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Barriers to the delivery of enteral nutrition in pediatric intensive care units: A national survey

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ABSTRACT

Background and Aim: According to previously reported studies in the literature, a significant number of patients do not receive enteral nutrition in pediatric intensive care unit (PICU) because of avoidable barriers. Optimal nutrition is a fundamental goal in PICU. This study aims to identify the barriers of enteral nutrition in PICU.

Setting and Design: A cross-sectional study of the results of a 25-item questionnaire-based survey distributed during the Annual International Critical Care Conference by the Saudi Critical Care Society.

Methods and material: A 7-point Likert-type scale was used to rank the participants' responses, and the relative importance index (RII) approach was used to analyze the relative contribution of each indicator to its main theme.

The factor and parallel analysis methods were used to assess the factorial and unidimensionality of the enteral feeding barriers scale.

Results: A total of 223 PICU healthcare workers from various intensive care settings responded to the survey. The top-three perceived barriers for commencing enteral feeding were due to the patient being hemodynamically unstable (M = 3.6 and SD = 1.70), delays and difficulties in obtaining small bowel access in patients not tolerating other types of enteral nutrition (M = 3.4 and SD = 1.52), or severe fluid restriction, particularly in postoperative cardiac surgery (M = 3.3 and SD = 1.59). The top perceived overall barriers to enteral feeding were the dietician-related issues (M = 3.3, SD = 1.32), barriers related to enteral feeding delivery (M = 3.16 and SD = 1.13), and medical practice-related (M = 3 and SD = 1.10) issues. The lowest reported overall barriers were the resource-related obstacles (M = 2.7 and SD = 1.26).

Conclusion: Being hemodynamically unstable and other dietician-related reasons were the top overall barriers in commencing enteral feeding.

Introduction

Achieving optimal nutrition therapy is a crucial and fundamental goal of the pediatric intensive care unit (PICU) as inadequate nutrition during children's critical illness is attributed to high rates of multiple organ dysfunction, complications, length of stay, and mortality [1,2]. This is because the acute stress response to critical illness is marked by significant protein catabolism, wherein the lack of adequate protein intake leads to ongoing negative nitrogen balance and loss of body mass [3,4]. Annette et al. stated that in critically ill patients who are ventilated and hemodynamically stable, enteral feeding should be initiated within the first 24–48 h of admission [5]. Similarly, Artinian et al. reported in their study that when enteral feeding was initiated within 24 h, a

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decrease in the intensive care unit (ICU) and hospital mortality was noticed (18.1% vs. 21.4%, $P = .01$ and 28.7% vs. 33.5%, $P = .001$, respectively) [6].

However, providing adequate nutrition to critically ill children is also challenging. Many of the previously reported studies in the literature have shown that a significant number of patients do not receive enteral nutrition (EN) during their critical illness because of avoidable barriers [3,7–11]. Unfortunately, these barriers consequently result in either failure or delay in achieving optimal nutritional goals. For instance, fluid restrictions and gastrointestinal disorders often interfere with the delivery of the best enteral feeding in the PICU [12]. In addition, many elective procedures and diagnostic tests require a state of fasting [13,14].

The question is, to what extent can these barriers be avoided? Although work exists regarding barriers to delivering EN in North American PICUs [15] and general nutritional issues in U.K. PICUs [16], specific investigations of such barriers to deliver EN have not been investigated in our region.

The present study aims to describe the barriers to enterally feed critically ill pediatric patients in PICU.

Subject and method

This is a cross-sectional questionnaire-based survey that was conducted in February 2020. The inclusion criteria were physicians, dietitians, and nurses working in the domain of Pediatric Critical Care in Saudi Arabia. Other healthcare providers working in other critical care setups were excluded. The survey was distributed during the Annual International Critical Care Conference organized by the Saudi Critical Care Society. Attendees to the pediatric track of this scientific gathering were invited to fill the survey. To improve the recruitment process and to reach all the target populations who may not have been in the conference venue, we circulated an e-mail through the Saudi pediatric critical care email group, followed by two reminders within four weeks.

