Original Article

Oropharyngeal colonization, and gastric and tracheal bacterial translocation, in children experiencing mechanical ventilation*

Colonização e translocação bacteriana orofaríngea, gástrica e traqueal em crianças submetidas à ventilação pulmonar mecânica

Colonización y translocación bacteriana orofaríngea, gástrica y traqueal en niños sometidos a ventilación pulmonar mecánica

Denise Miyuki Kusahara[1], Cristiane Cruz da Silva Canezin[2], Maria Angélica Sorgini Peterlini[3], Mavilde da Luz Gonçalves Pedreira[4]

ABSTRACT

Objective: To describe the pattern of oropharyngeal colonization and bacterial translocation, gastric and tracheal, in children experiencing mechanical ventilation. **Methods:** This descriptive study was conducted in a pediatric intensive care unit (PICU). Thirty children were recruited for the study, and 216 serial cultures were analyzed from oropharyngeal, gastric and tracheal secretions. Microbiological characteristics, demographic, clinical and treatment data were evaluated. **Results:** Among those who participated in the gastric suctioning, there was a predominance of children with chronic diseases, for which antibiotics, sedatives and gastric protectors were used. There was an increase in the number of children colonized by pathogens during hospitalization, and there was a predominance of several species: *Enterobacter spp, K.pneumoniae, P. aeruginosa, A. baumannii* and *S. aureus*. The majority of children (80.0%) experienced oropharyngeal translocation during hospitalization in the PICU. **Conclusion:** Critically ill children may represent a group of patients at increased risk for colonization and bacterial translocation, predominantly from the oropharyngeal region to the trachea.

Keywords: Bacterial translocation; Pneumonia, ventilator-associated; Pediatric nursing; Intensive care

RESUMO

Objetivo: Descrever o padrão de colonização e translocação bacteriana orofaríngea, gástrica e traqueal em crianças submetidas à ventilação pulmonar mecânica. **Métodos:** Estudo descritivo, realizado em uma Unidade de Cuidados Intensivos Pediátricos. Admitiram-se no estudo 30 crianças, sendo analisadas 216 culturas seriadas de secreção orofaríngea, gástrica e traqueal. Características microbiológicas, demográficas, clínicas, e terapêuticas foram avaliadas. **Resultados:** Houve predominância de crianças portadoras de doenças crônicas, que fizeram uso de antibióticos, sedativos e protetores gástricos, submetidas à sondagem gástrica. Houve aumento no número de crianças colonizadas por patógenos durante a internação e predomínio das espécies: *Enterobacter spp, K.pneumoniae, P.aeruginosa, A. baumanii* e *S.aureus.* A maioria das crianças (80,0%) sofreu translocação orofaríngea durante a internação na UCIP. **Conclusão:** Crianças criticamente enfermas podem representar grupo de pacientes com risco aumentado para colonização e translocação bacteriana predominantemente da região orofaríngea para a traquéia.

Descritores: Translocação bacteriana; Pneumonia associada à ventilação mecânica; Enfermagem pediátrica; Terapia intensiva

RESUMEN

Objetivo: Describir el patrón de colonización y translocación bacteriana orofaríngea, gástrica y traqueal en niños sometidos a ventilación pulmonar mecánica. **Métodos:** Estudio descriptivo, realizado en una Unidad de Cuidados Intensivos Pediátricos. Se admitieron en el estudio a 30 niños, siendo analizados 216 cultivos seriados de secreción orofaríngea, gástrica y traqueal. Fueron evaluadas características microbiológicas, demográficas, clínicas, y terapéuticas. **Resultados:** Hubo predominio de niños portadores de enfermedades crónicas, que hicieron uso de antibióticos, sedantes y protectores gástricos, sometidos a sondaje gástrico. Hubo aumento en el número de niños colonizados por patógenos durante el internamiento y predominio de las especies: *Enterobacter spp, K.pneumoniae, P.aeruginosa, A. baumanii* y *S.aureus*. La mayoría de los niños (80,0%) sufrió translocación orofaríngea durante el internamiento en la UCIP. **Conclusión:** los niños críticamente enfermos pueden representar un grupo de pacientes con riesgo aumentado para la colonización y translocación bacteriana con predominio de la región orofaríngea hacia la tráquea.

