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The Questionnaire of Current Situation in Pediatric Cardiac Intensive Care in Türkiye

Türkiye'de Pediyatrik Kardiyak Yoğun Bakım Güncel Durum Anketi

ABSTRACT

Objective: To enhance the results in pediatric cardiac intensive care patients, it is essential to determine the personnel, organisation and equipment status that require improvement. This study aimed to evaluate the current status in the units where pediatric cardiac intensive care patients are admitted, in Türkiye.

Method: The study was carried out by means of an online questionnaire form delivered to the chief physicians of intensive care units. The number of patients admitted in the intensive care unit, scope of the surgeries, the number and specialities of physicians and staff who are involved, their roles in patient care, as well as the use of monitorisation methods were defined. Descriptive statistics were applied to the results.

Results: The intensive care units are most commonly found in educational institutions and there is a high rate of subspecialty training clinics. The majority of the units are medical and surgical mixed units (76%) and pediatric-only (96%). Pediatric intensive care specialists are most often asserted as the primary responsible physician (48%). The average number of surgeries and annual number of admitted patients are variable among the institutions. Interventional procedures are performed (92%) and cardiac mechanical support systems are used (84%) in the vast majority of the institutions.

Conclusion: There is great heterogeneity in patient volumes, personnel status and organisation styles of the units in which pediatric cardiac intensive care patients are admitted. In the future, all these types of patients should be cared for in pediatric-only units and physicians specialized in Pediatric Intensive Care should be present in the teams caring for these patients.

Keywords: Congenital heart defects, pediatric cardiac intensive care, postoperative critical care

ÖZET

Amaç: Pediyatrik kardiyak yoğun bakım hastalarındaki sonuçları iyileştirmek için, geliştirilmesi gereken personel, organizasyon ve ekipman durumunu belirlemek önemlidir. Bu çalışma, Türkiye'de pediyatrik kardiyak yoğun bakım hastalarının kabul edildiği ünitelerdeki mevcut durumu değerlendirmeyi amaçlamaktadır.

Yöntem: Çalışma, yoğun bakım ünitelerinin sorumlu hekimlerine ulaştırılan çevrimiçi anket formu ile gerçekleştirildi. Yoğun bakım ünitesine kabul edilen hasta sayısı, yapılan ameliyatların kapsamı; hasta bakımında görev alan hekim ve personelin sayısı ve uzmanlık alanları, hasta bakımındaki rolleri ve kullanılan monitörizasyon yöntemleri tanımlandı. Sonuçlar üzerinde tanımlayıcı istatistikler uygulandı.

Bulgular: Ünitelerin çoğunluğu eğitim kurumlarında yer almakta ve yüksek oranda yan dal eğitim kliniği bulunmaktadır. Ünitelerin çoğunluğu medikal ve cerrahi karma (%76) ve yalnızca pediyatrik hasta takibi yapan (%96) ünitelerden oluşmaktadır. Birincil sorumlu hekim olarak en sık Pediyatrik yoğun bakım uzmanları belirtilmiştir (%48). Ameliyatların sayısı ve yıllık hasta kabul sayısı kurumlar arasında değişikenlik göstermektedir. Girişimsel işlemler yüksek oranda (%92) yapılmakta ve kardiyak mekanik destek sistemleri kurumların büyük çoğunluğunda (%84) kullanılmaktadır.

Sonuç: Pediatrik kardiyak yoğun bakım hastalarının kabul edildiği birimlerin hasta hacimleri, personel durumu ve organizasyon yapıları arasında büyük bir heterojenlik bulunmaktadır. Gelecekte, tüm hastaların yalnızca pediatrik birimlerde bakılması ve bu hastaların bakımını üstlenen ekiplerde Pediyatrik Yoğun Bakım uzmanlarının mutlaka yer alması gerekmektedir.

