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ORIGINAL

Behavior of ventilatory modalities in the Neonatology Service

Comportamiento de las modalidades ventilatorias en el Servicio de Neonatología

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ABSTRACT

In recent years the survival of high risk and sick newborns has increased, these neonates require special intensive care and their life depends, in many occasions, on ventilatory support. With the aim of describing the behavior of invasive and non-invasive modalities of mechanical ventilation in the Neonatology Service of the "Iván Portuondo" Hospital during the period from January 2020 to July 2021. We conducted a descriptive, retrospective, longitudinal study in which our universe was 597 newborns who required admission to the neonatal intensive care unit, and as a sample 112 of them who required assisted ventilation, during the period covered by the research. The invasive or non-invasive modalities were related to variables such as: gestational age, sex, birth weight, reasons and complications of ventilation, in addition to the duration of ventilation and survival of these newborns. It was possible to conclude that the application of the invasive modality predominated in male newborns weighing less than 1500 g and with a gestational age of less than 30 weeks. Coinciding with the literature, Hyaline Membrane Disease remained as the first cause requiring the use of mechanical ventilation, it has been possible to shorten the ventilation time, and there were fewer complications and better survival in the non-invasive modality.

Keywords: Artificial Respiration; Newborn Infant.

RESUMEN

En los últimos años la supervivencia del recién nacido de alto riesgo y enfermo ha aumentado, estos neonatos requieren cuidados intensivos especiales y su vida depende, en muchas ocasiones, de un soporte ventilatorio. Con el objetivo de describir el comportamiento de las modalidades invasivas y no invasivas de la ventilación mecánica en el Servicio de Neonatología del Hospital "Iván Portuondo" durante el período de enero 2020 a julio de 2021. Se realizó un estudio descriptivo, retrospectivo, longitudinal en el que nuestro universo fue 597 recién nacidos que requirieron ingreso en la unidad de cuidados intensivos neonatales, y como muestra 112 de ellos que requirieron ventilación asistida, durante el periodo que abarcó la investigación. Se relacionaron las modalidades invasivas o no, con variables como: edad gestacional, sexo, peso al nacer, motivos y complicaciones de la ventilación, además de la duración en ventilación y sobrevida de estos recién nacidos. Pudiendo concluir que predominó la aplicación de la modalidad es invasivas, en el recién nacido del sexo masculino con peso menor de 1500 g y con una edad gestacional menor de 30 semanas. Coincidiendo con la literatura, la Enfermedad de la Membrana Hialina se mantuvo como primera causa que requirió el uso de ventilación mecánica, se ha logrado acortar el tiempo de ventilación, y hubo menos complicaciones y mejor sobrevida en la modalidad no invasiva.

Palabras clave: Respiración Artificial; Recién Nacido.

INTRODUCTION

The biblical account of the creation of life posits that God shaped humanity from the dust of the earth and infused the breath of life into them.[1] This underscores the significance of respiration from the inception of our existence. It is imperative to enhance our comprehension of respiratory disorders during this critical phase and refine artificial ventilation methodologies to enhance the survival prospects of newborn infants requiring such intervention.

Ventilatory support encompasses the process of administering gases into and out of the lungs through an external apparatus directly linked to the patient. The pioneering experiments of Hippocrates involving tracheal intubation for ventilation support went largely unnoticed for centuries, then the 16th-century contributions of Paracelsus, who reported the use of oral tubes for this purpose, marked a notable turning point. The study of respiratory physiology and ventilatory techniques experienced a renaissance during the scientific advancements of the 16th and 17th centuries. In the 1800s, there was an increase of interest in resuscitation and mechanical ventilation, with nasotracheal intubation being introduced as an adjunct to mechanical ventilation. By the mid-19th century, the development of the first specialized apparatus designed for neonatal resuscitation and short-term ventilation became a milestone in the evolution of ventilatory assistance.[2]

In 1929, Drinker introduced the negative pressure ventilator for adults, subsequently paving the way for the development of positive pressure ventilators. Although isolated cases of mechanical ventilation in neonates had been documented since the 1940s, it took several years for the development of suitable neonatal ventilators. Early in the 20th century, mechanical ventilation was incorporated as a standard practice to facilitate the restoration of normal breathing in humans. In this historical context, Donald and Lord played pioneering roles in elucidating mechanical ventilation techniques for newborns experiencing severe respiratory distress, employing cycled equipment and servo-controlled respirators.[3]