Descriptores: Translocación bacteriana; Neumonía asociada al ventilador; Enfermería pediátrica; Cuidados intensivos

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[1] Doctorate in Nursing Philosophy. Professor of Undergraduate and Graduate Nursing, State University of Maringá – UEM, Maringá (PR), Brazil.

[2] Doctorate in Nursing Philosophy. Professor of Undergraduate and Graduate Nursing, State University of Maringá – UEM, Maringá (PR), Brazil.

[3] Post-graduate student (Master's) in Nursing, State University of Maringá – UEM, Maringá (PR), Brazil.

[4] Nurse in the Department of Health of Maringá. Maringá (PR), Brazil, Post-graduate student (PhD) in Nursing, State University of Maringá – UEM, Maringá (PR), Brazil.

Corresponding Author: **Denise Miyuki Kusahara**
Escola Paulista de Enfermagem. Rua Napoleão de Barros, 754, S113.
Vila Clementino – São Paulo – CEP: 04024-002
E-mail: dkusahara@unifesp.br

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INTRODUCTION

Healthcare-associated infections are considered important adverse events that compromise the patient's safety and result in considerable morbidity and mortality, increasing the time of hospitalization and attendance costs. In critically ill children, catheter-associated bloodstream infections are the most common, followed by pulmonary and urinary infections.[1]

Ventilator-associated pneumonia (VAP) in Pediatric Intensive Care Units (PICU), is the second most common cause of healthcare-associated infections, accounting for around 20% of the total number of events in this population. Data from the National Nosocomial Infections Surveillance System-NISS, have shown that in spite of the VAP frequency in children having diminished over the last few years, 2.1 episodes of VAP for every 1000 days of mechanical pulmonary ventilation (MPV) continue to be diagnosed in North American children[2,3]

The access of microorganisms to the normally sterile inferior respiratory tract may occur by means of four mechanisms: aspiration of secretions containing pathogens from the oropharynx, gastric cavity or sinus cavities; bacterial dissemination from a contiguous area, such as the pleura; by devices used for respiratory therapy and inhalation of contaminated aerosols, and or hematogenic translocation of microorganisms to the lung, coming from remote sites of infection. [4]

The importance of each potential reservoir of the gastrointestinal tract for tracheal colonization by microorganisms that cause VAP, whether oropharyngeal or gastric, has been cause for discussion among researchers for many years. During the 1980s in the 20th Century, evidence of colonization related to bacteria from the gastric cavity appeared in many researches. Nevertheless, recently, a positive relationship has been shown between bacterial species isolated from the oropharynx of adults and those identified in samples of bronchial secretions collected at the time of making diagnoses of pneumonia. [5]

The association between the oral and gastric microbiota and VAP has been documented in adult patients, however, investigations about the colonization of these sites and the translocation of microorganisms from the oropharynx or stomach to the lower airways are limited, particularly in the pediatric population. Thus, the aim of this study was to describe the pattern of oropharyngeal, gastric and tracheal bacterial translocation in a group of children exposed to mechanical pulmonary ventilation.

METHODS

The present investigation is a descriptive study about the colonization and translocation of bacteria from the stomach and oropharynx to the trachea in critically ill children, approved by the Research Ethics Committee of the Institution. The sample was composed of all the children hospitalized in a PICU, whose parents or legal guardians signed the term of free and informed consent, and who were submitted to MPV during the period of February 2007 to February 2008, and who did not have characteristics defined as criteria for exclusion from the main research to which the study is linked, these being: Newborn children, tracheostomized children, PICU length of stay and MPV duration less than 48 hours, respectively, children with diagnosis of pneumonia on admission, and those whose parents or guardians declined to concede free and informed consent. All the children admitted to the study were accompanied during the period of hospitalization in the PICU, and the microbiological, demographic, clinical, hospitalization, intensive therapy characteristics were analyzed.