Anahtar Kelimeler: Konjenital kalp hastalıkları, pediyatrik kardiyak yoğun bakım, postoperatif yoğun bakım

ORIGINAL ARTICLE
KLİNİK ÇALIŞMA

Ayşe Filiz Yetimakman[1]
Gökçen Özçifçi[2]
Merve Havan[3]
Mehmet Çeleğen[4]
Nagehan Aslan[5]
Murat Kangın[6]
Mehmet Boşnak[7]
Tanıl Kendirli[3]
Ayşe Berna Anıl[8]

[1]*Department of Pediatric Intensive Care, Marmara University, İstanbul, Türkiye*
[2]*Department of Pediatric Intensive Care, Health Ministry of Turkish Republic, İzmir City Hospital, İzmir, Türkiye*
[3]*Department of Pediatric Intensive Care, Ankara University, Ankara, Türkiye*
[4]*Department of Pediatric Intensive Care, Republic of Türkiye Ministry of Health, Kayseri City Hospital, Kayseri, Türkiye*
[5]*Department of Pediatric Intensive Care, University of Health Sciences Başakşehir Çam ve Sakura City Hospital, İstanbul, Türkiye*
[6]*Department of Pediatric Intensive Care, İstanbul Medipol University, İstanbul, Türkiye*
[7]*Department of Pediatric Intensive Care, Gaziantep University, Gaziantep, Türkiye*
[8]*Department of Pediatric Intensive Care, İzmir Katip Çelebi University Medical School, İzmir, Türkiye*

Corresponding author:
Ayşe Filiz Yetimakman
✉ filizyetimakman@hotmail.com

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Patients who have undergone cardiac surgery in the pediatric age group have an increased risk of mortality and morbidity. In order improve the prognosis of this patient group, it is critical that follow-up and treatment of patients be performed with a multidisciplinary approach, by all the relevant branches, especially pediatric intensive care specialists, cardiovascular surgeons and pediatric cardiologists. In addition, other healthcare professional should be trained in this field and, whenever possible, be well practised.[1-3]

This survey was designed to evaluate the current status in the units where pediatric cardiac intensive care patients are admitted in Türkiye. The aim of the study was to determine the number of patients who were operated on for pediatric cardiac diseases and followed up in intensive care units, the scope of the surgeries performed, as well as the number of physicians and personnel responsible and involved, their duties, working system and technical equipment.

Materials and Methods

The research was conducted as a survey study for the chief physicians of intensive care units of the centers where cardiac operations are performed in pediatric patients in Türkiye. The questionnaire was delivered to the participants via the Google forms platform and the answers were recorded. Each questionnaire was filled out by a single physician from every unit. In addition to the number of patients who were operated and followed up for pediatric cardiac disease in the intensive care unit, defining the scope of the surgeries performed, the number of physicians and staff who are involved, their duties, working system and technical equipment status were the primary endpoints of the research. A sample of the questionnaire form is presented in the Appendix.

Once the data was obtained from the recorded answers, descriptive statistics were applied, mean±standard deviation were calculated and frequencies were indicated as percentages (%). The study was conducted in accordance with the Declaration of Helsinki and the study was approved by Health Sciences University İzmir Tepecik Training and Research Hospital Non-Interventional Research Ethics Committee (Approval Number: 2023/06-20, Date: 13.07.2023). This work was exempt from patient consent and no artificial intelligence (AI)–assisted technologies were used its production.

Results

Pediatric cardiac surgery patients are followed up in approximately twenty-five centers in Türkiye. Twenty one of these (84%) are located in the three regions of Marmara, Aegean and Central Anatolia. Sixteen of the survey participants were working in a University Hospital, whereas nine were working in the Training and Research Hospitals and City Hospitals affiliated with the Ministry of Health. As stated by the participants, 56% of these institutions provide pediatric intensive care fellowship programme, 72% provide neonatal intensive care fellowship programme, 76% provide pediatric cardiology fellowship programme, 56% provide pediatric cardiovascular surgery fellowship programme and 64% provide adult intensive care fellowship programme. In twenty-one institutions, the chief physician is a faculty member and of those who participated in the survey, nineteen (76%) were pediatric intensive care specialists, three (12%) were pediatric cardiac surgeons, two (8%) were pediatric cardiologists and one (4%) is an anesthesiologist.