Over the subsequent 25 years, Donald and Lord dedicated their efforts predominantly to experimental work and technological advancements. In the 1970s, there was a pivotal evolution in intermittent positive pressure ventilation (IPPV) for newborns with the advent of nasotracheal intubation, obviating the necessity for tracheostomy. Prior to the 1960s, newborns afflicted with severe lung disease faced elevated mortality rates, as therapeutic options were confined to general supportive measures. However, the introduction of mechanical ventilation for neonates at peril of succumbing marked a turning point, yielding enhanced survival rates.[4]

In Cuba, mechanical ventilation was introduced in the 1970s, and substantial data regarding morbidity and survival indicators in mechanically ventilated newborns have been meticulously gathered. The techniques and equipment employed at the Port Royal Hospital in Paris were adopted by specialized neonatologists and nurses, leading to the William Soler Hospital's distinction as the pioneering center for implementing mechanical ventilation in newborns. In that same year, the continuous positive airway pressure (CPAP) modality was used for treating respiratory distress syndrome, resulting in a noteworthy reduction in mortality associated with Hyaline Membrane Disease.[5,6]

In 1974, a ventilation service was established, and two years later, the Continuous Positive Airway Pressure (CPAP) modality was introduced, significantly enhancing neonatal survival rates. Nonetheless, it was not until 1984 that the Intermittent Positive Pressure Ventilation (IPPV) modality was incorporated. In 2005, spontaneous modes (A-C and SIMV) were introduced. It is worth noting that, despite these commendable advancements, the High-Frequency Oscillatory Ventilation (HFOV) modality is yet to be integrated into the Neonatal Intensive Care Unit (NICU).[7]

Advancements in mechanical ventilation apparatus and the utilization of exogenous surfactant, among other approaches, have played a pivotal role in improving the survival rates of newborns afflicted with Respiratory Distress Syndrome. An important objective in neonatal intensive care has been the reduction of the duration of endotracheal intubation or its complete avoidance, considering the associated complications and substantial costs involved. To address this, Continuous Positive Airway Pressure (CPAP) administered through nasal prongs has been employed as a less invasive method for delivering respiratory support to neonates at risk of respiratory failure.[8,9]

Neonatal mortality serves as a sensitive gauge of the quality of maternal and child healthcare. The reduction of neonatal mortality is intricately linked to the enhancement of neonatal care. Mechanical ventilation serves as a valuable metric for assessing the caliber of such care. In Cuba, the mechanical ventilation rate in enclosed facilities has fluctuated within the range of 1,0 % to 1,5 % over the past five years, with rates exceeding 2 % noted in the Neonatal Intensive Care Unit situated in San Antonio de los Baños. These statistics have prompted the undertaking of the present study.[10]

In recent years, there has been an upsurge in the survival rates of neonates at high risk and those afflicted by critical illnesses, escalating the demand for specialized intensive care to address the growing intricacy of associated complications. In numerous instances, the survival of these neonates hinges on ventilatory support. Although the advantages of such life-sustaining ventilation are indisputable, it is imperative to acknowledge that it is not without its inherent risks and potential complications, encompassing alveolar injury, pulmonary

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edema, inflammatory responses, and fibrotic sequelae.[4]

Mechanical ventilation plays a pivotal role in neonatal resuscitation, annually preserving the lives of approximately one million newborns.[11] Neonates with low birth weight comprise a mere 1 % of all births; however, they constitute 60 % of neonatal mortality and 40 % of infant mortality. Predominant factors underlying neonatal mortality encompass asphyxia, pneumonia, and congenital malformations, exhibiting elevated prevalence in developing nations. Fortunately, neonatal mortality has decreased due to the evolution of innovative techniques associated with mechanical ventilation and other advances in neonatal healthcare.[10]

Respiratory disorders necessitating mechanical ventilation in neonates encompass conditions such as respiratory distress syndrome of the premature, pulmonary infections, asphyxia, meconium aspiration syndrome, pulmonary hypoplasia, and diaphragmatic hernia, among others.[12]

