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Perceived barriers to effective enteral and parenteral nutrition in pediatric intensive care units in Ecuador: a multicenter survey study

Barreras para la implementación de un soporte nutricional enteral y parenteral en las Unidades de Cuidados Intensivos Pediátrico de Ecuador: un estudio transversal multicéntrico

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ABSTRACT

Aims: To identify the main barriers perceived by pediatric intensive care healthcare professionals in delivering enteral and parenteral nutrition to critically ill children in Ecuador. **Methods:** An online cross-sectional survey was sent electronically from May 2020 to July 2020 to PICU intensivists, pediatricians, nurses, and dieticians across Ecuador. The questionnaire consisted of 27 questions on the barriers to enteral nutrition (EN) and 10 questions on the barriers to parenteral nutrition (PN). Respondents were asked to rate each barrier based on a 7-point Likert scale that ranged from 0 = "it is not a barrier at all" to 6 = "it has a great influence as a barrier". Each barrier was classified into three categories according to the Likert scale score: no barrier (0), moderate barrier (1-3), and important barrier (4-6). **Results:** A total of 119 responses from 16 hospitals were obtained. 34% of respondents were pediatricians, 21% pediatric intensivists, 39% nurses, and 6% dieticians. The top 5 perceived barriers for EN were: 1) Feeding being held too far in advance of procedures or operating room visits, 2) Not enough time dedicated to education and training, 3) No or not enough dietician coverage during evenings, weekends, and holidays 4) Dietician not routinely present on weekday patient rounds, 5) Lack of familiarity with current guidelines for nutrition. For PN the top three perceived barriers were: 1) Waiting for physician to place a central venous catheter and then request and review X-ray to confirm its correct placement, 2) There is no PN protocol in place or it is not applied, 3) There is no catheter or catheter lumen available for PN purposes only. **Conclusions:** Our study shows that many perceived barriers to EN in Ecuadorian PICUs are like those found internationally. Barriers to the implementation of PN were also evaluated, finding organizational problems to be one of the main limitations. Most of the identified barriers can be overcome through practical strategies such as the development of specific protocols for enteral and parenteral nutrition and the conformation of multidisciplinary teams. It is essential to implement continuous training programs in nutrition for all health personnel in charge of critically ill pediatric patients.

Keywords: Pediatric critical care; enteral nutrition; parenteral nutrition; pediatric; nutritional support; barriers.

RESUMEN

Objetivos: identificar las principales barreras identificadas por profesionales que trabajan en las unidades de cuidado intensivo pediátrico para la administración de soporte nutricional enteral y parenteral a niños críticamente enfermos en Ecuador. **Métodos:** encuesta enviada en forma electrónica desde mayo a julio de 2020 a intensivistas pediátricos, pediatras, enfermeras, y nutricionistas en Ecuador. El cuestionario incluyó 27 preguntas sobre las barreras para la nutrición enteral, y 10 preguntas sobre las barreras para la nutrición parenteral. Cada barrera fue clasificada en 3 categorías de acuerdo a su puntaje Likert: no es barrera (0), barrera moderada (1-3), y barrera importante (4-6). **Resultados:** se obtuvieron 119 respuestas de 16 hospitales. De las respuestas, 34% fueron de pediatras, 21% de pediatras intensivistas, 39% de enfermeras, y 6% de nutricionistas/dietistas. Las 5 barreras más importantes para la NE fueron: 1) La alimentación se detiene por demasiado tiempo antes de procedimientos operatorios en quirófano; 2) No existe suficiente tiempo dedicado a educación y entrenamiento; 3) No existe cobertura suficiente de nutricionistas/dietistas durante las noches, fines de semana o feriados; 4) No existe la presencia rutinaria de dietistas/nutricionistas durante la visita médica; 5) Falta de familiaridad con las guías clínicas actuales de nutrición. Las 3 barreras más importantes para la NP fueron: 1) Esperar para que un médico entrenado coloque un catéter venoso central y luego verifique la posición correcta del catéter mediante una radiografía; 2) No existe un protocolo para nutrición parenteral o éste no se usa; y, 3) No existe un catéter o un lumen de catéter disponible exclusivamente para la nutrición parenteral. **Conclusiones:** nuestro estudio muestra que las barreras para el soporte nutricional en Ecuador son similares a las descritas internacionalmente. Los problemas organizacionales son los más evidentes y podrían enfrentarse mediante estrategias de entrenamiento, diseño e implementación de protocolos locales e implementación de equipos multidisciplinarios de soporte nutricional.