ABBREVIATIONS

ECMO	Extracorporeal membrane oxygenation
$etCO_2$	End tidal CO_2
NIRS	Near infrared spectroscopy
PCICU	Pediatric cardiac-only intensive care units
PCICUs	Pediatric cardiac intensive care units
PiCCO	Pulse contour cardiac output
PICUs	Pediatric intensive care units
$ScvO_2$	Central venous oxygen saturation
VADs	Ventricular assist devices

The types of units that the survey participants were responsible for, the first unit in which patients were admitted in the postoperative period and the primary responsible physician for the follow-up of pediatric cardiac intensive care patients, are all summarized in Table 1. The total number of beds in the units varied from seven to 39, and it was revealed that 4% of all units had beds reserved only for pediatric cardiac surgery patients. Apart from the six units that serve only as pediatric cardiac intensive care units (PCICUs), it was determined that 36% of the units surveyed had beds reserved exclusively for pediatric cardiac surgery patients.

On the issue of follow-ups, the answers to the question "Which branches should be in the follow-up of pediatric cardiac intensive care patients?" are summarized in Table 1. In the follow-up of the postoperative patients treated on the ventilator, the patient/nurse ratio was reported as 1/1 by 8%, 2/1 by 68%, 3/1 by 12% and 1/1 or 2/1 by 12% of the participants. The time period since the congenital cardiac surgery operations were started in the institution, the average number of surgeries performed per year, the average number of pediatric bypasses performed per year and the number of pediatric cardiac intensive care patients admitted per year, are all summarized in Table 2.

The types of surgeries performed and the rates at which they are performed in these centers are reported in Figure 1. Pediatric cardiac interventional procedures are performed in 92% of the centers and cardiac mechanical support systems for pediatric patients are used in 84% of them. The number of extracorporeal membrane oxygenations (ECMOs) applied annually with respiratory and cardiac indications, as well as extracorporeal cardiopulmonary resuscitation (E-CPR) numbers, are shown in Table 3.

Of the centers participating in the survey, 28% were transplant centers. It was determined that four of the five centers where ventricular assist device (VAD) is applied, had less than five applications per year, whereas one of them has five to ten applications per year. In our survey study, the use of monitoring systems in pediatric patients was also queried and the types, as well as their individual rates of use in these centers, are shown in Table 4.

Table 1. Distribution of the Type of Units, Units of First Admission, Primary Responsible Physician and Branches that Follow Up the Patients

The types of units that the survey participants are responsible for	Mixed pediatric intensive care unit (medical + pre and post-operative patients)	18 (72%)
	Pediatric-only cardiac ICU unit	6 (24%)
	Medical + surgical + cardiac intensive care unit (both adult and pediatric)	1 (4%)
The first unit in which patients are admitted in the postoperative period	Pediatric cardiac intensive care unit	9 (36%)
	Cardiovascular surgery intensive care unit (adult + pediatric)	5 (20%)
	Mixed pediatric intensive care unit (medical + surgical)	4 (16%)
	The unit where the patient will be admitted is determined according to the patient's condition	7 (28%)
Primary responsible physician for the follow-up of pediatric cardiac intensive care patients	Pediatric intensive care specialist	12 (48%)
	Only cardiac surgeons	4 (16%)
	Only pediatric cardiologists	2 (8%)
	Pediatric intensive care specialists and cardiovascular surgeons	1 (4%)
	Cardiac surgeons and anesthesiologists	1 (4%)
	Anesthesiologists and pediatric cardiologists are equally responsible	1 (4%)
	The attending physician of the unit that the patient is admitted, responsible.	1 (4%)
Answers for "Which branches should be in the follow-up of pediatric cardiac intensive care patients?"	Pediatric intensive care specialist	24 (96%)
	Pediatric cardiac surgeon	21 (84%)
	Anesthesiologists	4 (16%)
	Pediatric cardiologist	23 (92%)
	Neonatal intensive care specialist	12 (48%)
	Pediatric radiologist	1 (4%)
	Pediatric Nephrology, Neurology, Gastroenterology, Endocrinology, Genetics, Infectious diseases	1 (4%)