The validated survey was adapted from the author Cahill et al. [17] The participants were informed that participation was not mandatory and assured of the anonymity and confidentiality of their responses. Consent was obtained from the participants before their enrollment in this survey. The questionnaire was divided into two parts. The first part included the demographic variables of the respondents, including years of experience, specialty, credential, gender, and the type of PICU where they are working (whether general PICU, cardiac PICU, or mixed cardiac and general PICU). The second part was composed of a list of 25 items that have been identified as barriers to feeding critically ill patients; these items were classified to four domains, including the delivery of EN to the patient (10 items), dietitian support (4 items), PICU resources (2 items), and critical care provider behavior (9 items). We explored their opinion and their position toward each item by requesting them to indicate the degree to which each item hinders the provision of EN in their unit on a 7-point Likert scale where one means "not at all" (they believe that it is not a barrier) and seven means "an extreme amount" (they believe that the provision of EN is severely affected by this item). The reliability for the overall instrument is acceptable, where the Cronbach's α coefficient is 0.94.

This study received ethical approval from the Institutional Review Board (IRB) of King Saud University.

Statistical data analysis

The mean and standard deviation were used to describe the continuous variables, while the frequencies and percentages were used for the categorical variables. Cronbach's alpha test of reliability was used to assess the reliability of the measured enteral feeding barriers 25-item questionnaire. The factor analysis and parallel analysis methods were used to assess the factorial and unidimensionality of the enteral feeding barriers scale - The Relative Importance Index (RII) was computed for each indicator of enteral feeding barriers [18].

The items were ranked in ascending order of their magnitude out of a hundred percent. The SPSS IBM V21 program and the FACTOR V.10 Stand-alone program (Ferrando PJ & Lorenzo-Seva U, 2017) were used for data analysis. The alpha significance level was considered at 0.050 level.

Results

The participants

Two hundred twenty-three pediatric ICU healthcare workers (HCWs) enrolled in the survey and responded to the questionnaire. Of the respondents, 164 respondents (73.5%) were ICU nurses, 54 (24.2%) were medical physicians, and only 5 (2.2%) were clinical dietitians. Among the HCWs, 126 (56.5%) had between 1 and 5 years of experience, 69 (30.9%) had between 6 and 9 years of experience, 17 (7.6%) had between 10 and 15 years of experience and the remaining 11 (4.9%) had above 15 years of experience. Furthermore, those critical care HCWs came from various intensive care settings (Table 1).

Enteral feeding barriers

Delivery of enteral nutrition to the patient

The top perceived barrier for delivering EN was due to either the patient being resuscitated, hemodynamically unstable, or the presence of other aspects of patient care that takes priority over nutrition (Mean 3.59 [1.70]). The second top perceived barrier was the delays and difficulties in obtaining small bowel feeding access in patients not tolerating other types of EN (i.e., high gastric residual volumes) (Mean 3.35 [1.52]). Similarly, the third-rated factor was a severe fluid restriction, particularly in postoperative cardiac surgery (Mean 3.31 [1.59]) Table 2.

Dietician-related barriers

The PICU HCWs perceived "No or not enough dietitian coverage during evenings, weekends and holidays" as the top barrier to early pediatric enteral feeding in PICU (Mean 3.83 [1.75]). The second top dietician-related barrier was "Waiting for the dietitian to assess the patient" (Mean 3.30 [1.44]). The third perceived cause of delayed PICU patients' enteral feeding was "Not enough time allocated by dietitians for education and training the HCW on how to feed patients optimally." (Mean 3.28 [1.62]).

Table 1
Baseline characteristics of the respondents.

	Frequency	Percentage
Profession		
Dietitian	5	2.2
Nurse	164	73.5
Physician	54	24.2
Experience years		
0–5 Years	126	56.5
6–9 Years	69	30.9
10–15 Years	17	7.6
>15 Years	11	4.9
Working department		
General PICU	149	64.2
Cardiac PICU	20	8.6
Mixed cardiac and general PICU	63	27.2

PICU: Pediatric Intensive Care Unit.

Table 2
Descriptive analysis and Relative Importance Index of the PICU healthcare workers perceived barriers to enteral feeding.