While mechanical ventilation has contributed to a reduction in neonatal mortality, its effect has not been uniform across all weight categories. Initially, a more pronounced decrease in mortality was noted among neonates weighing over 2000g at term. Nevertheless, the emergence of novel methodologies in the 1980s resulted in decreased mortality rates for both term neonates and very low birth weight premature neonates.[4]

The utilization of CPAP (continuous positive airway pressure) has demonstrated advantageous impacts on oxygenation, alveolar stability, preservation of pulmonary surfactant, and mitigation of apnea and respiratory resistance. Additional modalities of mechanical ventilation encompass controlled mechanical ventilation, controlled assisted ventilation, and synchronized mandatory ventilation.[13]

Complications associated with mechanical ventilation comprise barotrauma, volutrauma, atelectrauma, biotrauma, and nosocomial sepsis. Additional potential complications include pneumothorax, pneumomediastinum, and oxygen toxicity, which can exert adverse effects on various organs and systems.[13]

Mechanical ventilation in neonates demands a specialized approach owing to distinctive physiological and anatomical disparities when compared to adults. Proficiency in appropriate techniques, meticulous monitoring methods, and diligent surveillance is imperative for pediatricians engaged in mechanical ventilation for children. Regrettably, a comprehensive training program for healthcare professionals responsible for mechanical ventilation within pediatric intensive care settings remains notably absent thus far.[14]

In light of the preceding information, the following query is posed: What is the neonatal ventilation performance within the Neonatology Department of Iván Portuondo Hospital, spanning from January 2021 to December 2021?

METHODS

The methodological design of this study adopted a descriptive, observational, longitudinal, and retrospective approach. It was conducted within the Neonatology Department of Iván Portuondo Hospital, spanning from January 2020 to July 2021. The study universe encompassed 597 newborns necessitating admission to the Neonatal Intensive Care Unit (NICU). The selected sample consisted of 112 newborns requiring assisted ventilation during the research period. Inclusion criteria encompassed all NICU-admitted newborns in need of ventilatory support, provided they had parental informed consent (see annex 1). Conversely, exclusion criteria were applied to newborns admitted to the NICU who did not require ventilatory support. Data collection was sourced from various references, including the NICU admission logbook, the ventilated patients' record logbook, individual health records, and hospital statistics. Data acquisition utilized a designated form (see annex 2), with manual tabulation employing tally marks to enumerate each variable.

This study was conducted in accordance with the principles of bioethics,[15] specifically implementing the principles of beneficence and non-maleficence, given that the research posed no inherent risks, and the collected information has the potential to yield positive future outcomes. During the data collection phase, no privileges or biases were granted, ensuring adherence to the principle of justice.

RESULTS AND DISCUSSION

Table 1. Total number of newborns admitted to the Neonatal Intensive Care Unit (NICU) at the "Iván Portuondo" Hospital, who required mechanical ventilation

	Year 2020		Year 2021	
	N	%	N	%
Live births	1823		1882	
Admitted	309	16,9	288	15,3
Ventilated	58	18,7	54	18,7
Non-invasive ventilation	20	34,5	19	35,2
Invasive ventilation	38	65,5	35	64,8
Ventilation rate per live births (%)	3,2	-	2,8	-

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In the table above, we can observe that in 2020, out of 1823 live births, 309 newborns required admission to the Neonatal Intensive Care Unit (NICU), constituting 16,9 % of the total. Among these admissions, 58 newborn infants needed mechanical ventilation. In 2021, out of 1882 births, 288 newborn infants necessitated NICU admission, representing 15,3 % of the total, with 54 of them requiring mechanical ventilation. Despite a decrease in NICU admissions from 2020 to 2021 by 21 cases, the percentage of ventilated patients remained constant at 18,7 %. The ventilation rate for the service was 3,2 % in 2020 and 2,8 % in 2021, which is higher than the 1,5 % reported in a study conducted at "González Coro" Hospital with similar characteristics to the one under study.[16] The elevated ventilation rate may be attributed to our service's role as a provincial reference center for neonates weighing less than 1500 grams. Moreover, within the Artemisa province, there are only two neonatal therapy units offering ventilation services to neonates, with the center under study being the most capacitated one. According to the Statistical Yearbook10, the increase in the ventilated patients rate over the past two years may be linked to the rise in very-low-birth-weight neonates. Other researchers, such as Dr. Cárdenas et al.[17], have also reported an increase in the rate of ventilated newborns in their study on morbidity and mortality in neonates weighing less than 1500 grams.