ICU: Intensive care unit.

Discussion

Pediatric cardiac intensive care patients are in the high-risk group for mortality and morbidity due to cardiac diseases, comorbidities or complications. Determining the current personnel and equipment status and the issues that require improvement, is useful for prevention of high-risk circumstances. As no comprehensive report on the number of pediatric cardiac intensive care patients admitted in Türkiye, the types of surgeries performed, the status of the responsible and assigned doctors and their roles, nor their technical equipment were found, the results of the survey study will contribute to the literature.

Most of the units were grouped in the big cities of three regions of the country, which indicates a heterogeneity in the distribution of healthcare services for pediatric cardiac patients. Sixteen of the survey participants who were in charge of the unit were working in a university hospital and twenty-one were faculty members. In a survey conducted in the USA in 2009, it was determined that 79% of the institutions where pediatric cardiac intensive care patients were followed, were university hospitals.[4] The predominance of university hospitals in the follow-up of the patient group of the current survey is a result of advanced treatment options in tertiary health institutions, as well as due to the priority of case diversity in educational institutions. In addition, there was a high rate of subspecialty training clinics in participating centers. Of the participants, nineteen (76%) were pediatric intensive care specialists. This is a positive result of the increasing number of pediatric intensive care specialists who graduated since 2012.

In terms of patient content, the type of units that the survey participants are responsible for are stated as medical and surgical mixed units in nineteen centers (76%) and pediatric cardiac-only intensive care units (PCICU) in six (24%) centers. It was determined that the percent of mixed units was high in comparison to western countries.[4,5] Among these nineteen centers, one was an adult- pediatric mixed unit and the other eighteen were pediatric intensive care units (PICUs). Although Eldadah et al.[6] reported a decrease in mortality and morbidity after the organization of a unit where only pediatric cardiac surgery patients are cared for; this may be related to the institution's increased experience in pediatric cardiac surgery. Also the number of cases and the rate of complex cases did not increase in time. In addition, in a study also published by Burstein et al.[7] in 2011, it was reported that the results were