Children admitted to the study were submitted to the collection of serial cultures of oropharyngeal (OS), gastric (GS) and tracheal (TS) secretions. All collections were performed in the morning period. The first collection occurred within the first 24 hours of tracheal intubation and the following samples for collected at regular intervals of 48 and 96 hours, after intubation. Due to the clinical condition, extubation, discharge and death of some of the children at the third collection, it was possible to analyze a lower number of cultures.

Oropharyngeal secretion cultures were obtained by means of swabbing the tonsil regions and the posterior pharynx, with the swab being introduced directly in a sterile tube containing *Stuart Agar*. To obtain tracheal secretion, the technique of protected tracheal aspiration was used, in a closed system under vacuum, directly into the collector flask, with dilution in saline solution 1:1. In a similar manner, the gastric aspiration was obtained by means of introducing a gastric tube, aspiration and instillation of the contents in a sterile flask, without dilution.

In the microbiological laboratory the samples were seeded to perform incubated in accordance with the parameters determined for atmosphere, temperature, time and humidity. After incubation the suspect colonies were submitted to biochemical assays for exact identification of the species, and disclosure of the results by professional specialists in microbiology, who provided advisory assistance with conducting this study.

Primary Results: To describe the characteristics of oropharyngeal, gastric and tracheal colonization of the children, the results of the microbiological cultures obtained in the three time intervals of collection were evaluated, and the microorganisms were characterized as species of normal or pathogenic microbiota. Thus, 30 children and 216 cultures were analyzed, with 72 cultures being from each of the sites. Of these, 30 cultures of each of the

sites were obtained in time intervals of 24 hours, 30 in 48 hours and 12 in 96 hours. *Secondary Results:* The study of bacterial translocation, considered the displacement of bacteria from the enteric system to a sterile site, was initially based on the observation of a total number of 30 patients and 90 cultures, in order to identify bacterial translocation in the first 24 hours of hospitalization in the PICU. Afterwards, a second analysis was made of another 90 cultures, with the purpose of evaluating the occurrence of bacterial translocation that occurred between 24 and 48 hours after the first collection of cultures. Finally, a last analysis was made, including 12 children and 36 cultures to identify the translocation that occurred between 48 and 96 hours of intubation of the children in the PICU. The results of the three serial cultures were analyzed, with oropharyngeal translocation being considered the presence of the same bacteria in the oropharyngeal and tracheal secretion between the time intervals of culture collections; gastric translocation being the presence of the same bacteria in gastric and tracheal secretion between the time intervals of culture collections, gastric and or oropharyngeal translocation, being the presence of the same bacteria in the gastric, oropharyngeal and tracheal secretion between the time intervals of culture collection, and absence of translation being identification of the species of bacteria in the tracheal secretion the one identified in the other secretions, or the absence of microorganism growth. (Figure 1).

Quantitative variables were represented by mean, standard deviation (SD) and median and the qualitative variables by absolute (f) and relative (%) frequency.