Table 2. Distribution of ventilated newborns by weight and ventilatory modality in the NICU at the "Iván Portuondo" Hospital

Birth weight (in grams)	Ventilatory Modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
<1000 g	-	-	5	100	5	4,5
1000 – 1499 g	8	24,2	25	75,8	33	29,4
1500 – 1999 g	9	39,1	14	60,9	23	20,6
2000 – 2499 g	12	60	8	40	20	17,8
2500 g and more	10	32,3	21	67,7	31	27,7
Total	39	34,8	73	35,2	112	100

In the table above, it is observed that the group weighing 1000 to 1499 grams exhibited the highest demand for ventilatory support. Notably, there has been an increase in newborns weighing less than 1000 grams compared to previous years within the same service, a trend corroborated by Dr. García Fernández[18] in her 5-year study of ventilated newborns' survival. She reported only 2 infants weighing less than 1000 grams and 23 weighing between 1000 and 1499 grams among the ventilated newborns. A notable finding is that 100 % of newborns weighing less than 1000 grams and 75,8 % of those weighing 1000 to 1500 grams were subjected to invasive ventilation modalities, as the service still lacks experience in non-invasive CPAP ventilation for very low birth weight and extremely low birth weight newborns. A study by Dr. Suárez Delgado[19] at Eusebio Hernández Hospital reported 21,8 % of ventilated newborn infants weighing less than 1500 grams utilizing non-invasive modalities, resulting in positive outcomes. Similarly, Danish studies have demonstrated excellent results,[20,21] with a higher proportion of CPAP-ventilated patients weighing less than 1500 grams, comprising 43 %, and of which 12 % weighing less than 1000 grams.

Across our sample, 72,3 % of the ventilated newborns had a birth weight of less than 2500 grams. These findings are in line with data from the Perinatal Morbidity and Mortality Registry in Closed Services for the year 2021,[22] which observed a higher incidence and severity of Respiratory Distress Syndrome (RDS) in newborns weighing less than 2500 grams. Additionally, Lumiguano et al.[23], in their study, also documented a higher incidence of newborns weighing less than 2500 grams requiring ventilation for RSD, which concurs with the current study's findings. The second group, consisting of newborns weighing 2500 grams or more, had a noteworthy number of ventilated cases. However, it is worth mentioning that this group also represented the majority of the admission universe.

Table 3. Distribution of ventilated newborns by sex and modality in the NICU at the "Iván Portuondo" Hospital

Sex	Ventilatory modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
Male	16	22,2	56	77,8	72	64,3
Female	23	57,5	17	42,5	40	35,7
Total	-	-	-	-	112	100

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As depicted in table 3, the majority of newborns necessitating ventilation were male, totaling 72 patients and constituting 64,3 % of the cases. This observation is consistent with findings from other authors, which have consistently noted a higher incidence of RDS requiring ventilation in male newborns.[24] This observation aligns with the general trend described in the literature on the matter, where several common respiratory conditions in neonates, such as Hyaline Membrane Disease, Chronic Lung Disease, among others, are more frequently observed in male newborn infants.[25,26,27,28] Furthermore, it is observed that the CPAP modality could be used more frequently and with better outcomes for female newborn infants, accounting for 57,5 % within their group, in contrast to only 22,2 % of ventilated males using non-invasive modalities. In her study, Suárez Delgado[19] reported a higher prevalence of male newborns receiving CPAP ventilation compared to females.

Table 4. Distribution of ventilated newborns by gestational age and ventilatory modality used in the NICU at the "Iván Portuondo" Hospital

Gestational age	Ventilatory modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
< 28 weeks	-	-	1	100	1	0,9
28-30 weeks	9	25,7	26	74,3	35	31,2
31- 33 weeks	8	26,7	22	73,3	30	26,8
34- 36 weeks	15	71,4	6	28,6	21	18,8
37 weeks and more	7	28	18	72	25	22,3
Total	39	34,8	73	65,2	112	100