Palabras claves: Cuidado intensivo pediátrico; nutrición enteral; nutrición parenteral; soporte nutricional; barreras.

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INTRODUCTION

Nutritional support (NS) is a key component of the treatment of the critically ill pediatric patient [1]. Enteral nutrition (EN) is the preferred method of NS, but parenteral nutrition (PN) is recommended in some circumstances, especially when the digestive tract is affected by the critical illness or its treatment [2]. Practices for EN and PN in Pediatric Intensive Care Units (PICUs) have been described extensively [3,4]. Barriers for the adequate provision of NS, in particular EN, have also been identified [5], highlighting the need for more focused nutrition education for all PICU professional groups.

Ecuador is a Latin American country with a 23.9% prevalence of undernutrition in children under 5 years of age [6]. This figure prevails in PICUs, especially in low-resource areas, where strategies to improve the quality of NS are imperative [7]. The aim of our study was to explore the barriers in providing optimal NS to children in Ecuadorian PICUs, as viewed by physicians, nurses, and dietician. We use a validated survey tool, modified to include PN issues.

METHODS

Based on a Spanish versions of a previously validated survey on the main barriers to the delivery of NS in PICUs [6], the questionnaire used in the present study consisted of 27 questions on the barriers to EN and 10 questions on the barriers to PN. Respondents were asked to rate each barrier on a 7-point Likert scale that ranged from 0 = "it is not a barrier at all" to 6 = "it has a great influence as a barrier". Regional coordinators listed on the database of the Ecuadorian Society of Pediatric Intensive Care were identified across 4 major cities in Ecuador (Guayaquil, Quito, Portoviejo, and Cuenca). A pilot survey was conducted with 4 professionals before final approval. From May 2020 to July 2020, the anonymous survey was sent electronically to the regional coordinators for distribution within the PICUs of their respective regions. The inclusion criteria for respondents were physicians, nurses, and dieticians who worked in a PICU and made decisions on nutritional support. We excluded neonatal and adult intensive care staff (in mixed adult/pediatric units) and PICU staff that did not participate directly in NS. Survey reminders were sent to the regional coordinators of PICUs with low responses to improve response rates. No personally identifiable data were collected on staff, patients, or PICUs, and consent was implied by completing the survey. Coordinators were responsible for ensuring that ethical requirements were met according to the regulations of their institutions. The study was reviewed and approved by the Institutional Review Board at Hospital Metropolitano, Quito.

Statistical Methods: The survey data was analyzed descriptively and then inferentially in the statistical software R (version 3.4.3). Each barrier was classified into three categories according to the Likert scale score: no barrier (0), moderate barrier (1-3), and important barrier (4-6). We evaluated relationships between EN and PN barriers, the characteristics of respondents, and the hospitals they work in (i.e. clinical specialty, hospital type, and city) with Fisher's exact test. When a statically significant relationship between more than two groups was identified at a significance level of 5%, differences between the variables were further compared using a two-tailed pairwise t-test with Bonferroni correction.

RESULTS

A total of 119 responses from 16 hospitals were obtained from the electronic survey. Twelve responses from respiratory therapists were excluded. The 107 survey responses finally analyzed were distributed geographically as follows: in the Coastal region, Guayaquil (54%) and Portoviejo (10%); in the Northern Andes, Quito (28%); and, in the Southern Andes, Cuenca (8%). Eighty-eight percent of respondents worked at public hospitals, whereas twelve percent worked at private hospitals. Thirty-four percent of respondents were pediatricians, twenty-one percent were pediatric intensivists, thirty-nine percent were nurses, and six percent were dieticians. Half of the respondents (55%) had more than five years of PICU experience (table 1).

