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## The effects of different positions on physiological measurement and perfusion index in pediatric intubated patients

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### Abstract

**Objective:** The aim of this study is to determine the effects of four different body positions applied to paediatric intubated patients on physiological variables and perfusion index.

**Method:** The sample of this study, which was conducted as a quasi-experimental study in a single group in a paediatric intensive care unit, consisted of 44 intubated and monitored patients. The patients were given supine, right-lateral, left-lateral and Semi Fowler positions at intervals of two hours, and each position's measurements were evaluated separately. In the analysis of data, number, percentage, mean, standard deviation, ANOVA, and post-hoc (Tukey HSD) tests were used.

**Results:** Fifty per cent of the patients were under 1 year old, 56.8% were male, and the mean patient age was  $20.61 \pm 21.72$  months. Peripheral oxygen saturation, systolic blood pressure and perfusion index mean values in the supine and Semi Fowler positions given to the patient were found to be statistically significant ( $p < 0.05$ ).

**Conclusion:** It was determined that SPO<sub>2</sub>, systolic blood pressure and perfusion index values were higher in the semi-fowler position than in the other positions.

**Keywords:** Position, paediatric intensive care, physiological parameter, perfusion index

### Introduction

Paediatric intensive care units (PICU) are units that include patients between the ages of 1 month and 18 who need critical care and require holistic nursing care with a disciplined approach (Kılıç *et al.*, 2016)<sup>[9]</sup>. To ensure patient safety and hemodynamic stability in these units, children are usually restrained and observed in a bed-bound condition. Ineffective position change and limited mobility may cause various vital problems, such as disruption of circadian rhythm, cardiovascular problems, delirium, pressure ulcer development, and ineffective respiratory pattern in the short and long term (Bargos-Munárriz *et al.*, 2020; Wieczorek *et al.*, 2016)<sup>[4, 17]</sup>. Position changes of intensive care patients are among the independent functions and initiatives of nurses. The body position should be changed frequently in the bed to minimise damage from the effects of immobilisation and to ensure patient comfort during the treatment and care process (Anchala, 2016)<sup>[2]</sup>. Studies on the position changes of intensive care patients have reported effects on oxygenation, ventilator-associated pneumonia (Thomas *et al.*, 2007)<sup>[14]</sup> and the development of pressure sores (Jocelyn Chew *et al.*, 2018)<sup>[8]</sup>. Although supine and prone positions have different effects in mechanically ventilated patients, Ateş *et al.* (2021)<sup>[3]</sup>, in their study with patients diagnosed with Corona Virus Disease 19 (COVID 19), stated that the supine and lateral positions, together with the prone position, affected compliance with the treatment (Ateş *et al.*, 2021)<sup>[3]</sup>. Agustina *et al.* (2021)<sup>[1]</sup> stated that the right-lateral position can increase oxygen saturation and respiratory rate based on their study in children under five years of age diagnosed with pneumonia (Agustina *et al.*, 2021)<sup>[1]</sup>. Studies on position changes in paediatric intensive care units are relatively few, so more studies are needed to evaluate the effects of position changes (Piva *et al.*, 2019)<sup>[11]</sup>. Perfusion index (PI) is the ratio of pulsatile blood circulation in peripheral tissue to non-pulsatile blood circulation measured by non-invasive pulse oximetry (Hasanin *et al.*, 2016)<sup>[7]</sup>. It is stated that changes in blood flow, physical conditions of the environment (such as temperature, coldness) and acid-base balance problems in critically ill patients may affect the peripheral perfusion index (Hasanin *et al.*, 2016; Thijssen *et al.*, 2019)<sup>[7, 13]</sup>.

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Thijssen *et al.* (2019) [13] stated in their study that the accuracy of pulse oximetry in predicting arterial oxygenation, as well as moderate and increased perfusion index values, contributed little (Thijssen *et al.*, 2019) [13]. As a result, the parameters obtained during the position change may differ according to the type of position (Tor *et al.*, 2019) [16]. Considering these situations, it is important to monitor the blood pressure, pulse, fever, respiratory rate, peripheral oxygen saturation (SPO2) and perfusion index (PI) after different positions are taken to contribute to the development of more critical follow-up of paediatric patients and nursing care.

**Purpose and Hypotheses**

The main purpose of this study is to determine the effects of four different body positions applied to paediatric intubated patients on physiological variables and PI. Thus, the following hypotheses were created:

H1: Is there a difference between the physiological effects of different body positions of children on mechanical ventilators?

H2: Is there a difference between the perfusion index effects of different body positions of children on mechanical ventilators?