In terms of results, the observations indicate that newborns with a gestational age ranging from 28 to 30 weeks constituted the most frequent group requiring ventilation, accounting for 35 patients or 31,2 % of the cases (table 4). Following in order of significance, newborns born between 31 to 33 weeks made up 26,8 % of the cases. Across all age groups, invasive modalities over non-invasive ones were more frequently employed. However, a notable exception was observed in the 34 to 36 weeks group, where 71,4 % of infants were ventilated using CPAP. These findings resonate with a study conducted by Dumpa[29], which also highlighted a higher incidence of preterm infants under 30 weeks of gestational age requiring ventilation, consistent with the current results. Notably, our results differ somewhat from those of Sánchez-Luna et al.[30], who managed to implement CPAP at earlier gestational ages and more frequently in newborns within the 30-36 week group. Additional studies were also reviewed with contrasting results.

Table 5. Distribution of ventilated newborns by conditions leading to ventilation and modality used in the NICU at the "Iván Portuondo" Hospital

Conditions leading to ventilation	Ventilatory modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
Hyaline Membrane Disease	15	33,3	30	66,7	45	40,2
Infección Pulmonar precoz	9	37,5	15	62,5	24	21,5
Meconium Aspiration Syndrome	-	-	11	100	11	16,9
Transient Tachypnea	13	100	-	-	13	11,6
Other causes	2	10,6	17	89,4	19	16,9
Total	39	34,8	73	65,2	112	100

As evident from these results, the predominant condition necessitating mechanical ventilation was Hyaline Membrane Disease (HMD), constituting 40,2 % of the cases, with 66,7 % of these cases requiring invasive modalities. Following in terms of frequency was early-onset pulmonary infection, representing 21,5 % of the cases. Other conditions were less prevalent.

In general, the utilization of invasive modalities prevailed in the ventilatory management of every condition, with the exception of 13 cases of Transient Tachypnea in preterm newborns, a condition that in its early stages can be mistaken for HMD grades I-II. Remarkably, 100 % of these cases were ventilated using CPAP. In the study conducted by Sánchez-Luna et al.[30], Transient Tachypnea was the condition most frequently ventilated using CPAP, representing 38,3 % of all its indications. In Dr. García Fernández's study18, HMD accounted for ventilation in 49 % of her cases, aligning with the findings of this more recent study. It is worth noting that

respiratory pathologies often necessitate neonatal ventilation, and as per existing literature, the use of prenatal corticosteroids serves as a protective factor against mortality, yielding significant outcomes in lung and organ maturation.

The study by Sangsari et al.[25] not only establishes that prenatal steroids reduce mortality but also underscores that they do not diminish the incidence of RDS. However, they do mitigate its severity, as reflected by a reduced proportion of patients requiring mechanical ventilation. It is worth noting that in this study, a substantial portion of the patients did not benefit from this medication, as a significant proportion of them were mothers who arrived from the healthcare area in labor. The findings of authors such as Ferrer[31] and Acevedo Ortiz[32] align with the results of this study, with their research also pinpointing RDS in premature newborns or HMD as the primary cause necessitating ventilation.

Paradoxically, the progress in ventilation techniques has contributed to a higher incidence of Hyaline Membrane Disease in neonates. This outcome stems from the extension of the limit of fetal viability enabled by these advancements. Concurrently, while there has been a decrease in neonatal mortality, morbidity, particularly associated with respiratory tract conditions, has not seen a corresponding reduction. This trend is closely linked to the increasing rate of preterm births, as described in the studies by Pérez and Cortez.[33,34]

It is important to acknowledge that the healthcare service where this study was conducted lacks the High-Frequency Oscillatory Ventilation (HFOV) modality, which represents a limitation in the ventilatory management of newborns who may require this mode of treatment. In the work by Gupta et al.[35], they highlight that HMD stands as the primary cause necessitating mechanical ventilation, a trend consistent with the data presented in Table 5. However, their study showcases a higher utilization of non-invasive modes (64,5 %) in managing HMD, contrasting with our research, where only 33,3 % of newborns with HMD were ventilated using CPAP. In a prior study by Maciques Rodríguez36 conducted over a 7-year period, Hyaline Membrane Disease HMD was the most frequent cause leading to ventilation, with a prevalence of 43,4 %, closely aligning with our findings. As mentioned earlier, following in order of frequency for reasons requiring ventilation were Early-Onset Pulmonary Infections and "Other causes", which encompassed systemic infections, perinatal depression, asphyxia, congenital malformations, and apnea of prematurity. Meconium aspiration syndrome was among the conditions requiring ventilation but occurred at the lowest frequency.

