Characteristics and Outcomes of Patients with Do-not-Resuscitate in Pediatric Intensive Care Unit at King Saud Medical City: A Retrospective Study

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KEYWORDS

Pediatric Intensive Care Unit (PICU), Do-Not-Resuscitate (DNR) Orders, Palliative Care, Futile Treatment.

ABSTRACT

Background: Do-Not-Resuscitate (DNR) orders in pediatric intensive care units (PICUs) present substantial ethical, medical, and social challenges. This study investigates the factors influencing the issuance of DNR orders and their impact on patient outcomes in a pediatric setting.

Methods: This retrospective cohort study was conducted in the PICU at King Saud Medical City, focusing on pediatric patients aged 1 month to 14 years who were admitted from January 2023 to March 2024 and issued DNR orders during their stay. Data were gathered on demographic and clinical variables, specifics of DNR orders, and patient outcomes.

Results: Out of 150 patients initially assessed, 79 were included in the study. The median age was 12 years (IQR 6-27), with 45.6% male. A significant proportion of the cohort, 59.5% (n=47), received palliative care, whereas 40.5% (n=32) were subjected to treatments deemed futile. The survival analysis revealed a median duration from DNR order issuance to death of 2 days (IQR 1-6). The 12-day survival rate was 47.1% (95% CI 34.7%-64.1%), which remained consistent at 42.8% (95% CI 29.9%-61.4%) for both 36 and 60 days. Brain death was identified as a significant predictor of mortality with a hazard ratio (HR) of 4.68 (95% CI 2.22-9.85) in the multivariate analysis.

Conclusion: The study emphasizes the importance of considering a range of demographic and clinical factors when issuing DNR orders in pediatric patients. It highlights the critical role of palliative care in improving the quality of life, even as ethical dilemmas about futile care persist. Further research is needed to explore the psychosocial impacts of DNR decisions on families and healthcare providers, aiming to refine the approach to end-of-life care in pediatric settings.

Introduction

The idea of Do-not-Resuscitate (DNR) orders in pediatric intensive care units (PICUs) is an important part of medical ethics and clinical decision making. These directives are crucial in guiding end-of-life care for severely sick children, as they ensure that treatment is in the patient's best interests while also respecting the family's desires and cultural values. (1,2) DNR orders in pediatrics differ from those in adult medicine since such decisions are typically made for people who are unable to articulate their own wishes. Typically, these orders are issued when ongoing life-sustaining treatment is deemed hopeless or when it is believed that the quality of life will be

significantly harmed. (3) Understanding the demographic and clinical features that contribute to DNR orders can provide insight into how these choices are made and the factors that impact them. The effect of DNR orders on clinical outcomes is significant. According to current literature, these directives frequently shift the trajectory of care from curative to palliative, focusing on the child's comfort rather than life extension. However, the timing of these orders can have a major impact on both quality of life and the sort of medical intervention delivered. Early talks and choices about DNR orders are linked to a better coordinated care strategy, potentially reducing the use of invasive treatments while increasing the use of palliative care services. (4–6)

From a psychological and sociological perspective, providing DNR orders in a pediatric setting entails complex interactions between medical staff, the patient, and their family members. The decision-making process must be treated with delicacy and support, since it frequently involves navigating parental grief, ethical quandaries, and, on occasion, conflicting medical advice. (7,8) Effective communication is essential for ensuring that families are fully informed and included in the decision-making process, establishing trust and understanding between healthcare practitioners and families. Furthermore, the implementation of DNR orders involves various ethical concerns. The principle of autonomy is challenging in pediatric care since children are generally represented by proxies who must interpret what the kid would have wanted. The range of cultural, religious, and personal ideas about death and dying, which might impact decisions about end-of-life care, also raises ethical concerns. (9,10) Healthcare providers must navigate these waters with care and professionalism, respecting the views and beliefs of all individuals involved. So, we conducted this study to examine how DNR decisions are arrived at and their impact on patient outcomes by analyzing data from leading medical institutions like King Saud Medical City in Saudi Arabia.

