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ACCIDENTAL EXTUBATION IN NEWBORNS INTERNED IN A NEONATAL INTENSIVE CARE UNIT, FROM 2017 TO 2020, IN A PUBLIC MATERNITY IN SERGIPE: CONSEQUENCES AND ASSOCIATED FACTORS

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Abstract: Introduction: Orotracheal intubation is a frequent procedure in neonatal intensive care units. However, maintaining the intubation condition is as complex and relevant as the need and urgency that motivated its performance in order to avoid accidental extubation, understood as any event of unexpected extubation or performed at an unscheduled time, due to agitation. of the patient or the handling of the team. **Objective:** it is proposed to recognize the consequences of the event of unscheduled extubation in the population sample studied. **Methodology**: sample data were collected from newborns admitted to a low-risk maternity intensive care unit in Sergipe, between 2017 and 2020. **Results**: It was shown that patients submitted to accidental extubation had an increase of 25.82 days of NICU stay and 12.57 days of use of mechanical ventilation. In addition, this population had an odds ratio of 21.6 times for ventilator pneumonia, 4.59 times for resuscitation in the delivery room, 24.2 times for pneumothorax, 17 times for early infection, 20.5 times of late infection and 8 more likely to die. Regarding this, it was found that the main cause of death was sepsis. **Conclusion:** The present study demonstrated a relationship between unscheduled extubation and increased length of stay in the neonatal ICU and the use of mechanical ventilation. In addition to the increased chance of associated complications such as the pneumonia by mechanical ventilation, resuscitation in the delivery room, pneumothorax, early or late infections and death.

Keywords: Accidental extubation, intensive care unit, consequences, neonatal.

INTRODUCTION

It is known that orotracheal intubation is a frequent procedure in neonatal intensive care units. It is estimated that about 80% of extremely low birth weight newborns are

treated with invasive mechanical ventilation during the first days of life. Its indication varies according to the protocol established in each institution and with the medical perspective given the individualized need of the patient (Fiocruz, 2019).

To maintain the intubation condition is, however, as complex and relevant as the need and urgency that motivated its performance. It is necessary to constantly reassess the need to keep the patient intubated, the therapeutic schedule and the possibility of extubation, aiming not only to reduce damage due to prolonged exposure to mechanical ventilation, but also to the complication discussed in this article: accidental extubation.

Accidental extubation, or unplanned extubation (ENP), is defined as any event of unexpected extubation or performed at an unscheduled time, due to patient agitation or team handling (Fiocruz, 2019).

For the evaluation and identification of such an event, some clinical signs are used. Among them, displacement of the tube, gastric distention, sudden and/or unexplained air leak, present vocalization, cyanosis, sudden reduction in oxygen saturation and absence of of respiratory movements (Oliveira, 2012).

The literature shows that the percentage of ENP in intubated pediatric patients ranges from 0.6 to 13.3%, which is equivalent to a rate of 0.11 to 1.26 for every 100 days of mechanical ventilation (MV). In neonatal patients, the percentage ranges from 11.5 to 19.2%, and the ENP rate for every 100 days of MV ranges from 1.98 to 3.0. It is believed that this occurs, among other factors, due to the lower gestational age of newborns, the absence of physical restrictions, the reduction in the use of sedation, the increase in the number of procedures performed and the handling profile of the team with the newborn, especially if low birth weight (Oliveira, 2012).

Among the known factors that favor the risk of accidental extubation, low birth weight, prematurity, duration of mechanical ventilation, seizures and infections stand out (Bispo, 2020). Other publications also point out motor agitation of the R, handling of the endotracheal cannula and performing routine procedures as extremely relevant factors for ENP (MATTOS, 2020).

ENP causes serious consequences described in the literature such as infection, respiratory distress, upper airway injury, atelectasis and the need for reintubation (COSTA, 2014)

The identification of the profile of patients undergoing accidental extubation, as well as the consequences resulting from such an event, aims to improve care for the newborn during hospitalization in a neonatal intensive care unit. This way, it will be possible to mitigate the risk of ENP and provide an even more qualified service.

OBJECTIVES

This article aims to identify the profile of newborns who suffered accidental extubation during hospitalization in a neonatal intensive care unit, from 2017 to 2020, in a low-risk maternity hospital in Sergipe.