Table 6. Distribution of ventilated newborns by duration of ventilation and modality used in the NICU at the "Iván Portuondo" Hospital

Duration of ventilation	Ventilatory modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
≤ 3 days	29	74,4	31	42,5	60	53,6
4- 6 days	10	25,6	29	39,7	39	34,8
≥ 7 days	-	-	13	17,8	13	11,6
Total	39	100	73	100	112	100

The duration of mechanical ventilation is presented in Table 6, revealing that over half of the ventilated newborns (53,6 %) were successfully weaned from the ventilator within the first three days. This achievement was notably more significant among newborns ventilated with CPAP (74,4 %) than those managed with invasive modalities (42,5 %). The subsequent most common group had a ventilation duration of 4 to 6 days, and only 11 % required ventilation for 7 days or longer. Existing literature supports the notion that shorter ventilation durations correlate with improved quality of life and enhanced neonatal survival.[28] The utilization of prophylactic and early rescue use of SURFACEN® has demonstrated superior outcomes in terms of early extubation, leading to improved clinical progression, which impacts positively the natural course of conditions like HMD and consequentially reducing the duration of mechanical ventilation,[37,38] Neonatal Intensive Care Unit stays, and overall hospitalization periods. A study conducted at the Camilo Cienfuegos Hospital in Sancti Spíritus[39] reported an average mechanical ventilation duration of 5 days, which is longer than the results observed in this study. Regarding the duration of mechanical ventilatory support, the premise in this service has been to commence ventilation and wean newborns from the ventilator as early as possible, with the aim of minimizing harm while maximizing benefit. Research conducted by authors such as Martínez Lemus over a 10-year period within the same service found that more than half (51 %) of their sample of ventilated newborns were successfully extubated within the first 72 hours,[40] reinforcing the consistency of these findings with the current study.

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Table 7. Complications of ventilation by modality used in ventilated newborns in the NICU at the "Iván Portuondo" Hospital

Complications	Ventilatory modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
Airway obstruction	2	1,7	7	6,2	9	8
Ventilator-associated bronchopneumonia			5	4,4	5	4,4
Intracranial hemorrhage			4	3,6	4	3,6
Bronchopulmonary dysplasia			4	3,6	4	3,6
Reopening of the ductus arteriosus			3	2,6	3	2,6

As depicted in table 7, the most prevalent complications associated with ventilation in these newborns were airway obstruction, followed by Ventilator-Associated Respiratory Infections, with corresponding percentages of 8 % and 4,4 %. It is worth noting that authors like López Escobar and Zenteno, in their respective studies, concur by identifying Ventilator-Associated Pneumonia (VAP) as the most frequent complication arising from mechanical ventilation.[41,42] Other authors, such as Álvarez Alonso[43] reported an increased incidence of Intraventricular Hemorrhage associated with ventilation in their research. Notably, none of these previously mentioned studies align with the findings of the current study.

Complications arising from invasive ventilation modalities are notably more prevalent than those observed in CPAP, consistent with the findings of a study conducted by Rivas Fernández.[44] Their research highlighted complications such as Bronchopulmonary Dysplasia (BPD), which were attributed to issues like volutrauma, barotrauma, and atelectasis in patients using invasive modalities. These complications were notably absent in neonates receiving non-invasive modalities.

Meanwhile, Bresesti[45] reported an uptick in Ventilator-Associated Pneumonia (VAP) as a complication associated with mechanical ventilation; among neonates affected by this condition, a striking 98,5 % employed an endotracheal tube (ETT) for their ventilatory management. This coincides with the findings presented in the previous table, where it becomes evident that all the newborns who experienced the complication of VAP were ventilated with an ETT (in invasive modality).

