and improved the implementation of major multicenter research trials contributing to enhance the knowledge of the pathogenesis of the disease.<sup>(4)</sup>

Oxygen has become a fundamental and necessary element for the advancement of industries and sciences, especially medicine. This element is highly used in order to improve oxygen dependent patients' conditions due to several pathologies.<sup>(5)</sup>

The enzymatic devices by which oxygen is controlled are still avoiding the accurate specification of an injury mechanism. On a biochemical level, oxygen is both essential for the survival of organisms as well as capable of destroying cells in an insidious way.<sup>(6)</sup>

Oxygen is well-known for causing ROP. Nonetheless, it is neither unnecessary nor enough to develop that disease. One of the main issues is to better characterize the relationship among exposure, duration and oxygen saturation at a clinical level.<sup>(6)</sup>

ROP occurs mainly in preterm infants with severe neonatal development due to a variety of risk factors such as: unmonitored supplemental oxygen supply, lack of lung maturation with prenatal corticosteroids, intrauterine growth restriction (IUGR), postnatal malnutrition, sepsis and blood transfusions.<sup>(7)</sup>

In most cases, ROP can be prevented in Neonatal Intensive Care Units (NICU) that have adequate infrastructure and trained personnel who can handle perinatal behaviors correctly as well as risk factors.<sup>(7)</sup>

Primary prevention of ROP consists of promoting birth in maternity wards that have the infrastructure, biomedical supplies, technology, and well-trained personnel to assist at the time of birth.<sup>(8)</sup>

One of the first measures neonatal nursing staff must take is hand washing before any procedure. A perfect hand washing prevents hospital-acquired infections. In addition, personnel must check all types of equipment before a newborn is about to be connected. It is essential that nurses administer heated, humidified and mixed oxygen and avoid administering pure oxygen.<sup>(8)</sup>

Preterm newborns (PTNB) present anatomical and physiological conditions which make them particularly susceptible to oxygen therapy effects. Therefore, care must take into account three crucial aspects: to establish the need with certainty, to implement the treatment with accuracy, and to prevent complications.<sup>(9)</sup>

It is critical to use a pulse oximeter to monitor blood oxygen saturation at birth in order to determine the need for oxygen. That need is determined by comparing the obtained value with a table of expected ones.<sup>(10)</sup>

Clinical assessment allows one to evaluate the need of oxygen administration. To implement the delivery of a PTNB, either a clinical expertise and the ability on the assessment are required in accordance with an in-depth understanding of the transition and the principle that the less is more, as well as meeting deadlines, since the PTNB take longer to reach a 85 % oxygen saturation.<sup>(10)</sup>

This investigation is intended to offer an adequate, timely, efficient and effective support for each preterm who needs oxygen administration to prevent blindness. On preterm newborns is a continuous challenge for the nursing staff that must execute all their skills for oxygen supply, therefore, saving the sight of each preterm shows the importance of assessing the implementation of ROP protocol.

The aim of this article is to analyze the relationship between the level of knowledge about oxygen administration and nursing care for the prevention of retinopathy of the premature neonate.

## **METHOD**

An observational, descriptive, cross-sectional study was carried out between the months of July-October 2021 in the Neonatology service of a health institution of the Autonomous City of Buenos Aires. The sample consisted of 32 nurses who constituted the units of analysis, selected by a non-probabilistic convenience sample.

*Inclusion criteria:* Nursing staff with a nursing degree, a bachelor's in nursing or postgraduate degree, with more than 6 months of seniority in the institution.

*Exclusion criteria:* Personnel who did not agree to participate in the study and did not have contact with patients in their professional activities within the institution.

*Data collection instrument:* the instrument used, proposed by Rosales Sandoval<sup>(11)</sup> has two dimensions: General data about sociocultural factors of the nursing staff and level of knowledge about ROP. furthermore, a set of nursing records were analyzed and a checklist was applied to determine the nursing care in the prevention of retinopathy in the premature neonate.

The survey was anonymous and was applied after the informed consent approval, where it was clear the commitment to not share any data with third parties by the researcher, who also committed to not disclose any data that reveals the respondents' identity.

*Ethical aspects:* The survey was anonymous and administered after the approval of the informed consent, in which the researcher's commitment to not disclose data that would allow the identification of the respondents was made clear.

*Statistical analysis:* Microsoft Excel and MedCalc were used for the statistical processing. The Spearman correlation coefficient was used in order to analyze if there was a relation among variables. The significance cutoff was  $p < 0,05$ .