Methods

Study Design and Setting

A retrospective cohort study will be conducted at the PICU of King Saud Medical City Saudi Arabia., which is a highly specialized unit dedicated to the care of critically ill pediatric patients.

Study Population

The study population consists of pediatric patients admitted to the PICU at King Saud Medical City during the specified study period. Inclusion Criteria: Patients aged between 1 month and 14 years who were admitted to the PICU from January 2023 to March 2024 and patients who were issued DNR orders during their stay in the PICU.

Exclusion Criteria: Patients older than 14 years, patients without DNR orders, patients with incomplete medical records or DNR orders, and patients who had DNR orders issued before January 2023.

Data Collection

Data will be extracted from both electronic medical records (EMRs) and paper charts of eligible patients. Variables collected will include demographic Data: Medical Record Number (MRN), nationality, age, gender, primary diagnosis. Clinical Data: Date of admission, specific interventions in the PICU, length of PICU stay, and total length of hospital stay. DNR-Related Data: Date of DNR order issuance, specific details of the DNR order, signature of the healthcare provider, involvement of palliative care, timing of the order, and family involvement in the decision-making process. Outcome Data: Progression of the disease, limitations of treatment, and date of death

Ethical Considerations

The study will adhere to the ethical principles outlined in the Declaration of Helsinki. Ethical approval will be obtained from the Institutional Review Board (IRB) of King Saud Medical City. Patient confidentiality and anonymity will be maintained by utilizing de-identified data for analysis. The study will be conducted with full transparency and accountability, disclosing any potential conflicts of interest or biases.

Statistical Analysis

Descriptive statistics will summarize demographic and clinical characteristics of patients with DNR orders in the PICU, using medians and IQRs for not normally distributed continuous variables, and frequencies and percentages for categorical variables. Survival analysis is estimated, employing Kaplan-Meier curves and log-rank tests to assess differences between groups receiving futile care and those who did not. Cox Proportional Hazards Models will be used in both univariate and multivariate forms to identify factors influencing the time between signing DNR orders and death, with hazard ratios and 95% confidence intervals calculated for each variable. Significant variables from univariate analysis, along with clinically relevant ones, will be included in the multivariate analysis to adjust for confounders and pinpoint independent predictors. Statistical significance will be established at a p-value <0.05, and the analysis conducted using Jamovi software.

Results

The study included 79 pediatric patients who were issued DNR orders while admitted to the Pediatric Intensive Care Unit (PICU) at King Saud Medical City. The patient enrollment process for this clinical study start with 150 patients were assessed for eligibility. Out of these, 30 patients were excluded for not meeting the inclusion criteria, 20 declined to participate, and 21 were excluded for other reasons. Ultimately, 79 patients were successfully enrolled into the study. Figure 1

Demographic and Clinical Characteristics:

The median age of the patients was 12 years (IQR, 6-27), with a distribution of 45.6% male (n=36) and 54.4% female (n=43). Regarding nationality, 41.8% (n=33) were Saudi Arabian, and 58.2% (n=46) were Non-Saudi Arabian. The involvement of various medical teams indicated that 26.6% (n=21) of DNR orders were signed across different specialties including Cardiology (7.6%), Nephrology (6.3%), Genetic & Metabolic (3.8%), Neurology (2.5%), and other specialties (6.3%). A significant number of patients, 59.5% (n=47), received palliative care, emphasizing the focus on quality of life in the face of terminal conditions. Conversely, 40.5% (n=32) were reported to have received what was termed as futile care, highlighting the ethical challenges in treatment decisions. The study also noted an incidence of brain death in 17.7% (n=14) of the cases, and specific limitations in treatment were documented in 20.3% (n=16) of the cases. The universal involvement of families in the decision-making process was observed, as indicated by the 100% (n=79) rate of family involvement. The median duration of hospital stay was 11 days (IQR 6.5-24.5). The period between the signing of the DNR orders and death had a median of 2 days (IQR 1-6). The most frequently diagnosed disease among these patients was Acute Respiratory Distress Syndrome (ARDS), affecting 8.9% (n=7) of the cohort. Table 1