Based on the aforementioned analysis, it is proposed to recognize the consequences of the ENP event in the population sample studied.

METHODS

For the purpose of this article, sample data were collected from newborns admitted to a low-risk maternity intensive care unit in Sergipe, between the years 2017 and 2020, with authorization from the Ethics and Research Committee of the Tiradentes University, code of opinion 5,292,345 and formal authorization from the institution studied.

Among the variables studied, those chosen for this publication were: occurrence of unscheduled extubation, length of stay in days, duration of mechanical ventilation,

occurrence of ventilator-associated pneumonia, cardiopulmonary resuscitation in the delivery room, existence of pneumothorax, presence of early or late infection, outcome of hospitalization, and cause of death (if any).

For the theoretical basis used in the elaboration of the article, several articles were analyzed, searched through the Scielo, Google Scholar and Pubmed platform, with publication date between the years 2012 and 2021.

The results were obtained from the use of two statistical methods: The T method, which compares the same parameter of variables different and method chi-square to establish a statistical relationship of two different variables occurring simultaneously.

RESULTS

Among the 1637 newborns who had data collected for the present study, 135 had accidental extubation during hospitalization, which corresponds to 8.2% of newborns hospitalized in the period. 1502 neonates did not present unscheduled extubation or were not informed, in the research form, if it occurred.

The study showed that patients not undergoing unscheduled extubation (ENP) had an average of 9.39 days of hospitalization in the Neonatal Intensive Care Unit (NICU) during the study period. In contrast, those who went through the event had an average of hospitalization days corresponding to 35.21 days.

The mean difference therefore showed a mean increase of 25.82 days of NICU stay in patients undergoing accidental extubation.

The confidence interval of the mean difference ranged from a lower limit of 15.26 to an upper limit of 41.19, so that, despite the standard deviation greater than the calculated means, it is possible that the difference between them is observed in the confidence interval with 5% error. This, however, has a not very high probability of happening, which is indicated by the p-value = 0.125, which means that the chance of the groups not being different is 12.5%, which increases the chance that the calculated difference does not limited to the confidence interval.

The data studied showed that patients who progressed without unscheduled extubation had, on average, 7.08 days of mechanical ventilation, while those undergoing ENP had a higher value (19.65 days).

There was, therefore, an increase of, on average, 12.57 days of use of mechanical ventilation in patients who had accidental extubation.

The confidence interval showed a lower limit of the mean difference of 7.93 and an upper limit of 19.03, which allows accepting the hypothesis that this difference is possible, with a margin of error of 5%, which is reinforced by the low chance of this does not happen (0.9%) indicated by the p-value statistic.

782 survey forms were answered regarding the occurrence of ventilator-associated pneumonia. Among them, 82 signaled for accidental extubation.

Considering the 82 patients who underwent unscheduled extubation, 21 of these also suffered pneumonia associated with the use of mechanical ventilators. This value corresponds to the percentage of 25.6%.

The study demonstrates that patients who suffered ENP were 21.6 times likely to use mechanical ventilation than those who did not, with a probability of 99.9%.

1012 questionnaires were answered regarding the occurrence of resuscitation in the delivery room. Among them, 195 evidenced the occurrence of the event.

Among the 127 newborns who underwent unscheduled extubation, 58 required cardiopulmonary resuscitation (CPR) in the

Accidental Extubation		Frequency	Percentage	Percentage valid	Percentage cumulative
Valid	Yes	135	8,2	8,2	8,2
	No or not informed	1502	91,8	91,8	100,0
	Total	1637	100,0	100,0	

Table 1: Quantitative analysis of the occurrence of accidental extubation in the sample studied

		scores		Statistic of the test *t (Bootstrapping sample)*					
		μ	*DP*	*t*	*gl*	Valor-*p*	Difference of Mean	Mean Difference CI (95%)	
								Inferior limit	Upper limit
accidental extubation	Yes	35,21	56,9	6,26	53,2	0,125	25,82	15,26	41,19
	Not	9,39	12,9						

CI = confidence interval; gl = degrees of freedom; μ = mean; SD = standard deviation.