	Likert rating mean (SD)	RII-%	Rank
Delivery of enteral nutrition to the patient			
In resuscitated, hemodynamically unstable patients, other aspects of patient care still take priority over nutrition.	3.59 (1.70)	51.4	***1***
Delays and difficulties in obtaining small bowel feeding access in patients not tolerating other types of enteral nutrition (i.e., high gastric residual volumes).	3.35 (1.52)	47.8	***2***
Severe fluid restriction (particularly postoperative cardiac surgery).	3.31 (1.59)	47.3	***3***
Delay in physicians requesting the initiation of EN.	3.30 (1.56)	47.1	***4***
Delays in starting motility agents in patients not tolerating enteral nutrition (i.e., high gastric residual volumes).	3.27 (1.47)	46.7	***5***
Conservative PICU feeding protocol.	3.14 (1.60)	44.9	***6***
Waiting for the physician to order and check the x-ray to confirm tube placement.	3.13 (1.83)	44.7	***7***
Difficulty in delivering enteral feed due to feeding tube obstruction or pump delivery problems with thickened formula.	3.00 (1.55)	42.8	***8***
Nutrition therapy not routinely discussed on ward rounds.	2.79 (1.58)	39.8	***9***
Frequent displacement of the feeding tube, requiring reinsertion.	2.77 (1.66)	39.6	***10***
Dietician-related factors			
No or not enough dietitian coverage during evenings, weekends, and holidays.	3.83 (1.75)	54.7	***1***
Waiting for the dietitian to assess the patient.	3.30 (1.44)	47.1	***2***
Not enough time allocated to education and training on how to feed patients optimally.	3.28 (1.62)	46.9	***3***
Dietitian was not routinely present on weekday patient rounds.	2.92 (1.70)	41.7	***4***
Resource-related factors			
Delays to preparing or obtaining nonstandard enteral feeds.	3.00 (1.46)	42.9	***1***
No or not enough feeding pumps available in the unit.	2.39 (1.48)	34.1	***2***
Clinical practices and behaviors			
Enteral feeds being withheld in advance of procedures or operating department visits.	3.91 (1.73)	55.9	***1***
Enteral feeds withheld for bedside procedures, such as physiotherapy, turns, and the administration of certain medications.	3.41 (1.57)	48.7	***2***
Enteral feeds withheld due to diarrhea.	3.17 (1.43)	45.2	***3***
Non-PICU physicians (i.e., surgeons and gastroenterologists) requesting patients not to be fed enterally.	3.05 (1.30)	43.6	***4***
Lack of familiarity with current guidelines for nutrition in the PICU.	3.05 (1.61)	43.6	***5***
Fear of adverse events owing to aggressively enterally feeding patients.	2.99 (1.41)	42.7	***6***
The general belief among the PICU team that the provision of adequate nutrition does not affect patient outcomes.	2.71 (1.61)	38.7	***7***
Lack of staff knowledge and support around breastfeeding mothers.	2.71 (1.64)	38.7	***8***
Nurses failing to increment feeds as per the feeding protocol.	2.35 (1.40)	33.6	***9***

Resources-related barriers

The PICU HCWs rated “Delays to preparing or obtaining non-standard enteral feeds” (mean 3 [1.46]) with an insignificant RII (42.9%). However, “No or not enough feeding pumps on the unit” was also rated with insignificantly relative importance (RII 34.1%) and (mean 2.39 [1.48]).

Medical practice-related issues

The top perceived indicator of medical practice-related source of pediatric enteral feeding barriers was “Enteral feeds being withheld before procedures or operating department visits (mean 3.91 [1.73]). The second-rated indicator was the “Enteral feeds withheld for bedside procedures, such as physiotherapy, turns, and administration of certain medications” (mean 3.41 [1.57]). The third indicator of medical practice-related barriers to PICU patients’ enteral feeding was the patients being diagnosed with diarrhea (mean 3.17 [1.43]).

Overall barriers to enteral feeding

The top perceived overall barriers to enteral feeding were the dietician-related barriers (mean 3.33 [1.32]), then barriers related to enteral feeding delivery obstacles (mean 3.16 [1.13]). However, the third overall barrier was the medical practice-related obstacles (mean 3.04 [1.10]). The lowest perceived overall barriers were the resources-related obstacles (mean 2.70 [1.26]) (Fig. 1).

Discussion

Achieving optimal nutrition therapy is one of the fundamental targets of critical care of this vulnerable population and a potentially useful way to improve their clinical outcomes. However, the delivery of EN to critically ill children is impacted by several barriers. Recognizing these barriers is an important factor to improve feeding practices, and therefore achieving optimal nutrition [19]. This study reports the perceived potential barriers to enteral feeding across PICUs in Saudi Arabia by pediatric ICU HCWs and compares them to previously reported studies. Four major aspects were included: the delivery of EN to the patient, dietitian-related factors, resources-related barriers and clinical practices and behaviors. To our knowledge, this is the first national survey of the potential barriers to enteral feeding in PICU in Saudi Arabia.