Survival Analysis:

Survival rates at 12, 36, and 60 days were assessed. The 12-day survival rate was 47.1% (95% CI 34.7%-64.1%). This rate remained stable over 36 and 60 days at 42.8% (95% CI 29.9%-61.4%). In contrast, patients who did not receive futile care had markedly lower survival rates of 40.8% at 12 months, dropping to 28.8% at 36 days, and further to 22.4% at 60 days. Figure 2, Figure 3

Analysis of Risk Factors:

The Cox regression analysis provided insights into the factors influencing the period between the issuance of DNR orders and death. The occurrence of brain death was a significant predictor of a shorter time to death, with a hazard ratio (HR) of 4.09 (95% CI 2.08-8.04) in univariate analysis, which increased to 4.68 (95% CI 2.22-9.85) in multivariate analysis. Palliative care, while associated with a decreased risk in the univariate model (HR 0.56, 95% CI 0.34-0.94), did not maintain statistical significance in the multivariate model (HR 0.62, 95% CI 0.36-1.06). Other demographic factors such as gender and nationality were not significantly associated with outcomes in the multivariate analysis. Table 2

Discussion

Our findings indicate A significant proportion of included children received palliative care, suggesting an emphasis on quality of life rather than extending life through aggressive treatments, termed as futile care. Despite this, a substantial portion of patients underwent what was described as futile care, highlighting ongoing ethical dilemmas in the management of critically ill pediatric patients. The survival analysis showed that patients who did not receive futile care generally had lower survival rates compared to those who did, over a period extending up to 60 days. Risk factor analysis using Cox regression highlighted that the occurrence of brain death significantly decreased the time to death, reinforcing the severity of brain injury as a predictor of poor outcome. Interestingly, while palliative care initially appeared to offer a protective effect, it did not achieve statistical significance in the multivariate analysis, indicating that other unmeasured factors might influence survival outcomes.

Various factors interplay to influence end-of-life decisions in medical care. Park et al.'s findings emphasize the role of socio-demographic variables, such as residing in less urbanized areas, which may impact access to healthcare services and patient preferences towards end-of-life care. (11) Meanwhile, the work of Serrano-Eanelli et al. suggests that age could be a determinant in the proactive management of end-of-life care, as older individuals may be more likely to engage in planning and documentation related to life-sustaining treatments. (12) This readiness to prepare in advance could reflect a greater acceptance or understanding of their medical prognosis. Moreover, Devanand et al.'s research extends this discussion to the severity of illness, showing that not just age, but also the intensity of comorbid conditions and acute physiological disturbances significantly correlate with the decision to discontinue life-sustaining interventions. Their findings underline the critical nature of these medical assessments in guiding decisions about the continuation or cessation of aggressive medical interventions in critically ill patients, particularly following severe events like out-of-hospital cardiac arrests. (13)

Research in South Korean intensive care units (ICUs) found that haemato-oncology was the most prevalent department to withhold or remove life-sustaining therapy after the Lifesustaining therapy Decision Act. Intensivists' involvement in end-of-life decisions leads to higher rates of treatment withdrawal and transfer from the ICU to the ward, indicating their crucial role in guiding families and preventing unnecessary treatments. In contrast with us, as the most common department was cardiology. (14)

Moitra et al. found that longer ICU stays were associated with considerably higher 1-year mortality rates for older ICU survivors, which ranged from 19.4% for those spending one day to 57.8% for those staying 21 days or longer. (15) Regardless of the presence or absence of mechanical ventilation, the risks of death increased by 1.04 (95% CI 1.03–1.05) for every extra day spent in the ICU beyond seven days. Compared to patients who were not on mechanical ventilation, 60.8% of patients who were on mechanical ventilation died within a year after

spending more than 21 days in the intensive care unit. (15) The study conducted by Huynh et al. aimed to evaluate the opportunity cost of providing futile treatment in ICUs by assessing how it affects care for other patients. They found that futile treatment, as perceived by physicians, significantly delays the admission of critically ill patients from the emergency department (ED) and from outside hospitals to the ICU. Specifically, they identified that on days when an ICU was full and included at least one patient receiving futile treatment, there were notable delays in ICU admissions exceeding four hours from the ED and more than one day for patients waiting for transfer from outside hospitals. (16,17)