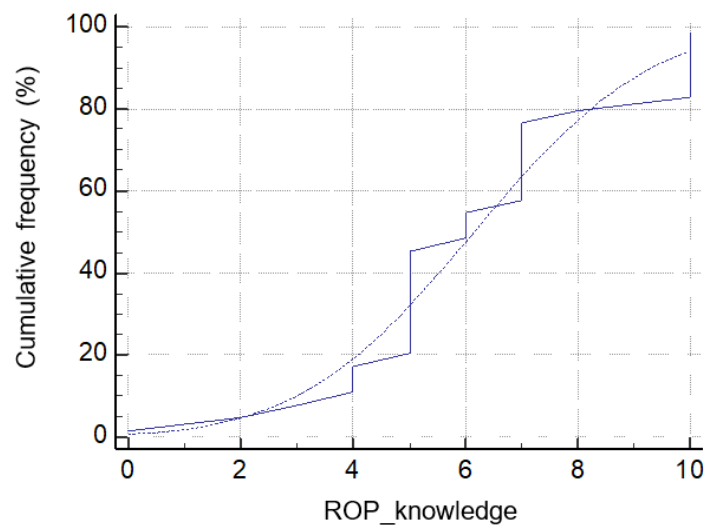
## RESULTS

Distribution of socio-demographic variables shows a prevalence of females (78,1 %) (table 1). The mean age was  $44,09 \pm 13,12$  (mode = 50). Almost half of the respondents (46,9 %) declared to have a bachelor's degree in Nursing. On the other hand, the rest 40,6 % were professional Nurses. The mean years since graduation were  $14,50 \pm 11,9$ .

**Tabla 1. Sample distribution according to socio-demographic variables**

Variables	N	%	Kolmogorov-Smirnov Test
<b>Gender</b>			
Female	25	78,1	p<0,001
Male	7	21,9	
<b>Age</b>			
Mean	44,09		p=0,0845
Standard Deviation	13,12		
Median	43,50		
Mode	50		
<b>Level of education</b>			
Nursing Assistant	2	6,3	p<0,001
Nurse	13	40,6	
Bachelor's Degree in Nursing	15	46,9	
Master's Degree in Nursing	2	6,3	
<b>Years since Graduation</b>			
Mean	14,50		p<0,001
Standard Deviation	11,90		
Median	11,00		
Mode	5		

Fuente: Encuesta.



**Figure 1. Cumulative Frequency Distribution of ROP survey**

When the results of the questionnaire were calculated, we found 43,75 % of the respondents answered correctly, at least 60 % of them. Figure 1 shows the cumulative frequency distribution in relation to this questionnaire in the studied sample.

Figure 2 shows the distribution by quartiles of the applied checklist results to a set of nursing records of this nursing staff, where 68,75 % of the sample fitted into all the indicators.

There is only one statistically significant correlation among the solely socio-demographic variables, which does not have any greater involvement in the survey. Correlational values are shown in Table 2.

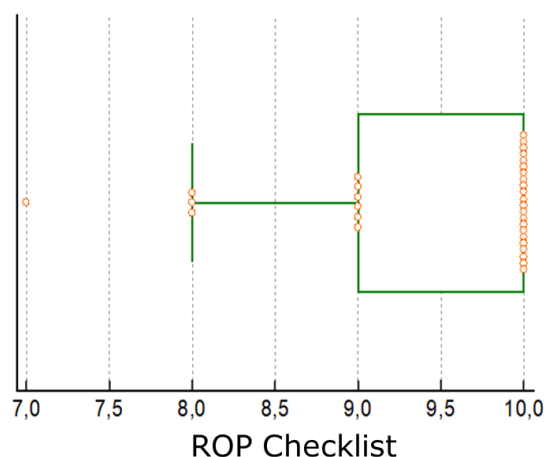


Figure 2. Distribution of positive responses on the ROP Checklist  
Source: Survey.

Tabla 2. Coeficiente de correlación de Spearman y nivel de significación estadística entre las variables analizadas

Variables	Gender	Age	Level of Education	Graduation Year	ROP Knowledge	Checklist
Gender	-					
Age	-0,521; p=0,0022	-				
Level of Education	-0,472; p=0,0064	0,410; p=0,0199	-			
Graduation Year	0,165; p=0,3676	-0,773; p<0,0001	-0,248; p=0,1717	-		
ROP Knowledge	0,0794; p=0,6658	-0,115; p=0,5311	-0,300; p=0,0958	0,0420; p=0,8196	-	
Checklist	0,165; p=0,3661	-0,0685; p=0,7094	-0,150; p=0,4134	0,0795; p=0,6653	0,127; p=0,4893	-

Source: Survey.

