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Original Research Article

Physiotherapy intervention after intubation in pediatric patients

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The aim of this study is to evaluate the effectiveness of respiratory physiotherapy after the extubation of children that were treated in the intensive care unit, based on vital parameters' values. The study was conducted in Intensive care unit of Ippokratio General Hospital of Thessaloniki. 22 children with different admission diagnosis met the selection criteria of this research. The study concerned the medical treatment of those children in their first and second 24 hours after extubation and implementation of respiratory physiotherapy techniques, with simultaneous change of position. Vital parameters of the monitor were recorded and analyzed before and after the physiotherapy session. Physiotherapy intervention affected vital parameters, like oxygen levels and respirations. The endurance of patients increased and exercises could be applied in the maximum duration and in multiple positions. Increase in the needs of the patients for endotracheal suction was also recorded because of liquidation of secretions that were forward to the upper airways. As an outcome of the above the time of hospitalization was decreased and there was a quicker discharge from the Intensive care units. It was observed that respiratory physiotherapy has beneficial effect in children patients hospitalized in the intensive care unit.

Key words: Intensive care unit, airway extubation, children, respiratory physiotherapy, respiratory technique

INTRODUCTION

The need for support in order to cope with seriously ill patients in the Intensive Care Unit (ICU) led to the development of a new independent internship the intensive unit care medicine, which is constantly evolving. Progress in intensive care medicine has led to significant improvements in the survival rates of patients treated in the ICU (Bellomo et al., 2007). An accomplishment in the last decades is the operation of organized children's ICU and the development of the internship ICU medicine. Apart from preventive care and nutritional support, the development of efficient pediatric emergency service and critical care in countries with limited resources, can significantly alleviate global mortality in children under 5.(Knotzer et al., 2006).

The room in a pediatrics ICU should be especially equipped with supportive devices like (inhalators, resuscitators) integrated suction system, blood air analyzers, compressed air units, oxygen, several sockets and medical monitors so the evaluation of vital parameters and effective therapy of the patients can be possible. In ideal conditions every patient should be treated in a room with one only bed (Caruso et al., 2014).

Some of the causes of admission of the pediatrics patients are serious injuries head lesion and brain injury, which is connected with about five times increase of mortality (Bair et al., 2002). Serious respiratory infections from several viruses, including Para influenza, cause serious implications to the respiratory system (Bessereau et al., 2010). Moreover food aspirations especially in vulnerable groups like children cause serious respiratory complications. Also asthma attack and alter surgery monitoring (including

pediatric tumors as well as swallowing excessive amount of chemical drugs resulting to poisoning.

The procedure of intubation is a specialized medical practice this is why it must be applied by experienced medical staff (Cook et al., 2011). Additionally the procedure of intubation should be applied according to specific medical protocols. Life support makes the cleaning of the airways difficult (Esguerra-Gonzalez et al., 2013) as a result the secretions cannot be successfully removed causing temporal mucosal main function and incapability to cough. Complications that may occur are functional disruptions, voice and swallowing disorders, new respiratory infections, pneumothorax (Wang et al., 2011), respiratory arrest and even death (Esguerra-Gonzalez et al., 2013).

Consequently it is of great importance the presence of a pediatrics physiotherapist in the ER room, so that with the application of respiratory techniques can deal with undesirable consequences of immobilization and contribute a) to the decrease of treatment time period, b) to the faster release from airway support, c) in the early detection and prevention of muscle weakness in the ICU, d) in the accomplishment of maximum functionality and e) in the achievement of higher as possible, health level of the patient in the long term (Needham, 2008).

The physiotherapy techniques used for restoration of respiration function are pressures impacts, vibrations, position changes, spirometer whenever is possible (Osadnik et al., 2012) (Strickland et al., 2013) (Rohde, 2011) (Spapen et al., 2017). The techniques above are applied during the phase of expiration so that there is better excretion of secretions from the small to the bigger airways . Integral part of the treatment for intubated pediatric patients being in the ICU constitutes the endotracheal suction (Overend et al., 2009).