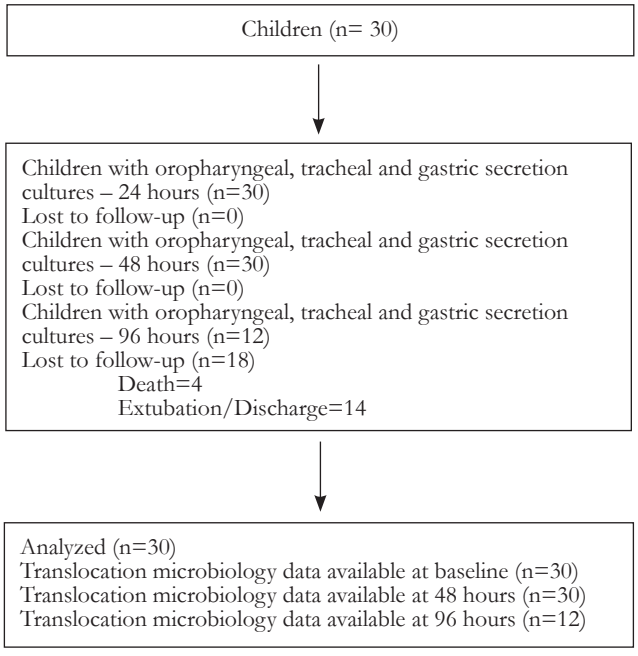

Figure 1. Study design.

RESULTS

The demographic, clinical, hospitalization and therapeutic characteristics of the 30 children included in the stud are presented in Table 1. There was predominance of children with chronic diseases, who made use of antibiotics, central nervous system depressants, and gastric pH modifiers and those submitted to gastric tubes during hospitalization in the PICU. Long periods of use of mechanical pulmonary ventilation, hospitalization in the PICU and in hospital were observed.

Table 1. Demographic, clinical e therapeutics characteristics of children in a Pediatric Critical Care Unit, São Paulo – SP, 02/2007 a 02/2008 (n=30)

Características	**f (%)**
Age(mean± SD);months	49,8±56,14
Male gender	20 (66,6)
Malnutrition condition	14 (46,7)
Cronic Disease	23 (76,7)
Antibiotic therapy before admission	9 (30,0)
Antibiotics use in PICU	30 (100,0)
Medications used during PICU stay	
Central nervous system suppressors	27 (90,0)
Neuro-muscular blockers	6 (20,0)
Gastric pH modifiers	26 (86,7)
Gastric tube	28 (93,3)
No enterla feeding	28 (93,3)
Oral route intubation	30 (100,0)
Intercorrences during intubation	02 (6,7)
Reintubation	08 (26,7)
Duration of mechanical ventilation(mean±SD);h	199,6±122,6
PICU lenght of stay (mean± SD); days	12,74±24,77
Hospital lenght of stay(mean± SD); days	36,93±36,86

Legend: SD – Standard Deviation, PICU- Pediatric Critical Care Unit.

A total of 216 samples were obtained, being 72 cultures of each type of secretion, distributed into three collection time intervals. Data with respect to children colonized by microorganisms of the normal and pathogenic microbiota are shown in Table 2.

Table 2. Microorganisms identified in the serial cultures of oropharyngeal, gastric and tracheal secretion from children in a PICU – São Paulo –SP, 02/2007 a 02/2008

Children	Oropharyngeal secretion f (%)	Gastric secretion f (%)	Tracheal secretion f (%)
Pathogenic microflora			
Positive culture at 24h (n=30)	11(36,7)	09 (30,0)	03 (10,0)
Positive culture at 48h (n=30)	16 (53,4)	08 (26,7)	06 (20,0)
Positive culture at 96h (n=12)	07 (58,3)	04 (33,3)	07 (53,3)
Normal microflora			
Positive culture at 24h (n=30)	26 (86,6)	05 (16,6)	14 (46,7)
Positive culture at 48h (n=30)	25 (83,3)	05 (16,6)	14 (46,7)
Positive culture at 96h (n=12)	9 (75,0)	-	04 (33,3)

As regards the presence of microorganisms of the pathogenic microbiota in the serial cultures of oropharyngeal, gastric and tracheal secretion, it may be observed that there was an increase in the number of children colonized by these bacteria as the days passed. Whereas analysis of the normal microbiota revealed a small reduction in the number of colonized children.