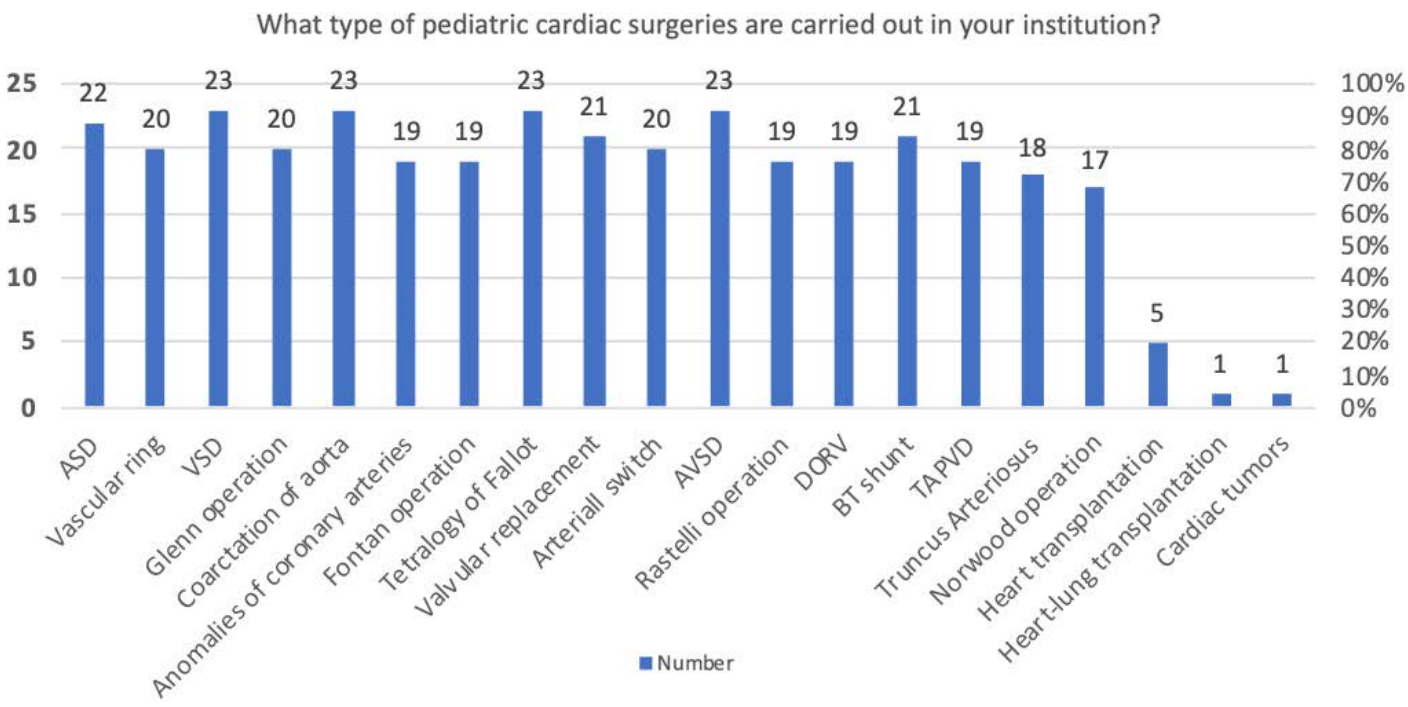

Figure 1. The type of pediatric cardiac surgeries carried out in the centers.

ASD, Atrial septal defect; VSD, Ventricular septal defect, AVSD, Atrioventricular septal defect; DORV, Double outlet right ventricle; BT shunt, Blalock-Taussig shunt; TAPVD, Total anomalous pulmonary venous drainage.

Table 2. Experience and Patient Volume of the Institutions

Congenital cardiac surgery operations are performed in the institution for	5 years or less	28%
	5–10 years	24%
	10–20 years	28%
	More than 20 years	16%
The average number of surgeries performed per year	0–50	24%
	50–100	20%
	100–200	16%
	200–300	4%
	300–500	20%
	More than 500	16%
The average number of pediatric bypasses performed per year	0–50	32%
	50–100	16%
	100–200	28%
	200–300	8%
	300–500	4%
	More than 500	12%
Pediatric cardiac intensive care patients admitted per year	0–50	36%
	50–100	12%
	100–200	8%
	200–300	8%
	300–500	16%
	More than 500	20%

no different from mixed units in terms of mortality, length of hospitalization and complications in patients treated in CICUs, except for patients in certain surgical risk categories. In our country, the units providing intensive care services for critically ill children (PICUs) are mostly organized in a mixed manner. Pediatric Intensive Care specialists working in these PICUs graduate from subspecialty training programs, preparing them to shoulder responsibility for both medical and surgical patients.

Table 3. Average Number of ECMO and E-CPRs

The annual number of ECMOs for respiratory indications	Not applied	6 (24%)
	Less than 10	18 (72%)
	10–30	1 (4%)
The annual number of ECMOs for cardiac indications	Not applied	4 (16%)
	Less than 10	10 (40%)
	10–30	8 (32%)
	30–50	3 (12%)
Total number of E-CPRs	Never	10 (40%)
	1–5	7 (28%)
	6–10	2 (8%)
	11–20	2 (8%)
	More than 20	4 (16%)

ECMO, Extracorporeal membrane oxygenation; E-CPR, Extracorporeal cardiopulmonary resuscitation.