## DISCUSSION

According to the newborn's condition, the nursing staff in the neonatology area should set expectations to address the factors affecting the infant's survival within a reasonable time. The sooner the risk factor is eliminated (oxygen therapy as initial treatment due to the immaturity of the respiratory system), the more beneficial it will be for the newborn to adapt to life.<sup>(12)</sup>

Oxygen was introduced in the neonatal clinical practice due to the absence of randomized distribution studies. Moreover, oxygen is not systematically well-measured on a daily basis even today that SpO<sub>2</sub> monitors exist it. However, oxygen, is one of the most frequently used treatments at the NICU without restrictions or supervision. If we recommend 'some lower oxygen saturation' without a controlled and reliable test, we can either sentence to death or lead to severe disability to a higher number of children apart from the ones that could be saved from blindness. Nevertheless, using only 'lower oxygen saturation' is insufficient to prevent or eliminate errors.<sup>(13)</sup>

Retinopathy of the prematurity is a deplorable growing global concern currently. Moreover, ROP is a persistent complication that can potentially damage sight in children with a very low gestational age (GA < 28 weeks) in industrialized countries as well as in preterm newborns with heavier birth weight and higher gestational age at birth in developing countries. Visual development is compromised after severe retinopathy of prematurity, even if it is treated. Furthermore, retinopathy is one of the most common causes of blindness. Consequently, ROP could be prevented by combining efforts from the research field as well as from clinical practice.<sup>(13)</sup>

Nursing staff knowledge is based on scientific insights which allow professionals to fortify all their practices and thus perform their duties properly. This also ensures the welfare of the hospitalized neonate at neonatal units.<sup>(14)</sup>

Less than half of the respondents had sufficient knowledge about oxygen administration to prevent retinopathy of the preterm newborn. This could probably be due to a lack of engagement and training of the nursing staff who work at neonatal units. However, we cannot discard other factors such as education level, age, gender, or other socio-demographic variables.

The results of our investigation differ from those encountered by Soloa and col.<sup>(15)</sup> who reported that a large number of the staff that works at the service are well aware in terms of prevention, the consequences of an improper use of the oxygen, the management of the gas flow, and the optimal saturation values.

Similarly, these are differences between our results and the ones presented by Pereyra and col.<sup>(16)</sup> in the research study known as "Nursing staff knowledge of preterm newborn management", where 84 % of the staff has the expertise on the management of the newborn that receives oxygen therapy.

In a study made at Neonatal Intensive Care Units of Dr. H. Notti Hospital at Mendoza, Ordoñez and col.<sup>(17)</sup>, found out that 73 % of the nurses in the mentioned service own the expertise about oxygen administration as priority to maintain an open airway, results which also differ from the ones encountered in the current investigation.

Every institution should seek to teach permanent comprehensive knowledge regarding ROP prevention and its pathophysiology, how to perform an early diagnosis, good nursing practices which must include administering and handling oxygen as a drug, as well as knowing guidelines and national programme regulations.

It is remarkable that beyond the poor knowledge about ROP, a considerable number of nursing staff meet the quality records and the checklist applied to the sample. However, we must consider that quality records and staff actions must not be partial in any way but complete. It is important to highlight the absence of any relation between the knowledge about ROP and the quality records applied through the checklist.

The nursing role lies in taking action, mainly, in the primary prevention, in coordinating the effort of all the staff to prevent ROP development and its critical stage in those patients that are showing the first signs and symptoms of this disease.

It is necessary to maintain control and comply with the National Ministry of Health's recommendations regarding oxygen saturation in preterm newborns, as well as to evaluate the need for oxygen saturation requirements of patients undergoing treatment.<sup>(15)</sup>

Altogether, these results provide support to the premise that most of the nursing staff has a poor knowledge level, which could lead to not contribute to an early recovery of the hospitalized neonate because of the insufficient care given by them at neonatal units. As a consequence of the improper management of the oxygen administration to the hospitalized neonate, retinopathy of the prematurity is considered one of the highest risk complications.

Observations have demonstrated that, in most cases, the most important thing is not what we see but everything we do not see. This can be applied to what happens to many children in delivery rooms or the NICU all over the world in relation to the oxygen dose, the oxygenation, and the retinopathy of the prematurity.<sup>(13)</sup>

## CONCLUSIONS

In the light of the present research, we can assure that the chosen institution does not have a trained staff to prevent retinopathy which could be limited by the lack of consensus on the staff action and the training. Although the quality records of nursing were not poor, there was not a significant correlation between the knowledge level and the quality records.