Tabla 1. Baseline characteristics of the respondents (N=107).

	n (%)
City	
Guayaquil	58 (54.2)
Quito	30 (28.0)
Portoviejo	11 (10.3)
Cuenca	8 (7.5)
Region	
Coast	69 (64.5)
Andes	38 (35.5)
Hospital Type	
Private	13 (12.1)
Public	94 (87.9)
Primary Clinical Specialty	
Pediatrician	36 (33.6)
Pediatric Intensivist	23 (21.5)
Nurse	42 (39.3)
Dietician	6 (5.6)
Years of working experience	
0-5 years	48 (44.9)
>5 years	59 (55.1)

Table 2 presents the overall perceived importance of the barriers for EN and PN. The top 5 perceived barriers for EN were: 1) Feeding being held too far in advance of procedures or operating room visits (54%); 2) Not enough time dedicated to education and training (53%); 3) No or not enough dietician coverage during evenings, weekends and holidays (51%); 4) Dietician not routinely present on weekday patient rounds (47%); 5) Lack of familiarity with current guidelines for nutrition (41%). For PN, the top three perceived barriers were: 1) Waiting for physician to place a central venous catheter and then request and review X-ray to confirm its correct placement (39%); 2) There is no PN protocol in place or it is not applied (34%); 3) There is no catheter or catheter lumen available for PN purposes only (33%).

Tabla 2. Perceived Barriers for Enteral and Parenteral Nutrition.

		Median [IQR]	Not a barrier (%)	Important barrier (%)
Delivery of Enteral Nutrition to the Patient				
1	Delay in physicians ordering the initiation of EN.	2 [1-4]	8,4%	27,1 %
2	Waiting for physician/radiology to read x-ray and confinn tuve placement.	1 [0-2]	38,3%	13,1%
3	Frequent displacement of feeding tube,requiring reinsertion.	1 [0-2]	26,2%	12,1%
4	Delays in initiating motility agents in patients not tolerating enteral nutrition (i.e. high gastric residual volumnes).	2 [1-3]	12,1%	24,3%
5	Delays and difficulties in obtai ning small bowel access in patients not tolerating enteral nutrition (i.e. high gastric residual volumes).	2 [1-4]	13,1%	33,6%
6	In resuscitated, hemodynamically stable patients, other aspects of patient care still take priority over nutrition.	2 [1-4]	13,1%	31,8%
7	Nutrition therapy not routinely discussed on patient care rounds.	2 [1-4]	17,8%	27,1%
8	Severe fluid restriction (es pecially post-operative cardiac surgery).	3 [1-4]	14,2%	35,8%
9	There is no EN protocol in place or it is not applied.	2 [0-6]	32,7%	39,3%
10	Conservative PICU feeding protocol.	2 [0-4]	27,1%	29,0%
Dietician Support for Enteral Nutrition				
11	Waiting for the dietician to assessthe patient.	2 [0-6]	27,5%	34,3%
12	Dietician not routinely present on weekday patient rounds.	3 [0-6]	**30,4%**	**47,1%**
13	No or not enough dietician coverage during evenings,weekends and holidays.	4 [0-6]	**26,5%**	**51,0%**
14	Not enough time dedicated to education and training on how to optimally Feed patients.	4 [1-6]	**14,7%**	**52,9%**
PICU Resources for Enteral Nutrition				
15	Delays to preparing or ob taining habitual or standard enteral feeds.	1 [1-2]	18,7%	17,8%
16	Delays to preparing or obtaining enteral feeds with non-standard specialized fmmulas.	2 [1-3]	15,0%	21,5%
17	No or not enough feeding pumps on the unit.	1 [0-3]	45,8%	16,8%
Healthcare Professional Attitudes and Behaviour related to Enteral Nutrition				
18	Non-ICU physicians (i.e. surgeons, gastroenterologists) requesting patients not be fed enterally	2 [1-3]	13,1%	18,7%
19	Nurses failing to progress feeds as per the feeding protocol.	1 [0-3]	25,2%	21,5%
20	Feeds being held due to presence of elevated gastic residue.	3 [2-4]	6,5%	28,0%
21	Feeds being held due to dianhea.	2 [1-3]	16,8%	23,4%
22	Fear of adverse events due to aggressively feeding patients.	1 [1-3]	19,6%	19,6%
23	Enteral feeds withheld for bedside procedures, such as physiotherapy, turns, and administration of certain medications.	2 [1-3]	21,5%	22,4%
24	Feeding being held too far in advance of procedures or operating room visits	4 [2-6]	11,2%	**54,2%**
25	Lack of familiarity with cunent guidelines for nutrition in the ICU.	3 [2-5]	13,1%	**41,1%**
26	General belief among ICU team that provision of adequate nutrition does not impact on patient outcome.	2 [0-3]	38,3%	24,3%
27	Lack of staff knowledge and suppo1t around breastfeeding mothers.	2 [1-5]	15,9%	36,4%