Table 2: Comparative relationship regarding length of stay, in days, between patients submitted to accidental extubation in relation to those not accidentally extubated.

		scores		Statistic of the test *t (Bootstrapping sample)*					
		μ	*DP*	*t*	*gl*	Value -*p*	Difference of Mean	Mean Difference CI (95%)	
								Inferior limit	Upper limit
accidental extubation	Yes	19,65	30,5	4,37	122,6	0,009	12,57	7,93	19,03
	Not	7,08	6,95						

CI = confidence interval; gl = degrees of freedom; μ = mean; SD = standard deviation.

Table 3: Comparative relationship of the duration of mechanical ventilation, in days, between patients submitted to accidental extubation in relation to those not accidentally extubated.

	Accidental Extubation			c^2 *(gl)*	*P*	*RC*
	Yes	*Not*	*Total*			
Pneumonia per Mechanical ventilation				60,7 (1)	<0,001*	21,6
Yes	21	11	32			
Not	61	689	750			
Total	82	700	782			

$p < 0,001$; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 4: Statistical relationship between accidental extubation and the occurrence of ventilator-associated pneumonia.

	Accidental Extubation			c^2 *(gl)*	*P*	*RC*
	Yes	*Not*	*Total*			
delivery room resuscitation [1]				65,1 (1)	<0,001*	4,59
Yes	58	137	195			
Not	69	748	817			
Total	127	885	1012			

$p < 0,001$; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 5: Statistical relationship between accidental extubation and cardiopulmonary resuscitation in the delivery room:

delivery room, corresponding to 45.7% of the cases.

Patients who suffered accidental extubation were 4.59 more likely to be resuscitated in the delivery room than during hospitalization, with a 99.9% probability.

It is observed that 1030 questionnaires were answered regarding the occurrence of pneumothorax. Among them, 96 reported the occurrence of unscheduled extubation.

Among the 96 newborns who suffered accidental extubation, 13 also suffered pneumothorax. This number corresponds to 13.5% of the total cases of the event. It was also estimated that patients who suffered accidental extubation are 24.2 times more likely to suffer pneumothorax, with a 99.9% probability.

The surveys showed that 1013 forms were answered regarding early infection (infection within the first 48 hours of life). It was observed that 483 newborns presented this pathology.

Among the patients who underwent accidental extubation, 119 also had infection, corresponding to 92.2% of the cases.

The odds ratio shows that patients who underwent unscheduled extubation were 17 more likely to develop infection in the first 48 hours of life.

758 questionnaires were answered about the occurrence of late infection (after 48 hours of life). Among these, 100 also pointed to accidental extubation.

Among the 100 patients who underwent unscheduled extubation, 84 had late infection, corresponding to 84%.

The odds ratio calculation showed that patients who suffered accidental extubation were 20.5 more likely to develop infection after 48 hours of life, with a 99.9% probability.

Among the 1077 results regarding the outcome of patients hospitalized in the NICU during the study period, 95 indicated the occurrence of death.

Among the 135 patients accidentally extubated, 42 died, corresponding to 31.1% of the cases.

The odds ratio showed an 8-fold increase in a patient dying due to accidental extubation, with a 99.9% probability.

87 forms reported the cause of death among the 95 patients who died during this period.

Among the causes of death reported in the evaluation, the high presence of sepsis among those accidentally extubated (41.5%) stands out. This percentage is much higher than that observed among those not accidentally extubated (28%). All other causes of death were observed to be less likely among those who were accidentally extubated than among those who were not accidentally extubated.

It is worth noting that variables not described as underlying diseases or diseases acquired in a hospital environment not indicated in the research form and the individual condition and evolution of each patient can influence the outcome of the condition. Therefore, the relationship between the two causes mentioned in the table above cannot be considered isolated from the other medical issues involved. It is understood, therefore, that other factors not mentioned may influence the results presented, which is demonstrated by the impossibility of calculating a consistent odds ratio between those causes.