According to the research (Browning et al., 2007) conducted, patients' movement in the ISU room was attempted by specialized pediatric physiotherapists for less than 10 to 15 minutes. Based on previous studies, respiratory physiotherapy application for 15 min may lead to decrease of saturation levels, which can be improved with simultaneous change of position after 15 min (Mehta et al., 2016).

METHODOLOGY

Study design: observational study

The research was conducted in the children's ICU of General Hospital of Thessaloniki Ippokratio. The unit of children is unique in all Northern Greece. Cases from 35 to 14 years of age are presented. This unit operates on the basis of the European Standards since June 1999. It was morally approved by the committee of Alexander TEI Thessaloniki and also was approved by the scientific department of G.H. of Thessaloniki. The ICU environment were the research was conducted is made up from eight beds. The tools of measurement and recording that were used were the medical monitor and a form of evaluation for the children's vital parameters before the end of physiotherapy sessions. Moreover there was recording of the data from the daily update of the children's health report that the doctors filled in. The patients received one session of physiotherapy with pressures, vibrations and strokes in the 1st and 2nd 24 hours. Before the beginning of the session in the first 24 hours there was recording of the data in the monitor (saturation, blood pressure, pulses, temperature, number of respirations) consequently there was application of the techniques above for 10 to 15 min, putting the patient in different positions (supine, semi-seated, broadside). After the completion of the procedure there was again recording of the monitor's data. The same procedure went on during the second 24 hours.

Subjects

There were 22 children selected (13 boys and 9 girls) between 40 days old to 14 years old. The admission diagnosis of the children to ER were not similar so they were divided in 3 categories a) Surgery, b) Respiratory, c) Infections. The selection criteria concerned children that were successfully extubated from respirator and remained without artificial breathing machine for at least two the first 24 hours. On the other hand, the exclusion criteria referred to children that completed the extubation procedure but had to be intubated again in the first 48 hours. Moreover patients were excluded that were in danger of bleeding, rib fracture or other adverse effects.

Statistical analysis

The statistical processing of the results was done with SPSS 23.0 statistical programme. For the continuous variables, parametric tests like t-tests and Paired t-test and non parametric test Mann-Whitney, U Test, Kruskal- WallisTest and Wilcoxon Raintest were used. For the bisected and divisional variables, the statistic tests Chisquare test, Fisher's exact test and McNemar were applied. The correlation factors were calculated with Spearman's rho correlation indicator. The assessment of the reports was made for level of statistical importance $p<0.05$.

RESULTS

Twenty-two children were the sample size of our research. All were treated in the children's intensive care unit and fulfilled the selection criteria. In those children comparisons and associations of the data in the first and second 24 hours are presented in Tables 1, 2, 3 and 4.

Particularly in the first case it was found that after the end of physiotherapy the average rate of acidimetric that was recorded in the monitor was statistically significant rise compared with the rate before physiotherapy with $p<0.001$, so the $p<0.05$. Also the average rate of respirations per minute after the physiotherapy was statistically significantly

Table 1. Comparison of respirations number and acidimetric in the 1η 24 hours before and after the physiotherapy session

	Before physiotherapy	After physiotherapy	p
Number of respirations	38±8	36±11	0,015
Average rate (range of rates)			
Acidimetry	97 (6 min:94-max:100)	100 (0)	<0,001

Table 2. Comparison between clinical characteristics of the patients, in the 2nd 24 hours, before and after the physiotherapy session

		Aspirations after physiotherapy			
		Yes	**No**	**Total**	**P**
Aspirations. before physiotherapy	**Yes**	4	0	4	<0,001
		18,2%	0%	18.2%	
	No	17	1	18	
		77.3%	4.5%	81,8%	
	Total	21	1	22	
		95.5%	4.5%	100%	

Table 3. Comparisons between the hospitalization days and the existence of underlying disease

	Existence of underlying disease Average rate (range of rates)		
	Yes	**No**	**P**
Hospitalization days	22 days	9 days	0,051

Table 4. Connections between the days of hospitalization- intubation and Extubation efforts

	Days of hospitalization	**Days of intubation**	**Extubation effort**
Days of hospitalization	-	rho=0.959 p<0.001	rho=0.3 p=0.175
Days of intubation	rho=0.959 p<0,001	-	rho=0.416 p=0.054
Extubation effort	rho=0.3 p=0.175	rho=0.416 p=0.054	-

lower compared with the rate before physiotherapy with p=0.015 so p< 0.05.