**Method**

**Method of research**

The research was carried out as a quasi-experimental study in a single group. The research was carried out in the paediatric intensive care unit of a tertiary hospital between September 2021 and January 2022. The sample size was determined as 44 patients with a 95% confidence interval and 0.05% significance level by G\*power analysis. Patients who had parental consent and met the inclusion criteria were included in the study. The inclusion criteria were as follows: (1) children aged one month to 15 years, (2) patients who are intubated and followed up with monitoring, (3) patients without signs of acute respiratory distress syndrome (ARDS) or increased intracranial pressure (ICP) and (4) patients who did not have a medical problem that prevented them from being positioned. The exclusion criterion was (1) patients who were extubated during the study.

**Data collection**

Demographic data were recorded from patient files, and measurements were recorded via monitor, pulse oximeter and fever meter devices. Because the patients formed their own control group in the study, randomisation was carried out through a simple random numbers table. From the random number in the selected block, patients who met the research criteria were placed in supine, right-lateral, left-lateral and Semi Fowler positions, with two hours between each position change, and blood pressure, pulse, fever, respiratory rate, SPO2 and PI values were evaluated at the second hour after each position.

**Evaluation of Data**

Data were analysed with SPSS package program 24.

In the study, blood pressure, pulse, fever, SPO2 and PI were accepted as dependent variables, whereas the supine, right-lateral, left-lateral and Semi Fowler positions were considered independent variables. Number, percentage, mean, and standard deviation were used in the descriptive analyses. Post hoc (Tukey HSD) analysis was performed to determine the differences between physiological measurement and PI after the patient’s position was given.

**Ethical Considerations**

Before starting the research, approval was obtained from ethics committee at the hospital where (date: 03.09.2021 no: 884). Necessary information was given to the parents of the patients, and their consent was obtained in line with their voluntary participation.

**Limitations of the Research**

The fact that the data of this study were collected from the same group provides reliability in terms of homogeneity. However, the limitation of the research is that the same person performed the application and measurement. The research results can be generalized to similar patient groups.

**Results**

The mean age of 44 children included in the study was 20.61±21.72 months, the mean duration of being connected to a mechanical ventilator was 4.18±3.39 days, and their mean weight was 9.32±5.19. In addition, it was determined that 50% of the children were under the age of 1, 56.8% were male, and 38.6% were diagnosed with respiratory diseases (Table 1).

**Table 1:** Introductory Characteristics and Clinical Information of Children

Feature		Number (n)	Percent (%)
Age	< 1 age	22	50
	1-5 age	17	38.6
	> 5 age	5	11.4
Gender	Female	19	43.2
	Male	25	56.8
Medical diagnosis	Respiratory diseases	17	38.6
	Cardiac diseases	9	20.5
	Metabolic diseases	7	15.9
	Neurological diseases	7	15.9
	Nephrological diseases	3	6.8
	Gastrological diseases	1	2.3
	$\bar{x}\pm ss$	Minimum	Maximum
Intubation time (days)	4.18±3.39	1	15
Age (month)	20.61±21.72	1	80
Weight	9.32±5.19	3.20	25

Vital signs, SPO2 saturation, and the perfusion index (PI) were measured in different positions of the children through at least three cycles two hours apart. The mean values of the post-position values were compared. There were statistically significant differences between the positions in the mean values of SPO2 saturation (p .000), systolic blood pressure (p .007), and the perfusion index (p .000) (Table 2).

**Table 2:** Comparison of Vital Signs and Perfusion Indices of Different Positions of the Children

	Supine	Left lateral	Right lateral	Semi Fowler	P value
O <sub>2</sub> saturation*	91.88±4,78	94.93±4,36	94.70±4,35	96.72±3,75	,000
Blood pressure (systole)*	92,70±13,76	91,77±13,59	92,04±17,42	100,95±12,03	,007
Blood pressure (diastole)	54,31±7,76	52,93±7,09	52,52±11,91	56,52±6,92	,130
Pulse	138,38±22,84	138,00±22,25	137,72±24,24	139,93±21,71	,970
Fever /Temperature	36,71±,48	36,77±,45	36,75±,49	36,77±,40	,945
Respiratory rate	32,75±9,48	33,20±9,82	32,95±9,43	33,40±10,45	,990
Perfusion index*	,81±,52	1,08±,92	,80±,51	1,50±,85	,000

\*: Tukey test, one of the post hoc tests, was studied.

There was a statistically significant difference between the mean values of the supine position and the right lateral (p .014), left lateral (p .006), and Semi Fowler (p .000) positions for SPO<sub>2</sub> saturation, but for the right lateral, left lateral, and Semi Fowler, there was no significant difference between the positions. There was a statistically significant difference between the mean values for blood pressure in the Semi Fowler, right lateral (p .021), supine (p .038), and

left lateral (p .016) positions, but for the right lateral, left lateral, and supine positions, there was no significant difference. For the PI, there was a statistically significant difference between the mean values taken in the semi fowler, right lateral (p .000), supine (p .000), and left lateral positions (p .043), but there was no significant difference between the right lateral, left lateral, and supine positions (Table 3).