DISCUSSION

According to the results presented, 8.2% of newborns hospitalized during the data collection period of the present study in a neonatal intensive care unit (NICU) had accidental extubation. This data reinforces the information in the literature that confirms the chance of unscheduled extubation in hospitalized newborns due to several factors mentioned above, such as anatomical propensity to exit the tube, recurrent

	Accidental Extubation			c^2 (gl)	P	RC
	Yes	Not	Total			
Penumotorax[2]				40,7 (1)	<0,001*	24,2
Yes	13	6	19			
Not	83	928	1011			
Total	96	934	1030			

p < 0,001; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 6: Statistical relationship between cases of pneumothorax in patients who suffered accidental extubation

	Accidental Extubation			c^2 (gl)	P	RC
	Yes	Not	Total			
48h early infection[1]				117,7(1)	<0,001*	17
Yes	119	364	483			
Not	10	520	530			
Total	129	884	1013			

p < 0,001; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 7: Statistical relationship between accidental extubation and the occurrence of early infection:

	Accidental Extubation			c^2 (gl)	P	RC
	Yes	Not	Total			
Late infection 48 hours [1]				171,6 (1)	<0,001*	20,5
Yes	84	134	218			
Not	16	524	540			
Total	100	658	758			

p < 0,001; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 8: Statistical relationship between accidental extubation and the occurrence of late infection:

	Accidental Extubation			c^2 (gl)	P	RC
	Yes	Not	Total			
Outcome type [2]						
Death	42	53	95	75,8 (3)	<0,001*	8
hospital discharge	86	859	945			
Transfer	0	12	12			
Not informed	7	18	25			
Total	135	942	1077			

p < 0,001; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 9: Statistical relationship between the types of outcomes of the evaluated patients and their relationship with accidental extubation.

	Accidental Extubation		
	Yes	Not	Total
Cause of death [2]			
Intrapartum events	6	16	22
sepsis	17	13	30
Bad formation. congenital	6	9	15
Other conditions	12	8	20
Total	41	46	87

p < 0,001; c^2 = chi-square; gl = degrees of freedom; RC = Odds Ratio.

Table 10: Statistical relationship between causes of death and unscheduled extubation.

mobilization by the multidisciplinary team, low birth weight and prematurity (MATTOS, 2020). According to the literature, such factors are present in greater proportions precisely in babies who are in the intensive care unit for life support and who may even have, in the reason for hospitalization, components of risk factors for accidental extubation.

The average difference in the number of more days that these patients spend in the NICU is 25.82 days compared to those not accidentally extubated, as estimated in the present study, but the margin of error in this estimate makes it not very robust, with 12.5 % of chances that both forms of extubation are correlated, or have similar results on days of hospitalization.

The increase in the length of hospital stay, in any of the extubation cases, can be explained by the increase in hospitalization-related complications such as infection, hemodynamic instability and cardiac arrest (PINTO, 2019). Although there is a significant chance that the length of hospital stay is not 25.82 days longer for those who were accidentally extubated than for those who were not accidentally extubated, with each new complication triggered by accidental extubation, it is necessary to increase the length of hospital stay to effectiveness of the treatment of each of the complications mentioned above and the achievement, finally, of the stabilization and clinical improvement of the patient.

With clearer odds of occurrence than length of hospital stay, time on mechanical ventilation was longer in patients with unscheduled extubation. The mean difference was 12.57 more days of mechanical ventilation in these patients than in the non-accidentally extubated patients.

This result can be explained by the respiratory complications resulting from ENP. They are: respiratory distress, upper airway injury, need for reintubation, increased risk of hypoxemia, atelectasis, ventilator-associated pneumonia and tracheal injury (COSTA, 2014). Such respiratory damage increases the need to use mechanical ventilation as they decrease the capacity for efficient spontaneous breathing, thus leading to prolonged mechanical ventilation.

The study also showed that 25.6% of newborns who suffered accidental extubation also had pneumonia associated with the use of mechanical ventilators. It was found, through the odds ratio, that those who suffered ENP were 21.6 more likely to develop ventilator-associated pneumonia.

Ventilator-associated pneumonia (VAP) is defined by the National Health Surveillance Agency (Anvisa) as the pneumonia evidenced 48 hours after the start of mechanical ventilation, associated with clinical, radiological and laboratory criteria (ALECRIM, 2019). Such infection is associated with several factors directly associated with the mechanical ventilator itself, such as bronchoaspiration by secretions present in the circuit, change in cuff pressure and continuous administration of sedatives (HONORATO, 2021).