Parenteral Nutrition				
28	Delay in physicians ordering the initiation of PN.	2 [I-4]	12,1%	28,0%
29	Waiting for physician to place a central venous catheter and then request and review X-ray to confirm the correct placement.	3 [1-5]	12,1%	39,3%
30	There is no trained professional for the correct prescription of PN.	1 [0-3]	45,3%	18,9%
31	There is no trained professional for the correct preparation of PN.	I [0-3]	40,2%	21,5%
32	There is no adequate infrastructure for the preparation of PN.	I [0-4]	34,6%	28,0%
33	There are no adequate medical supplies for the preparation of pediatric PN such as pediatric amino acids, lipids, vitamins or trace elements.	1 [0-4]	29,9%	26,2%
34	There is no PN protocol in place or it is not applied.	2 [0-5]	30,8%	32,7%
35	There is no catheter or catheter lumen available for PN purposes only. Instead, it is used for administration of IV fluids or medications.	2 [0-4]	36,4%	33,6%
36	A management and care protocol for central venous catheter does not exist or is not used.	I [0-4]	40,2%	25,2%
37	No easy access to laboratory tests for monitoring PN support.	1 [0-2]	48,6%	16,8%

Abbreviations: EN: Enteral Nutrition; PICU: Pediatric intensive care unit; PN: Parenteral Nutrition.
Responders answered the questionnaire through Likert scale (range 0-6). Median [IQR] refers to the full Likert scale (0-6). Each barrier was classified into three categories according to the Likert scale score: no barrier (0), moderate barrier (1-3), and importan barrier (4-6).

Table 3 presents the three most important barriers by professional group. Pediatricians and pediatric intensivists coincided that the three most important barriers for EN were: "Not enough time dedicated to education and training", "No or not enough dietician coverage during evenings, weekends and holidays", and "There is no EN protocol in place or it is not applied". Dieticians also rated "Not enough time dedicated to education and training" as the most important barrier for EN (100%). Nurses, on the other hand, rated "Feeding being held too far in advance of procedures or operating room visits" as the top barrier (60%). With regards to PN, all clinical specialties rated "Waiting for physician to place a central venous catheter and then request and review X-ray to confirm the tube placement" among the top three most important barriers (28% pediatricians; 30% pediatric intensivists, 45% nurses; 100% dieticians). Finally, pediatricians (31%), pediatric intensivists (34%), and nurses (31%) included the barrier "There is no PN protocol in place or it is not applied" among the top three.

Tabla 3. Top 3 barriers to deliver enteral nutrition and parenteral nutrition in the PICU reported per clinical specialty.

		Median [IQR]	Important barrier (%)
Pediatricians (n=36)			
Enteral Nutrition			
1	No or not enough dietitian coverage duringevenings,weekends and holidays.	4 [1-6]	052,9%
2	There is no EN protocol in place or it is not applied.	4 [2-6]	50,0%
3	Not enough time dedicated to education and training on how to optimally feed patients.	3 [2-6]	47,1%
Parenteral Nutrition			
1	There is no catheter or catheter lumen available for PN purposes only. Instead, it is used for administration of IV fluids or medications	2 [0-5]	33,30%
2	There is no PN protocol in place or it is not applied.	2 [1-4]	30,60%
3	Wa iting for physician to place a central venous catheter and then request and review X	2 [1-4]	27,80%
Pediatric Intensivists (n=23)			
Enteral Nutrition			
1	Not enough time dedicated to education and training on how to optimally feed patients.	4 [1-6]	66,7%
2	No or not enough dietician coverage during evenings,weekends and holidays.	4 [2-6]	52,4%
3	There is no EN protocol in place or it is not applied.	2 [0-6]	47,8%
Parenteral Nutrition			
1	There is no PN protocol in place or it is not applied.	1 [0-6]	34,80%