With respect to the identification of bacteria typical of normal microbiota, there was predominance of the Gram-positive species *Streptococcus* viridans and *Staphylococcus* coagulase-negative species and of the Gram-negative *Moraxella* spp species. The species of pathogenic microbiota isolated with greater frequency were the enterobacteria such as, *Enterobacter spp* and *Klebsiella pneumoniae;* non-glucose-fermenting bacilli such as *Pseudomonas aeruginosa* and *Acinetobacter baumanii* and Gram-positive *Staphylococcus aureus* species. As regards analysis of the gastric secretion, the identification of fungi and enterobacteria is emphasized.

Detailed results of the cultures analyzed may be observed in Chart 1.

It is pointed out that the majority of strains identified presented resistance to antimicrobial agents, with high frequency of strains of *Klebsiella pneumoniae ESBL*; strains of *Pseudomonas aeruginosa* and *Acinetobacter baumanii* Carbapenens-resistant and β-lactamase inhibitor resistant; strains of *Staphylococcus aureus* meticilin–resistant and strains of *Enterobacter* spp resistant to second and third generations of cephalosporins.

Of the 30 children analyzed, bacterial translocation was observed in 24 children (80.0%). As demonstrated in Table 3, these children suffered from some type of translocation in at least one of the time intervals of observation of the cultures, with oropharyngeal translocation being predominant, followed by absence of translocation. Among the children that presented bacterial translocation, 2 (8.3%) presented translocation identified exclusively before 24 hours, and between 48 and 96 hours; and in 5 (20.8%) patients it was shown that translocation occurred exclusively between 24 and 48 hours.

Table 3. Oropharyngeal, gastric and tracheal translocation in children hospitalized in a Pediatric Intensive Care Unit – São Paulo – SP, 02/2007 a 02/2008

	Translocation		
	Before 24h (n=30) f (%)	**Between 24 and 48 h (n=30) f (%)**	**Between 48 and 96h (n=12) f (%)**
Orophayngeal translocation	15 (50,0)	17 (56,7)	6 (50,0)
Gastric translocation	1 (3,3)	-	-
Gastric and oropharyngeal translocation	-	3 (10,0)	2 (6,7)
Absence of translocation	14 (46,7)	10 (33,3)	4 (33,3)

DISCUSSION

The physiopathology of respiratory infections involves mainly two processes: Colonization of the respiratory and digestive tracts and microaspiration of secretions from the upper and lower airways. [6]

Bacterial colonization refers to the presence of bacteria in a certain site of the body without causing an active host response to its presence. In the case of the lungs, colonization may occur due to invasion by microorganisms from sites such as the oropharynx, nasal cavities, dental plaque, gastrointestinal tract, the mechanical ventilation appliance circuit and other patients. [4,6]

The presence of a tracheal tube harms the body's natural defense mechanisms, such as reduction in air filtration and humidification, coughing reflex and mucociliary movement, providing a direct route enabling bacteria that colonize the upper airways to reach the lungs. [4,6]

Chart 1. Details about results of the cultures performed in PICU children – São Paulo –SP, 02/2007 – 02/2008