Table 4. Monitoring Methods Used for Pediatric Cardiac Intensive Care Patients

Use of monitoring methods	Number of centers (%)
NIRS	20 (80%)
SVO_2	22 (88%)
Lactate	24 (96%)
$etCO_2$	23 (92%)
USG	24 (96%)
Echocardiography	25 (100%)
PICCO	8 (32%)
Non-invasive cardiac output measurement	8 (32%)

NIRS, Near Infrared Spectroscopy; SVO_2, Venous Oxygen Saturation; $etCO_2$, End Tidal CO_2; USG, Ultrasound Sonography; PiCCO, Pulse Contour Cardiac Output.

Apart from the six units that served only as pediatric cardiac intensive care units, it was found that 36% of the units had beds reserved only for pediatric cardiac surgery patients. This rate is similar to the data reported by Horak et al.[5] in the USA in 2018. Intensive care unit beds in our country serve with a high occupancy rate, throughout the year, and it is imperative to plan surgeries of pediatric cardiac surgery patients in a timely manner. For this reason, the presence of beds reserved for cardiac surgery patients in some of these units, contributes to planning the surgeries on time.

In the survey, mixed cardiovascular surgery intensive care units (adult + child) are specified as the first units in which patients were hospitalized in the postoperative period at a rate of 20% (5 units). Although cardiovascular surgery intensive care units are served by experienced teams, critically ill children differ significantly from adult patients, and the medical troubles of these patients involving more than one organ system require pediatric expertise.[8] In the units to be structured in the future, priority should be given to the management of the care of pediatric patients by specialties appropriate for the age group.

Pediatric intensive care specialist was listed as the primary responsible physician in the follow-up of pediatric cardiac intensive care patients in twelve (48%) units. With the increase in the number of pediatric intensive care specialists, this rate is expected to increase.

Participants were asked their opinion on which branches should be in the follow-up of pediatric cardiac intensive care patients. Due to the complex medical and surgical problems of pediatric cardiac intensive care patients, it is possible to improve the prognosis by monitoring them using a multidisciplinary team consisting of related branches.[9,10] In the prevention of complications in particular, the knowledge, experience and equipment status of the physicians and staff gains importance.[6,11–14]

In the follow-up of critically ill children treated on a mechanical ventilator, it is recommended that the patient/nurse ratio should ideally be arranged in such a way that there are no more than two patients per nurse.[12,15] In our survey, it was determined that this ratio or even a 1/1 ratio could be achieved in 76% of the participants. In order to increase the quality of care in these patients, it is imperative to make appropriate assignments in order to provide this rate in all units.

The average numbers of pediatric cardiac intensive care patients admitted per year in every unit, are parallel with the number of surgeries performed per year, per institution. In pediatric cardiac surgery, it is known that the annual number of surgeries performed at the center is associated with survival, especially in the early postoperative period.[16] In addition, the length of intensive care unit stay and complication rates decrease in parallel with the experience of the center.[6,17] For this reason, it can be predicted that the centralization approach in the healthcare system and operating on patients in more experienced centers, particularly in complex cardiac surgery cases, will have positive effects in terms of prognosis.

Pediatric cardiac interventional procedures were performed in 92% of the centers and cardiac mechanical support systems was reportedly used in 84%. It was found that four of the five centers where VADs were applied had fewer than five applications per year, and only one had five to ten applications per year. Since many centers where cardiac mechanical support systems are used are not transplant centers, patients who do not improve with cardiac mechanical support systems need to be referred to transplant centers when there is an indication for transplantation and when there is an appropriate donor.