2	Waiting for physician to place a central venous catheter and then request and review X ray to confirm its correct placement.	3 [1-4]	30,40%
3	There is no catheter or catheter lumen available for PN purposes only. Instead, it is used for administration of IV fluids or medications	2 [1-4]	30,40%
Nurses (n=42)			
Enteral Nutrition			
1	Feeding being held too far in advance of procedures or operating room visits.	4 [2-6]	4 [2-6]
2	Severe fluid restriction (especially post-operat ive cardiac surgery)	4 [1-6]	4 [1-6]
3	Dietician not routinely present on weekday patient rounds.	3 [0-6]	3 [0-6]
Parenteral Nutrition			
1	Waiting for physician to place a central venous catheter and then request and review X	3 [2-6]	45,2%
2	ray to confirm its correct placement.	2 [0-5]	33,3%
3	A management and care protocol for central venous catheter does not exist or is not	1 [0-5]	31,0%
Dieticians (n=6)			
Enteral Nutrition			
1	Not enough time dedicated to education and trainingon how to optimally feed patients.	6 [5-6]	100,0%
2	Lack of familiarity with current guidelines for nutrition in the ICU.	5 [4-6]	100,0%
3	In resuscitated, hemodyna mically stable patients, other aspects of patient care still take priority over nutrition.	4 [4-6]	100,0%
Parenteral Nutrition			
1	Delay in physicians ordering the initiation of PN	6 [5-6]	100,0%
2	Waiting for physician to place a central venous catheter and then request and review X- ray to confirm its correct placement.	5 [5-5]	100,0%

Abbreviations: EN: Enteral Nutrition;PICU: Pediatric intensive care unit;PN: Parenteral Nutrition.
Responders answered the questionnaire through Likert scale (range 0-6). Median [IQR] refers to the full Likert scale (0-6).
Important barriers were those with scores of 4,5,or 6.

To analyze the perceived importance of each barrier by the clinical specialty, dieticians' responses were excluded due to the small sample size of respondents. When comparing responses between pediatric intensivists and nurses, the former considered "Severe fluid restriction (especially post-operative cardiac surgery)" a more important barrier than the latter (p=0.013). Conversely, pediatric intensivists and pediatricians, respectively, gave greater importance to the barriers "Delays to preparing or obtaining enteral feeds with non-standard specialized formulas" (p=0.008) and "There is no EN protocol in place or it is not applied" than nurses (table 4).

Tabla 4. Difierences in perceived important barriers (Likert scores 4-6) by professional group.

		Overall n=101	Nurses n=36	Pediatricians n=23	Pediatric Intensivists n=42	p-value
8	Severe fluid restriction (especially post-operative cardiac surgery).	34,0%	50%[a]	25,7%	17.4%[a]	0,013
9	There is no EN protocol in place or it is not applied.	37,6%	21.4%[a]	50.0%[a]	47,8%	0,018
16	Delays to preparing or obtaining emteral feeds with non-standard specialized formulas.	18,8%	7.1%[a]	19,4%	39. 1%[a]	0,008

Dietitians were excluded from this analysis due to the small sample size (6 respondents)
Abbreviations: EN: Enteral Nutrition; PICU: Pediatric intensive care unit; PN: Parenteral Nutrition.
Responders answered the questionnaire through Likert scale (range 0-6).
Important barriers were those with scores of 4, 5, or 6.
The subscript letter ''a'' denote categories in which proportions significantly differ from each other.

When evaluating responses by hospital type, only one barrier was considered more important by medical professionals in public hospitals than those in private hospitals: "Feeds being held due to diarrhea" (p=0.036). The perceived barrier importance did not differ significantly by location (city or country region). The only exception was the barrier "Severe fluid restriction (especially post-operative cardiac surgery)", which was thought to be more important in Guayaquil

than in other cities (p=0.043). Finally, no significant differences in perceived barrier importance were found by years of PICU experience.