In the second case it was pointed out that, after physiotherapy, the children that needed suction were statistically more with p<0.001 so p<0.05.

In the third case it was found that children with no disease-causing background, had less average rate of hospitalization days (9 days) in comparison to those that another disease existed (22 days) with p=0.051 marginally statistically important difference since p<0.05.

In the forth case it was found that days of hospitalization had a considerably positive and statistically significant connection with the days of intubation, since p<0.001 and rho=0.959. Also the days of intubation had a modestly positive and marginally, statistically significant connection to the Extubation efforts, since p=0.054 and rho=0.416. The days of hospitalization were found to have a modestly positive non-statistically significant connection to the number of extubation attempts, since p=0.175 and rho=0.3.

DISCUSSION

The analysis of results point out that, after physiotherapy intervention, in the 1st 24 hours, the frequency of respirations in children decreases pulse oximetry in both 24 hours seem to have increased. This can be confirmed by another research according to it, proper layout of the patient and application of respiration techniques increases the level of saturation by improving connection of passing gas and blood flow (Gosselink et al., 2008) (Gosselink et al., 2011) (Boles et al., 2008) (Clini and Ambrosino, 2005).

Furthermore, it was found that the application of respiratory techniques helped in the first 24 hours as a result in the second 24 hours all the children were able to execute the maximum time (15 min) of the session and also the number of children executing the exercises in semi-seated position. This ascertainment is support by a previous study that has taken place in ER patients, especially in cases of after surgery recovery, where the time period of a

physiotherapy intervention range from 10 min minimum to 15 maximum (Browning et al., 2007). In another research it was pointed out that when physiotherapy intervention with the application of respiratory techniques is 15 min and after Endotracheal suction is done, then the level of saturation is improved (Mehta et al., 2016). The respiratory techniques (pressures, vibrations, strokes) are usually used in compilations with the patient's change of position (Spapen et al., 2017).

Moreover it appeared that the number of children that received bronchodilators after the end of physiotherapy session in the 1st 24 hours had increased from a previous study it turns out that bronchodilators relax the smooth muscular fibers, reversing the blockage of airways and preventing bronchoconstriction (Dhand, 2007) between respirator and dependent patient.

Another element of this study is that after the physiotherapy intervention the children's need for Endotracheal suction increased, this means that the secretion liquidized with the help of respiratory physiotherapy techniques. According to bibliography endotracheal suction is used in the end of every physiotherapy session to remove secretions (Moffat and Jones, 2009). Subsequently it was noticed that the hospitalization days of a child in ICU were connected to the days of intubation as well as with the number of extubation attempts. The rates are proportional, specifically as the days of hospitalization increase, the days in which the child patient is intubated as well as the number of attempts to disengage mechanical ventilator increase too. Therefore it is considered necessary the early physiotherapy intervention it contributes to the decreased the time needed to stay in mechanical ventilator. Consequently it leads to the decrease of hospitalization time in ICU (Adler and Malone, 2012) (Kayambu et al., 2013) (Pathmanathan et al., 2014).

Patients that are treated in ER and are intubated for a long time run the risk of having respiratory impairments and infections that are probably not due to their own pathology but to the extended time of mechanical support and the results of positive airway pressure and diffusion (Moffat and Jones, 2009).

Conclusion

Analyzing the data and comparing them to studies of other researchers showed at least to a point that our first assumption was confirmed. The clinical picture of a child after the respiratory physiotherapy showed positive results. Respiratory rates and frequency improved, cough became effective and saturation levels increased. Nonetheless data for children's ICU are limited. Recent studies show that early physiotherapy intervention, which includes respiratory physiotherapy in combination with movement, can safely begin in children intensive units care. A future study with a bigger specimen of patients would be of particular interest, it would provide consistency so more secure conclusions can be drawn.

The presence of a specialized children's physiotherapist in ICU is considered necessary so that personalized programmes can be applied. This fact is confirmed by the results of this study that showed a positive impact of respiratory physiotherapy techniques when applied in intubated children patient of the intensive unit care.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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