From this, it is possible to infer that accidental extubation, which promotes an increase in mechanical ventilation time, also causes longer exposure to the causes of VAP and, therefore, a greater risk of developing ventilator-associated pneumonia.

Regarding cardiopulmonary resuscitation (CPR) in the delivery room, the present study showed that among newborns who required CPR in the delivery room, 29.7% suffered accidental extubation during the period of hospitalization in the neonatal intensive care unit. The odds ratio indicated 4.59 more chances of accidental extubation in patients who required CPR in the delivery room.

Prolonged hospitalization becomes a risk

factor for accidental extubation. (PIRONE, 2019). Thus, since cardiopulmonary resuscitation is related to the increase in hospital stay, cardiopulmonary resuscitation may also be indirectly related to the occurrence of accidental extubation through the prolongation of in-hospital stay.

The research also showed that 13.5% of the patients who suffered accidental extubation developed pneumothorax during the period of hospitalization. An odds ratio of 24.2 times was estimated for a NB who presented ENP to suffer pneumothorax.

Pneumothorax is defined by the Ministry of Health as the presence of air in the pleural cavity, which results from the loss of continuity of the respiratory epithelium, which can lead to partial or complete lung collapse. This event is one of the major complications of unscheduled extubation, accompanied by hypoxia, secondary pneumonia, bronchopulmonary dysplasias and delay in neuropsychomotor development (FRANÇA, 2016).

Among the main complications of pneumothorax, there are reduced lung compliance, formation of bronchodysplasias, pulmonary hemorrhage, interventricular hemorrhage, increased length of stay, need for mechanical ventilation, and death (FRANÇA, 2016). The study that resulted in the present article showed an odds ratio of 24.2 times that one NB who had unscheduled extubation had more pneumothorax than one who had it.

Tables 7 and 8 statistically correlate the event of unscheduled extubation with the occurrence of early infections (occurring within the first 48 hours of life, correlated with an intrauterine event and during delivery) and late infections (after the first 48 hours of life, related to postpartum etiological mechanisms).

Among the factors that contribute to the emergence of nosocomial infections in intensive care units, invasive procedures, length of stay, low birth weight and early contact with parents stand out (MARTINS, 2021). Furthermore, in the context of Brazilian hospitals, hospital overcrowding must be considered as an important factor for the emergence and lack of control of intra-hospital infections in newborns.

Bloodstream infection is the one that most affects neonatal patients admitted to intensive care units (MARTINS, 2021). This infection is directly associated with high mortality rates and increased length of hospital stay.

The literature shows that both the occurrence of infections in the neonatal ICU and the rate of accidental extubation are directly linked to the length of stay of the patient (MARTINS, 2021). The occurrence of ENP is also related to the increase in mechanical ventilation time and the occurrence of infections. Likewise, infections in the intensive care unit increase the length of stay, consequently, the need for ventilatory support, the chance of clinical complications and accidental extubation. The two variables are, therefore, directly linked and increase the chance of occurrence of such events with each other.

In the present article, the odds ratio between accidental extubation and early infection was 17 times higher than among those who were not accidentally extubated, while the relationship between ENP and late infection was 20.5 times higher.

As for the outcome of the patient who underwent unscheduled extubation, the article highlighted, in Table 9, that 31.1% of newborns accidentally extubated died, with the odds ratio for this occurrence among those accidentally extubated being up to 8 times higher. than a neonate dying without accidental extubation.

Evidence in the literature relates accidental extubation with a higher risk of infection, with a high rate of evolution to sepsis and consequent neonatal death (PINTO, 2019).

Among the causes of death in neonatal patients accidentally extubated, the main etiology was sepsis, corresponding to 41.4% of the cases. This data agrees with the literary evidence that shows that sepsis represents one of the main causes of neonatal mortality in Brazil, deaths that represent 60% of infant deaths in the country (MARTINS, 2021).

CONCLUSION

It is possible to conclude from the present study that the phenomenon of unscheduled extubation in the newborns studied influenced several variables during the period of hospitalization. Among them, we highlight the increase in the duration, in days, of hospitalization in an intensive care unit and the use of mechanical ventilation, the greater chance of occurrence of pneumothorax, pneumonia associated with the use of mechanical ventilator, cardiopulmonary resuscitation in the delivery room, early or late infection and, ultimately, neonatal death.

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