DISCUSSION

This is the first study in Ecuador that seeks to identify barriers for NS in PICUs. The main barrier identified for EN was fasting before procedures. Recent guidelines recommend a 2-hour fast for clear liquids, a 4-hour fast for breast milk, and a 6-hour fast for formula in patients with systemic severe disease and anticipated need for advanced airway management and mechanical ventilation[8,9]. These recommendations, however, are intended for elective surgical patients eating solid food and make no reference to fasting in intubated critically ill patients on EN. There is a lack of research on gastric emptying times for EN in intubated critically ill patients, and, therefore, no recognized guidance on the length of time that should elapse between stopping EN and the anesthetic procedure[10]. Tube feeding formula itself fits into the 6-hour fast category for a light meal, but fasting guidelines were created for a bolus meal, not the continuous infusion used during EN. Gastric content residual from a continuous rate of feeding is likely to be significantly less than the one from a single meal considered in the guidelines, but data in critically ill children is sparse[11]. The general purpose of preoperative fasting is to allow enough time for the stomach to empty, and hence reduce the incidence of regurgitation of gastric contents into the trachea to prevent a subsequent aspiration pneumonitis. This longstanding tradition has minimal scientific support. Despite traditional thoughts, the incidence of aspiration associated with anesthesia and sedation in children is exceptionally low. The best evidence comes from a study with almost 140.000 pediatric patients (17% with ASA physical status 3 or 4) where the overall aspiration incidence was 1:13.914 patients with zero mortality[12]. Other studies show an incidence of aspiration associated with general anesthesia of 1:7.103 for adults and 1:4.800 for children; reasonable point estimates for aspiration mortality are 1:78.732 for adults and immeasurably small for children (10) (Table 5). Non-compliance with fasting guidelines was not identified as a risk factor in either anesthesia or procedural sedation[13]. In pediatric studies of actual preoperative fasting times, the 2-hour regimen for clear fluids led to as much as 21 hours of fluid-fasting[14].

Tabla 5. Summary of publications on aspiration risk in children during procedural sedation*.

Study	Agent	Patients	Overall	Non-fasted**
Bhatt	Ketamine	6295	None	None
Beach	Propofol	139142	1:13914	1:12701
Chiaretti	Propofol	36516	None	None
Rajasekaran	Propofol	12447	None	None
Green	Ketamine	8282	None	None
Sanborn	Pentobarbital	16467	1:8234	No stated

*Modified from Green SM, Anaesthesia 2020; 75: 374–385
**Aspiration during non-fasted procedures

Additionally, fasting has been associated with adverse outcomes like decreased sedation efficacy, thirst, dehydration, hypoglycemia, anxiety, postoperative nausea and vomiting, and transoperatory hypotension[15-18]. There are also metabolic derangements induced by fasting: worsening catabolism, inflammation, decrease of insulin levels, dyslipidemia, secretion of stress hormones, and insulin resistance leading to hyperglycemia[19-21]. Moreover, prolonged fasting is related to postoperative complications. With all this evidence, the current focus on fasting may be largely misleading, especially in critically ill patients already intubated on mechanical ventilation in whom EN could be interrupted and the stomach aspirated just before the procedure or surgery, optimizing EN time while avoiding unnecessary interruptions and undernutrition. In fact, the implementation of fasting guidelines has led to significant improvements in EN delivery and reduced duration of feed breaks[13,22,23]. EN interruptions is a fully identified barrier in other several studies in PICUs [24,25,26). In 2010, Mehta found that EN was interrupted in 30% of the children at an average of 3.7 ± 3.1 times per patient, accounting for 1,483 hours of EN deprivation in that cohort. Moreover, 58% of these episodes could have been avoided. Reasons for avoidable EN interruptions included endotracheal tube issues, intolerance to EN, mechanical problems related to post-pyloric feeding tubes, and other procedures in the operating room, radiology suite, or at the bedside[24]. Keehn conducted a study whose objective was to quantify and identify reasons for time spent without nutrition in a PICU. Interruptions and prolonged time to the initiation of surgery and airway management were found to be major contributing factors to the time spent without nutrition. On average, patients spent more than 40%

of their admission time without nutrition while meeting just over half of their energy requirements[27].