It was clear that the top barrier with regard to the delivery of EN to the patient, is a resuscitated, hemodynamically unstable patient or the presence of other aspects of patient care that takes priority over nutrition. Similarly, a multicenter survey of critical care nurses has also found that the top perceived barrier to nurses was in resuscitated, hemodynamically unstable patients, other aspects of patient care still take priority over nutrition [20]. Likewise, Darawad et al. stated that 44% of nurses who participated in their study agreed to the same point where feeding becomes a secondary priority compared with other ICU tasks [19]. This might be due to a lack of knowledge about the importance of EN, which can be due to the complicated tasks in the ICU, work pressure, and not enough staffing [19]. As a result, critically ill patients may be at risk of developing complications such as muscle weakness, nosocomial infections, and prolong ventilatory support that may be related to undernutrition and malnutrition [21].

Conversely, the top perceived barrier reported by Roger et al. and Tume et al. in PICU was “fluid-restrictive policies.” [14,16] In addition, “interruption of feeds for procedures” was also identified as the main barrier because it affected a comparable number of patients as the fluid restriction [20].

The second top perceived barrier was the delays and difficulties in obtaining small bowel access in patients not tolerating other types of EN, contrary to a study that was notable for no or not enough feeding pumps on the unit as the secondly ranked

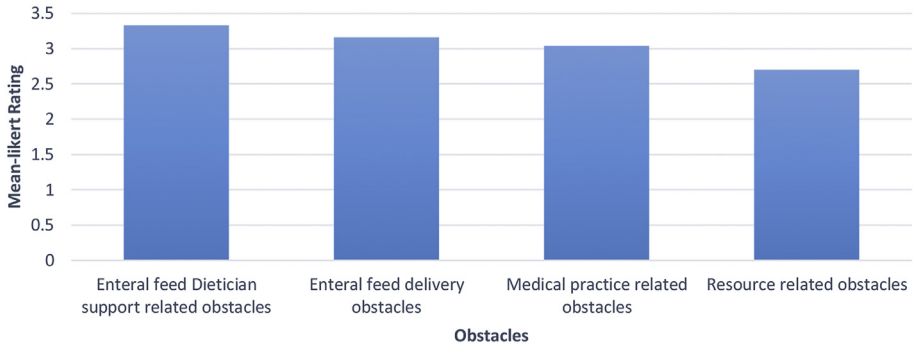

Fig. 1. The healthcare workers perceived overall barriers to enteral feeding in the PICU.

perceived barrier [20]. Furthermore, the third top perceived barrier was a severe fluid restriction, particularly in postoperative cardiac surgery. In fact, it is the most often reported barrier in the literature in pediatric ICU [12]. Rogers et al. pointed out in their study that the main barrier to provide adequate nutrition in critically ill children in PICU was fluid restrictions, particularly in infants undergoing cardiac surgery [14].

The remaining barriers to the delivery of EN to the patient were comparable to Cahill et al. study, which showed the following barriers to EN delivery; "feeding tube not in place, delay in physicians' orders, delay in initiation of motility agents, lack of EN formula or feeding pumps, and delay in the initiation time of EN." [20].

In addition, the unavailability of dietitians during the evening, weekends, and holidays was the highest-rated barrier by the HCW in this study when it comes to Dietitian-Related Barriers. Cahil et al. revealed this barrier out of the ten most common barriers in their study [20]. While Darawad et al. reported that it was ranked as the third barrier in their study [19]. However, it appears that even if the dietitians were available, they have not dedicated enough time to discuss and educate how to optimize nutritional support. Nutritional support is a multidisciplinary task, and the dietitian presence is very important to ensure safe and optimal nutrition delivery to ICU patients [19]. However, the unavailability of resources such as special formulas or feeding pumps can delay the delivery of EN, and therefore put the patient at risk of the underfeeding condition. Therefore, to overcome such issues, a collaboration between nurses, physicians, and dietitians is recommended [19]. ICU resources (e.g., the lack of availability of enteral formula or feeding pumps) have been noted to be one of the five most important resource-related barriers from a nursing perspective. This indicates that identifying resource-related barriers are an effective strategy for improving nutrition practice [20].