The number of ECMOs administered annually with respiratory indications was found to be less than ten in eighteen (72%) centers and the annual number of ECMOs applied with cardiac indications, less than ten per year in ten (40%) centers. In ten (40%) of the twenty-five centers, E-CPR was never performed. According to the data published by Barbaro et al.[18] in 2015, the increase in the ECMO experience of a center has been shown to have a positive effect on mortality. On the other hand, the use of ECMO has been shown to have a positive effect on survival in cardiac arrest that does not correspond to traditional resuscitation in pediatric intensive care.[19] For this reason, improving the ECMO organization and increasing the experience in the centers where high-risk postoperative pediatric cardiac patients are followed, will have a positive effect on patient outcomes.[20]

In our survey study, the use of monitoring methods in pediatric patients was also examined. Near infrared spectroscopy (NIRS) was used in twenty (80%) centers, central venous oxygen saturation ($ScvO_2$) in twenty-two (88%) centers, lactate in twenty-four (96%) centers, End tidal CO_2 ($etCO_2$) in twenty-three (92%) centers, Ultrasonography in twenty-four centers (96%), Echocardiography in twenty-five centers (100%), minimally invasive hemodynamic monitoring [pulse contour cardiac output (PiCCO)] in eight centers (32%), and non-invasive cardiac output measurement in eight centers (32%). In the Horak et al.[5] 2018 study, it was stated that while NIRS and $etCO_2$ were used in all centers, non-invasive cardiac output measurement and advanced data analytical methods were used in less than 20% of units. Ease of access and user experience are usually decisive in determining which monitoring methods will be used.[21]

To the best of our knowledge, these twenty-five centers represented all of the centers in our country performing pediatric cardiovascular surgical procedures. The participants were chief attending physicians of the units in which pediatric cardiac surgical patients are admitted. The main limitation of the study is that it is a survey study and the data is derived from participants and not medical records. This may have caused some discrepancies, specifically concerning data regarding the numbers of surgeries and types of surgeries carried out in each center, every year. On the other hand, the study gives valuable information about perspectives of physicians in the field.

Conclusion

There is great heterogeneity in patient volumes, personnel status and organisation styles of the units in which pediatric cardiac intensive care patients are admitted. The effect of this heterogeneity on education and patient care should be further investigated by cohort studies. Multidisciplinary patient care is a positive aspect of the units in our country, which should be underlined and further improved.

In the future, instead of mixed units, all the units should be planned exclusively for pediatric patients, where the patient care is given by specialties appropriate for the age group. Pediatric Intensive Care specialists must invariably be present among the team members responsible for the care in these units.

Ethics Committee Approval: Ethics committee approval was obtained from Health Sciences University İzmir Tepecik Training and Research Hospital Non-Interventional Research Ethics Committee (Approval Number: 2023/06-20, Date: 13.07.2023).