Table 8. Discharge status by ventilatory modality used in ventilated newborns in the NICU at the "Iván Portuondo" Hospital

Discharge status	Ventilatory modality				Total	%
	Non-invasive		Invasive			
	N	%	N	%		
Alive	38	97,4	53	72,6	91	81,2
Deceased	1	2,6	20	27,4	21	18,8
Total	39	100	73	100	112	100

Among the ventilated newborns, 81,1 % were successfully discharged alive, with the majority of them having undergone invasive ventilation, taking into account the relevant indications for such. It is important to note that cases of continuous positive pressure (CPP) failures were included in this modality. Nevertheless, survival rates, when considering the ventilated sample in each modality, were higher when CPP was employed, at 97,4 %.

The survival outcomes for ventilated newborns in this study have exhibited no significant variations compared to findings from previous years within our service. The values in our table are very similar to those reported in the study by Morilla Guzmán[7], which documented an 81,5 % survival rate for ventilated newborns.

In a study conducted by Morilla[38], it was noted that the improved survival achieved with CPP ventilation was linked to the contemporary practice of initiating this ventilation mode at an earlier stage. Roberts[46], in his research, also indicated that enhanced survival rates were obtained by including newborns with a gestational age of over 32 weeks in this modality. Sinha[47] referenced a Columbia University study, which reported an impressive 91 % survival rate in patients ventilated with CPP. In contrast, a study by Árias Manosalva24 showed a lower 57 % survival rate with Intermittent Positive Pressure (IPP), which fell below the results of this investigation. Furthermore, results published in Cochrane by Rivas Fernández44 found an 88,2 % survival rate with IPP, slightly higher than what was observed in this study.

CONCLUSIONS

The invasive mode predominated among male newborns with a birth weight of less than 1500 g and a gestational age of under 30 weeks. Hyaline Membrane Disease continued to be the predominant cause necessitating mechanical ventilation. The utilization of non-invasive ventilation resulted in a reduced ventilation duration and fewer complications, ultimately enhancing survival rates.

RECOMMENDATIONS

- To achieve a decrease in prematurity, low birth weight, and early-onset infections, thereby reducing the incidence of ventilatory requirements in newborns, it is imperative to pursue a systematic, continuous, comprehensive, and intersectoral enhancement of prenatal and perinatal care.
- We should consider applying CPAP modality more frequently in neonates weighing less than 1500 g, given its proven benefits.
- The integration of HFOV into our healthcare service should be contemplated, as it represents a fundamental element in the effective management of RDS in newborn infants with low and extremely low birth weights, being our service the provincial reference center for such cases.

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CONFLICT OF INTEREST

There are no conflicts of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Mario Gutiérrez Martínez.
Research: Mario Gutiérrez Martínez.
Methodology: Mario Gutiérrez Martínez.
Project management: Mario Gutiérrez Martínez.
Original writing-drafting: Mario Gutiérrez Martínez.
Writing-revision and editing: Mario Gutiérrez Martínez.

MATERIAL SUPLEMENTARIO

ANEXO 1

Consentimiento Informado

Yo _____, hago constar por este medio mi disposición y consentimiento informado para participar en el estudio acerca del comportamiento de la ventilación mecánica en recién nacidos que se realizará en el Hospital Iván Portuondo, municipio San Antonio de los Baños, para dar los datos necesarios que puedan contribuir al estudio de este tema. Además, se me ha asegurado que los datos de esta investigación son anónimos y que no extrañan perjuicio alguno para mi hijo(a).

Declaro que he sido informada del objetivo del estudio por el cual se me aplicará una encuesta. Así mismo se me ha explicado la importancia de participar en las actividades programadas de este estudio y las ventajas que significa para nuestra Salud Pública y para la familia minimizar la aparición de cuadros de infección respiratoria en nuestros niños.

Para constancia de lo expuesto anteriormente firmo este documento en Quiebra Hacha a los __ días del mes _____ del año 202_.

Firma _____

ANEXO 2

Cuestionario:

1. Nombre y apellidos del recién nacido: _____
2. Número de HC: _____
3. Fecha de Nacimiento: _____
4. De la HC materna:

a) EG: ___ semanas

5. De la HC del recién nacido:

a) Peso al nacer _____ gr.

b) Sexo: Femenino ___ Masculino ___

c)Estadía en Ventilación: Menos de 3 días ___ De 3 a 7 días ___ Más de 7 días ___

e) Motivo de la ventilación: _____

f) Modalidad ventilatoria y tiempo de utilización: _____

g) Complicaciones: _____

h) Estado al egreso: Vivo ___ Fallecido ___

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