Our study aligns with the study conducted by Lee et al. investigated the impact of the duration of palliative care services on the survival of terminal cancer patients in South Korea. (18) They found that longer durations of palliative care were associated with better survival outcomes. Patients who received palliative care for more than 90 days had a significantly lower hazard ratio compared to those who received care for shorter periods. (18) Lee et al. conducted a study revealing that 36.6% of patients admitted to a medical ICU had completed a DNR or Stop Life-Sustaining Treatment (POLST) document. Notably, the incidence of DNR or POLST documentation prior to ICU admission was significantly higher in the POLST group (32.9%) compared to the DNR group (12.5%, $p < 0.001$). The duration from document completion to in-hospital death was longer in the POLST group (3.0 days) than in the DNR group (2.0 days, $p = 0.027$). Despite the presence of DNR or POLST documents, invasive interventions in the DNR/POLST group were similar to or even higher than those in the group without such documentation, which was contrary to expectations. (19)

Research Implication

This study highlights the need of initiating palliative care early in the management of severely ill pediatric patients with DNR orders. It emphasizes the importance of continual education and training for healthcare practitioners to properly manage end-of-life care, particularly in interpreting and implementing DNR orders according on patient and family preferences. Furthermore, the findings call for a rethinking of healthcare policies addressing fruitless therapies, with a focus on evidence-based procedures that maximize resource usage while maintaining patient care quality.

Conclusion

Our study reveals the complex dynamics influencing DNR orders in pediatric intensive care settings. We observed a marked emphasis on palliative care, reflecting a commitment to quality of life even as challenging decisions about futile care persist. The findings underline the significance of timely and thoughtful end-of-life discussions, which not only align with ethical medical practices but also support family-centered care.

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Tables

Table 1. Baseline characteristics of enrolled patients.

Variable	N (%)
Age, Median (IQR)	12 (6-27)
Gender	
Male	36 (45.6)
Female	43 (54.4)
Nationality	
Saudi Arabian	33 (41.8)
Non-Saudi Arabian	46 (58.2)
Other teams signed DNR	21 (26.6)
Cardiology	6 (7.6)
Nephrology	5 (6.3)
Genetic & Metabolic	3 (3.8)
Neurology	2 (2.5)
Others	5 (6.3)
Received Palliative Care	47 (59.5)
Received Futile Care	32 (40.5)
Incidence of Brain Death	14 (17.7)
Treatment Limitations	16 (20.3)
Family Involvement	79 (100)
Hospital Stay, Median (IQR)	11(6.5-24.5)
Period between Signed DNR and Death, Median (IQR)	2 (1-6)
Most Diagnosed Disease, ARDS	7 (8.9)

Table 2. Univariate and multivariate Cox regression analysis addressing the risk factors for elongation of the period between signed DNR and Death.

Variable	HR Univariate analysis			HR Multivariate analysis		
	OR	95% CI	P-value	OR	95% CI	P-value
Male	1.21	(0.72-2.02)	p=0.474	1.33	(0.78-2.26)	p=0.290
Saudi Arabian	0.99	(0.60-1.65)	p=0.975	0.72	(0.42-1.25)	p=0.244
Received Palliative Care	0.56	(0.34-0.94)	p=0.027	0.62	(0.36-1.06)	p=0.079
Not Received Futile Care	0.56	(0.34-0.94)	p=0.027	N/A	N/A	N/A
Incidence of Brain Death	4.09	(2.08-8.04)	p<0.001	4.68	(2.22-9.85)	p<0.001
Have Treatment Limitations	1.22	(0.67-2.23)	p=0.513	1.39	(0.72-2.66)	p=0.326