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References

1. Section on Cardiology and Cardiac Surgery; American Academy of Pediatrics. Guidelines for pediatric cardiovascular centers. *Pediatrics*. 2002;109(3):544-549. [CrossRef]
2. Balachandran R, Nair SG, Kumar RK. Establishing a pediatric cardiac intensive care unit - Special considerations in a limited resources environment. *Ann Pediatr Cardiol*. 2010;3(1):40-49. [CrossRef]
3. Fraisse A, Le Bel S, Mas B, Macrae D. Paediatric cardiac intensive care unit: current setting and organization in 2010. *Arch Cardiovasc Dis*. 2010;103(10):546-551. [CrossRef]
4. Burstein DS, Rossi AF, Jacobs JP, et al. Variation in models of care delivery for children undergoing congenital heart surgery in the United States. *World J Pediatr Congenit Heart Surg*. 2010;1(1):8-14. [CrossRef]
5. Horak RV, Alexander PM, Amirnovin R, et al. Pediatric Cardiac Intensive Care Distribution, Service Delivery, and Staffing in the United States in 2018. *Pediatr Crit Care Med*. 2020;21(9):797-803. [CrossRef]
6. Eldadah M, Leo S, Kovach K, et al. Influence of a dedicated paediatric cardiac intensive care unit on patient outcomes. *Nurs Crit Care*. 2011;16(6):281-286. [CrossRef]
7. Burstein DS, Jacobs JP, Li JS, et al. Care models and associated outcomes in congenital heart surgery. *Pediatrics*. 2011;127(6):e1482-1489. [CrossRef]
8. DeSena HC, Nelson DP, Cooper DS. Cardiac intensive care for the neonate and child after cardiac surgery. *Curr Opin Cardiol*. 2015;30(1):81-88. [CrossRef]
9. Biçer M, Kozan Ş, Öztürk F et al. Comparing Two Models of Pediatric Cardiac Care Establishment in a Developing Country. *GKDA Derg*. 2023;29(3):167-173. [CrossRef]
10. Aydin SI, Boukas K, Koo J, Meliones JN, Ofori-Amanfo G. Pediatric Cardiac Intensive Care Unit Model. In: Ungerleider RM, Meliones JN, McMillan KN, Cooper DS, Jacobs JP, eds. *Critical Heart Disease in Infants and Children*. Elsevier;2019:35-47. [CrossRef]
11. Bryant KJ. Pediatric Delirium in the Cardiac Intensive Care Unit: Identification and Intervention. *Crit Care Nurse*. 2018;38(4):e1-e7. [CrossRef]
12. Hanson RM, Phythian MA, Jarvis JB, Stewart C. The true cost of treating children. *Med J Aust*. 1998;169(S1):S39-S41. [CrossRef]
13. Kabbani MS, Hijazi O, Elbarbary M, Ismail S, Shaath G, Jijeh A. Pediatric cardiac intensive care at the King Abdulaziz Cardiac Center. *Eur Heart J*. 2014;16(Suppl_B):B64-B67. [CrossRef]
14. Alten J, Cooper DS, Klugman D, et al. Preventing Cardiac Arrest in the Pediatric Cardiac Intensive Care Unit Through Multicenter Collaboration. *JAMA Pediatr*. 2022;176(10):1027-1036. [CrossRef]
15. Koroglu TF, Bayrakçı B, Dursun O, Kendirli T, Yıldızdaş D, Karabocuoglu M. *Turk Arch Pediatr*. 2006;41(3):139-145.
16. Zmora R, Spector L, Bass J, et al. Procedure-Specific Center Volume and Mortality After Infantile Congenital Heart Surgery. *Ann Thorac Surg*. 2023;116(3):525-531. [CrossRef]
17. Egbe AC, Uppu SC, Mittnacht AJ, et al. Primary tetralogy of Fallot repair: predictors of intensive care unit morbidity. *Asian Cardiovasc Thorac Ann*. 2014;22(7):794-799. [CrossRef]
18. Barbaro RP, Odetola FO, Kidwell KM, et al. Association of hospital-level volume of extracorporeal membrane oxygenation cases and mortality. Analysis of the extracorporeal life support organization registry. *Am J Respir Crit Care Med*. 2015;191(8):894-901. [CrossRef]
19. de Mos N, van Litsenburg RR, McCrindle B, Bohn DJ, Parshuram CS. Pediatric in-intensive-care-unit cardiac arrest: incidence, survival, and predictive factors. *Crit Care Med*. 2006;34(4):1209-1215. [CrossRef]
20. Pollak U, Feinstein Y, Mannarino CN, et al. The horizon of pediatric cardiac critical care. *Front Pediatr*. 2022;10:863868. [CrossRef]
21. Roeleveld PP, de Klerk JCA. The Perspective of the Intensivist on Inotropes and Postoperative Care Following Pediatric Heart Surgery: An International Survey and Systematic Review of the Literature. *World J Pediatr Congenit Heart Surg*. 2018;9(1):10-21. [CrossRef]