**Table 3:** Differences in O<sub>2</sub> Saturation, Blood Pressure (Systole), and the Perfusion Mean according to Positions (post hoc/Tukey HSD)

Variables	Position (i)	Supine	Left Lateral	Right Lateral	Semi Fowler
O <sub>2</sub> saturation	Right Lateral	,014	,995		,130
	Supine		,006	,014	,000
	Left Lateral	,006		,995	,214
	Semi Fowler	,000	,214	,130	
Blood pressure (Systole)	Right Lateral	,996	1,000		,021
	Supine		,990	,996	,038
	Left Lateral	,990		1,000	,016
	Semi Fowler	,038	,016	,021	
Perfusion Index	Right Lateral	1,000	,259		,000
	Supine		,307	1,000	,000
	Left Lateral	,307		,259	,043
	Semi Fowler	,000	,043	,000	

**Discussion**

In paediatric intensive care units, changing a child’s position due to limited movement is essential in nursing care for children receiving mechanical ventilator support (Maq *et al.*, 2003) [10]. Therefore, this study was conducted to evaluate the effects of different positions on the physiological parameters and perfusion index in intubated children. Although 88.6% of the children in the study were in the 0-5 age range, more patients were diagnosed with respiratory diseases (Table 1). Therefore, the demographic data of the study are similar to those in the literature (Augustina *et al.*, 2021; Tor *et al.*, 2019) [16].

In this study, the mean values of SPO<sub>2</sub>, systolic blood pressure, and PI were significantly higher in the semi fawler position (Table 2). Augustina *et al.* (2021) reported that the right lateral position increased the SPO<sub>2</sub> value in children with pneumonia. Tor *et al.* (2019) [16] did not detect any difference in systolic blood pressure values in the measurements they made in the supine and semi fawler positions in intensive care patients. Emerson and Banasik (1994) [5] emphasized in their study that different positions cause significant changes in systolic and diastolic blood pressure. Thijsen *et al.* (2019) [13] found PI < 1 at a rate of 52.8% in their study on intensive care patients. Based on these studies, it can be concluded that there is no consensus in the literature.

In the study, the SPO<sub>2</sub> value in the supine position and the systolic blood pressure and PI value in the semi-fawler position differed from the other positions (Table 3). Göcze

*et al.* (2013) [6], in their study with patients connected to mechanical ventilators, reported that their central venous pressure changed, arterial blood pressure decreased, and oxygen saturation was significantly reduced in the third-minute measurements of the semi-fowler position compared to different positions in which they placed the patients (Göcze *et al.*, 2013) [6]. Brindle *et al.* (2013) [15] stated that the hemodynamic parameters return to normal after five to ten minutes in different positions. The difference in research findings may be due to the difference in measurement times. Tapar *et al.* (2018) [12] stated that different body positions might affect the PI. Based on the literature, it can be concluded that the choice of the various positions is not made within the framework of a standard protocol.

**Conclusion and Recommendations**

it is important to evaluate the effectiveness of the positions applied to patients for critical patient follow-up in paediatric intensive care units (Piva *et al.*, 2019) [11]. Studies in this area are controversial (Göcze *et al.*, 2013; Tod Brindle *et al.*, 2013; Tor *et al.*, 2019) [6, 15, 16]. This study determined that the systolic blood pressure, SPO<sub>2</sub>, and PI values of the Semi Fowler position, in which patients are placed in two-hour cycles, are significantly higher than the supine, right lateral, and left lateral positions. According to these data, it can be concluded that the Semi Fowler position is more effective in paediatric patients with mechanical ventilator support. When nurses position patients, it is beneficial to pay attention to their respiratory, pain-free and patient

comfort. In addition, to create standard care recommendations in the literature, it is recommended to conduct studies in different patient groups, with repeated and different measurements at different time intervals.