Food intolerance evaluated mainly by measuring the gastric residual volume has been considered a barrier to EN[28]. In a survey carried out in Latin-American PICUs in 2009, the most widely used method of tolerance monitoring was the measurement of gastric residual, carried out in 71% of PICUs with the gastric route and in 33% with the duodenal-jejunal route[29]. However, this figure has changed over time and, today, gastric residual monitoring is no longer recommended[30]. In concordance with this, feeding intolerance evaluated with gastric residual volume was not perceived as a barrier in our survey. Moreover, other measures of food intolerance (presence of diarrhea or adverse events due to aggressive nutrition) were not perceived as important barriers by any of the professional groups.

In our study, lack of enteral and parenteral nutrition protocols was perceived as a major barrier. Leong, in 2013, conducted a survey in Canadian PICUs (26) looking for perceived barriers to delay the onset of EN or interrupt EN administration. There was high variability among clinicians, but the main barriers included lactate levels (as a subrogate measure of splacnic hypoperfusion), high gastric residual volumes, CT/MRI scans, and hypoplastic left heart syndrome. Sixty-eight percent of PICU clinicians reported no written feeding protocol in place. Fluid restriction, either clinical or surgical, has been valued as one of the most important barriers to the administration of EN, especially in patients with heart disease[25,31]. In our study, fluid restriction was identified as the second most important barrier by nurses in relation to physicians.

Two of the five main barriers for EN identified in our study were related to the presence of dieticians as an important component of the NS team. The lack of professionals in nutrition has been identified in intensive care units for both adults and children. Of 116 adult ICUs in 8 Latin American countries, only 39.7% were identified to have a NS team[31], whereas in Latin American and Spanish PICUs, 68% had a NS team and 48.9% had a NS protocol[4].

EN is the preferred route for NS. The role of supplemental PN to reach a specific goal for energy delivery and the time when PN should be initiated are unknown. Based on a single study, supplemental PN should be delayed until 1 week after PICU admission in patients with normal baseline nutritional state and low risk of nutritional deterioration. In patients who are severely malnourished or at risk of nutritional deterioration, PN may be supplemented in the first week[5]. Although the mechanical, metabolic, and infectious complications of the use of parenteral nutrition are widely known, there is little information on the barriers to implementing PN in PICUs. In our study, the 3 main barriers for using PN were related to catheter and protocol issues. In critically ill children, there is an increase in the early indication of EN with a significant decrease in PN, which is reserved for patients with ischemic intestinal lesions, obstructive ileus, for those who do not tolerate or have complications with EN, and in whom mixed nutrition (PN + NE) is not possible[33,34]. Catheter issues could be addressed with ultrasound guidance during insertion and more training[35,36]. It is important to highlight that, in our survey, lack of education and training is considered a particularly important barrier. Unfortunately, nutrition remains a low priority in the training curricula of health care professionals[37]. The education of frontline PICU staff by trained professionals such as pediatric dieticians who are certified in pediatric nutrition can also help to promote improved practices and outcomes of nutritional support[38].

CONCLUSIONS

NS of critically ill children could be jeopardized by several barriers such as lack of protocols or guidelines, insufficient training for and motivation of clinicians, and organizational factors[39]. Identifying barriers for NS is a very important first step for the implementation of nutritional guidelines[40]. Our study shows that many perceived barriers to EN in Ecuadorian PICUs are like those found internationally. Barriers to the implementation of PN were also evaluated, finding organizational problems to be one of the main limitations. Most of the identified barriers can be overcome through practical strategies such as the development of specific protocols for enteral and parenteral nutrition and the conformation of multidisciplinary teams that include physicians, nurses, dieticians, and pharmacists, all trained to implement such guidelines. It is essential to implement continuous training programs in nutrition for all health personnel in charge of patients in the PICU.

Contribución de los autores

Campos-Miño S, Velasco MC, Moscoso P, Páez X, Alvear MdL, Alvarado C, Guillen B: Concepción y diseño del trabajo, recolección/obtención de resultados, análisis e interpretación de datos, redacción del manuscrito, revisión crítica del manuscrito, aprobación de su versión final, aporte de pacientes o material de estudio, asesoría estadística.

Conflicto de intereses

Los autores declararon no tener ningún conflicto de interés personal, financiero, intelectual, económico y de interés corporativo con el Hospital Metropolitano y los miembros de la revista MetroCiencia.

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