To conclude, we believe it is vital to address important topics such as to develop a detailed protocol, proper oxygen administration, and the evaluation of the difficulties on its administration as well as the consequences that oxygen therapy causes without any specific supervision.

## REFERENCES

1. Curbelo Quiñones L, Durán Menéndez R, Villegas Cruz DM, Broche Hernández A, Alfonso Dávila A. Retinopatía del prematuro. *Revista Cubana de Pediatría* 2015;87:69-81.
2. Palacios PT. Retinopatía de la prematuridad? Qué debe saber el pediatra. *Anales de Pediatría Continuada* 2014;12:10-6.
3. Blanco Teijeiro MJ. Retinopatía de la prematuridad. *Archivos de La Sociedad Española de Oftalmología* 2006;81:129-30.
4. Chiang MF, Quinn GE, Fielder AR, Ostmo SR, Paul Chan RV, Berrocal A, et al. International Classification of Retinopathy of Prematurity, Third Edition. *Ophthalmology* 2021;128:e51-68. <https://doi.org/10.1016/j.optha.2021.05.031>.
5. Domínguez Dieppa F. Reanimación neonatal y la medicina basada en la evidencia. *Revista Cubana de Pediatría* 2011;83:323-6.
6. Ramos Tercero JA, Colchero A, Folch Pi A. *Clínicas pediátricas de Norteamérica*. México D.F.: Nueva editorial Interamericana; 1987.
7. Chattas G. El rol de enfermería en la prevención de la retinopatía del prematuro. *Oceano Medicina - Magazine* 2020. <https://magazine.oceanomedicina.com/actualidad/el-rol-de-enfermeria-en-la-prevencion-de-la-retinopatia-del-prematuro> (accessed November 6, 2021).
8. Erpen N. Enfermería: un pilar fundamental en la prevención primaria de la retinopatía del prematuro (ROP). *Medicina Infantil* 2008;15:200-3.
9. Jonusasb SF, Funesc S, Galettod S, Herrerab S, Juárez CE, Lewf A, et al. Manejo del dolor en Neonatología. *Arch Argent Pediat* 2019;117:180-94.
10. Ministerio de Salud de Neuquén. *Nuevas generaciones de oximetría de pulso en Neonatología*. Neuquén: Ministerio de Salud de Neuquén; 2020.
11. Rosales Sandoval FC. *Conocimiento sobre administración de oxígeno y cuidado de enfermería para la prevención de retinopatía en el prematuro*. Tesis de Especialidad. Universidad Nacional de Trujillo, 2019.
12. Castro F, Urbina O. *Manual de Enfermería en Neonatología*. La Habana: ECIMED; 2007.
13. Sola A, Chow L, Rogido M. Retinopatía de la prematuridad y oxigenoterapia: una relación cambiante. *Anales de Pediatría* 2005;62:48-63. <https://doi.org/10.1157/13070182>.
14. Samorán Aguilar JR. *Conocimientos que posee el personal de enfermería del servicio de Ginecoobstetricia sobre el síndrome depresivo postparto*, Hospital Regional Escuela Dr. Ernesto Sequeira Blanco, Bluefields, I Semestre 2017. Tesis de Grado. Universidad de San Carlos, 2017.

15. Soloa MN, Tapia MD. Cuidados de enfermería en neonatos con oxigenoterapia en la prevención de retinopatía (ROP). Tesis de Grado. Universidad Nacional de Cuyo. Facultad de Ciencias Médicas. Escuela de Enfermería., 2013.

16. Pereyra C, Méndez V, Saavedra A. Conocimiento que posee el personal de enfermería sobre el manejo del recién nacido prematuro. Tesis de Grado. Universidad Nacional de Cuyo. Facultad de Ciencias Médicas. Escuela de Enfermería., 2013.

17. Ordoñez M, Rios M, Sánchez S. Rol del enfermero de neonatología en la administración de oxigenoterapia. Tesis de Grado. Universidad Nacional de Cuyo. Facultad de Ciencias Médicas. Escuela de Enfermería., 2014.

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#### **CONFLICT OF INTEREST**

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#### **AUTHORSHIP CONTRIBUTION**

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*Formal analysis:* Clara Elena Yacquet.

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*Methodology:* Clara Elena Yacquet.

*Project administration:* Clara Elena Yacquet.

*Resources:* Clara Elena Yacquet.

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*Writing - revision and editing:* Clara Elena Yacquet.