In addition to the barriers associated with the delivery of EN, Dietitians, and Resources, it appears that many variables were related to unfamiliarity with the nutritional guidelines and recommendations among HCW. In the same way, Darawad et al. [19] and Hammad et al. [22] agreed that the lack of knowledge among nurses about feeding protocols was an essential barrier. The availability of clear guidelines, educational programs, and protocols will aid in overcoming barriers of delivering optimal nutrition in the pediatric critical care unit and enhance compliance among HCW [23].

With regard to clinical practices and behavioral barriers, the top perceived barrier was Enteral feeds being withheld before procedures or operating department visits, followed by Enteral feeds withheld for ICU procedures such as physiotherapy, turns, and the administration of certain medications as the second top perceived barrier. This can be explained by the fact that taking care of a critically ill patient includes multiple interventions, which often compete with the delivery of EN in the intensive care setting. Elective procedures, unplanned interventions, or diagnostic tests often require a fasting state, requiring the interruption of EN. However, many of those interruptions are avoidable [13]. From a nursing perspective, bathing has been reported to be the most frequent reason for EN interruption. Moreover, bed linen changes, wound dressing changes, and exchanging empty infusion bags have also been reported to be one of the reasons behind EN interruption [21].

There was consensus among clinicians that feeds should be stopped for the suspicion of necrotizing enterocolitis, hemodynamic instability, after cardiac arrest, planned extubation, planned intubation, surgery scheduled in the operating room, endotracheal tube change planned, and gastrointestinal endoscopy. However, there is marked variability among clinician perceptions with regard to indications for delays to and interruptions of EN [15]. Mehta et al. reported that 20% of interruptions in pediatric critically ill patients due to radiology procedures were avoidable [24].

As for the overall barriers to enteral feeding, the dietician-related barriers have been considered to be the top perceived barrier. However, dietitians or physicians have historically been the focus of nutrition guideline implementation activities [25–27]. Nevertheless, critical care nurses play a key role in implementing the nutrition plan of care for patients in the ICU as the (EN) is the primary mode of delivering nutrition to critically ill patients [1].

Study limitations

The self-reporting nature of this study may be subject to recall bias that needs further direct observations in prospective, PICU-based clinical trials. Another limitation of our study include a relatively small number of participants who were recruited because of the nature of the cross-sectional design of the study that was applied within a single scientific society, which limits its generalizability and needs further exploration in the other healthcare facilities and scientific societies.

Furthermore, no validated and reliable survey tool exists for PICUs to explore the barriers to EN in critically ill pediatric patients. The development and validation of such a tool would allow individual PICUs to assess barriers in their PICU and address them in a quality improvement process. The identification of barriers to feeding allows us to develop interventions to intervene to address these barriers actively.

Conclusion

Factors related to critical illness, such as hemodynamic instability, procedures, and fluid restriction, continue to represent ongoing challenges for enteral feeding in children. This study believes that EN is a multidisciplinary responsibility. Therefore, the importance of having National Feeding Protocols and Guidelines for high-risk and

low-risk PICU patients are of paramount importance. This standardized evidence-based feeding protocol may play a role in overcoming the discrepancy among HCWs perceptions regarding indications for delays and interruptions of EN. In addition, those guidelines would improve HCWs' attitudes and enhance the provision of adequate EN. Moreover, emphasis and educational sessions on enteral feeding delivery should be regularly updated by ICU dietitians and delivered to HCW to support best practices related to EN. The dietitian support is highly warranted while further research is needed to explore the best approach to address these barriers.

Author statement

FA: Proposal writing, IRB application, consenting process, data collection, data analysis, methodology, manuscript writing, and manuscript revision.

GA: Data analysis, manuscript writing, and manuscript revision.

MA: Data analysis, manuscript writing, and manuscript revision.

WA: Methodology, manuscript writing, and manuscript revision.

HA: Consenting process, data collection, and manuscript revision.

MAA: Data analysis, manuscript writing, and manuscript revision.

RA: Data analysis, manuscript writing, and manuscript revision.

AA: Proposal writing, IRB application, methodology, and manuscript revision.

MT: Proposal writing, IRB application, methodology, and manuscript revision.

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Ethical statement

Ethics approval and consent to participate: Written informed consent was obtained from all participants. Participation was voluntary, and all participants were assured that their confidentiality would be protected.

The Institutional Review Board of King Saud University granted permission to conduct this survey.

Availability of data and material: All data generated or analyzed during this study are included in the published article.

Declaration of competing interest

The authors declare that they have no competing interests.

Visual abstract

Supplementary data to this article can be found online at https://doi.org/10.1016/ijpam.2020.12.003.

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