## References

- Agustina N, Nurhaeni N, Hayati H. Right lateral position can improving oxygen saturation and respiratory rate on under-five children with pneumonia. *La Pediatria Medica e Chirurgica*. 2021;43(s1). <https://doi.org/10.4081/pmc.2021.262>
- Anchala AM. A Study to Assess the Effect of Therapeutic Positions on Hemodynamic Parameters among Critically Ill Patients in the Intensive Care Unit at Sri Ramachandra Medical Centre. *Journal of Nursing & Care*, 05(03). <https://doi.org/10.4172/2167-1168.1000348>
- Ateş İ, Erden A, Gürler E, Çağlayan A, Güçbey Ö, Karakaş Ö, *et al.* Compliance to not only prone but also lateral and supine positioning improves outcome in hospitalised COVID-19 patients. *International Journal of Clinical Practice*. 2021;75(11). <https://doi.org/10.1111/IJCP.14673>
- Bargos-Munárriz M, Bermúdez-Pérez M, Martínez-Alonso AM, García-Molina P, Orts-Cortés MI. Prevention of pressure injuries in critically ill children: A preliminary evaluation. *Journal of Tissue Viability*. 2020;29(4):310-318. <https://doi.org/10.1016/J.JTV.2020.08.005>
- Emerson RJ, Banasik JL. Effect of position on selected hemodynamic parameters in postoperative cardiac surgery patients. *American Journal of Critical Care*. 1994;3(4):289-299. <https://doi.org/10.4037/AJCC1994.3.4.289>
- Göcze I, Strenge F, Zeman F, Creutzenberg M, Graf BM, Schlitt HJ, *et al.* The effects of the semirecumbent position on hemodynamic status in patients on invasive mechanical ventilation: Prospective randomized multivariable analysis. *Critical Care*. 2013;17(2):1-9. <https://doi.org/10.1186/CC12694/TABLES/6>
- Hasanin A, Mohamed SAR, El-adawy A. Evaluation of perfusion index as a tool for pain assessment in critically ill patients. *Journal of Clinical Monitoring and Computing*. 2016;31(5):961-965. <https://doi.org/10.1007/S10877-016-9936-3>
- Jocelyn Chew HS, Thiara E, Lopez V, Shorey S. Turning frequency in adult bedridden patients to prevent hospital-acquired pressure ulcer: A scoping review. *International Wound Journal*. 2018;15(2):225-236. <https://doi.org/10.1111/iwj.12855>
- Kılıç FZ, Çoban Y, Davutoğlu M, Dalkıran T. A Retrospective Analysis of Patients Monitored in a Pediatric Intensive Care Unit and an Investigation of Factors Affecting Mortality. *Turkish Journal of Pediatric Emergency and Intensive Care Medicine*. 2016;3(3):140-145. <https://doi.org/10.4274/cayd.02996>
- Curley MAQ, Quigley SM, Lin M. Pressure ulcers in pediatric intensive care: incidence and associated factors. *Pediatr Crit Care Med*. 2003;4(3):284-290.
- Piva TC, Ferrari RS, Schaan CW. Early mobilization protocols for critically ill pediatric patients: Systematic review. *Revista Brasileira de Terapia Intensiva*. 2019;31(2):248-257. <https://doi.org/10.5935/0103-507X.20190038>
- Tapar H, Karaman S, Dogru S, Karaman T, Sahin A, Tapar GG, *et al.* The effect of patient positions on perfusion index. *BMC anesthesiology*. 2018;18(1):111. <https://doi.org/10.1186/s12871-018-0571-z>
- Thijssen M, Janssen L, le Noble J, Foudraine N. Facing SpO2 and SaO2 discrepancies in ICU patients: is the perfusion index helpful? *Journal of Clinical Monitoring and Computing*. 2019;34(4):693-698. <https://doi.org/10.1007/S10877-019-00371-3>
- Thomas PJ, Paratz JD, Lipman J, Stanton WR. Lateral positioning of ventilated intensive care patients: A study of oxygenation, respiratory mechanics, hemodynamics, and adverse events. *Heart and Lung: Journal of Acute and Critical Care*. 2007;36(4):277-286. <https://doi.org/10.1016/j.hrtlng.2006.10.008>
- Tod Brindle C, Malhotra R, O'rourke S, Currie L, Chadwick D, Falls P, *et al.* Turning and repositioning the critically ill patient with hemodynamic instability: A literature review and consensus recommendations. *Journal of Wound, Ostomy and Continence Nursing*. 2013;40(3):254-267. <https://doi.org/10.1097/WON.0B013E318290448F>
- Tor Ö, Mert G, Tosun B. Yoğun Bakım Hastalarına Verilen Pozisyonların Hemodinamik Ölçümlere Etkisi. *E-Journal of Dokuz Eylul University Nursing Faculty*. 2019;12(1):15-20. <https://dergipark.org.tr/en/pub/deuhfed/705912>
- Wieczorek B, Ascenzi J, Kim Y, Lenker H, Potter C, Shata NJ, *et al.* PICU Up!: Impact of a Quality Improvement Intervention to Promote Early Mobilization in Critically Ill Children. *Pediatric Critical Care Medicine: A Journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies*. 2016;17(12):e559. <https://doi.org/10.1097/PCC.0000000000000983>

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