Children	Culture at 24 hours			Culture at 48 hours			Culture at 96hours		
	SOF	SG	ST	SOF	SG	ST	SOF	SG	ST
1	*E.coli*	*E.coli*	AC	*S. coag neg*	*E.coli*	*S. coag neg* *	*S. coag neg*	AC	AC
2	*S. coag neg*	*S.*viridans	AC	*P.aerugin*	AC	AC	*P.aerugin*	AC	AC
3	*S.*viridans *Cand* spp	AC	AC	*S.*viridans *Cand* spp	AC	AC	NC	NC	NC
4	*S.*viridans *Mora* spp *P.aerugin*	*Cand* spp *E.coli*	*S.*viridans *	*S.*viridans *P.aerugin*	AC	*P.aerugin* *	NC	NC	NC
5	*S. coag neg* *S.*viridans	*S. coag neg*	AC	*S.*viridans *K. pneum*	AC	*S. coag neg* *	NC	NC	NC
6	*S.*viridans	*Enter.*spp	AC	*S. coag neg*	*S. coag neg*	*S.*viridans *	NC	NC	NC
7	*S.*viridans	AC	*S.*viridans *	*S.*viridans *Mora* spp	AC	*S.*viridans *	NC	NC	NC
8	*S.*viridans *S. coag neg*	AC	AC	*S.*viridans *Mora* spp	*Cand* spp	*S.*viridans *	NC	NC	NC
9	*S.*viridans *Mora* spp *K.oxyt*	*K.oxyt*	*S. coag neg*	*S.*viridans *Mora* spp *K.oxyt*	*K.oxyt*	*S. coag neg*	*S.*viridans *A.baum*	*K.oxyt*	*A.baum* *
10	*S.*viridans *Enter.*spp	AC	*S.*viridans *	*S.*viridans *Enter.*spp	AC	*S.*viridans *	*S.*viridans *S. coag neg*	*A.baum*	*S. coag neg* *
11	*S.*viridans *Mora* spp	*K. pneum*	*K. pneum* *	*S.aureus*	*S.aureus*	*S.aureus* *	NC	NC	NC
12	*S.*viridans *Enter.* spp	*S. coag neg*	AC	*S.*viridans *Enter.*spp	*S. coag neg*	AC	*Enter.* spp	*Enter.* spp	*Enter.* spp *
13	*S.*viridans *Mora* spp	AC	*S.*viridans *	*S.*viridans *Mora* spp	AC	*S.*viridans *Cand* spp *	*S.*viridans *Mora* spp	AC	*S.*viridans *Cand* spp *
14	*S.*viridans	*K. pneum*	*S.*viridans *	*S.*viridans	*S. coag neg*	AC	*S.*viridans	AC	AC
15	*S.*viridans *P.aerugin*	*Cand* spp	*S.*viridans *	*S.*viridans *P.aerugin*	*Cand* spp	*S.*viridans *	*S.*viridans *P.aerugin*	*Cand* spp	*S.*viridans *
16	*S.*viridans *Enter.*spp	*Enter.*spp	AC	*S.*viridans *Enter.*spp	*Enter.*spp	AC	NC	NC	NC
17	*S.*viridans *S. coag neg*	*Cand* spp	AC	*S.*viridans *S. coag neg*	*Cand* spp	AC	NC	NC	NC
18	*S.*viridans	AC	*S.*viridans *	*S.*viridans	AC	*S.*viridans *	NC	NC	NC
19	*K. pneum*	AC	*K. pneum* *	*K. pneum*	AC	*K. pneum* *	*K. pneum*	AC	*K. pneum* *
20	*S.*viridans *Mora* spp	AC	*S.*viridans *Mora* spp *	*S.*viridans *Mora* spp	AC	*S.*viridans *Mora* spp *	*S.*viridans *Mora* spp *Enter.*spp	*Enter.*spp	*S.*viridans *Enter.*spp *
21	*S.*viridans *E.coli*	AC	*S.*viridans *E.coli* *	*S.*viridans *E.coli*	AC	*S.*viridans *E.coli* *	NC	NC	NC
22	*S.*viridans *Mora* spp	AC	*S.*viridans *	*Mora* spp *S. coag neg*	AC	*S.*viridans *	*Mora* spp *S. coag neg*	AC	*S.*viridans
23	*S. coag neg*	*S. coag neg*	AC	*S. coag neg*	*S. coag neg*	*S. coag neg* *	NC	NC	NC
24	*S.*viridans *Mora* spp	AC	AC	*S. coag neg* *K. oxyt*	*S. coag neg*	AC	NC	NC	NC
25	*S.*viridans	AC	*S.*viridans *	*S.*viridans *S. coag neg*	*Cand* spp	AC	NC	NC	NC
26	*S.*viridans *S. coag neg*	*S.*viridans	*S.*viridans *S. coag neg* *	*S.*viridans	AC	*S.*viridans *	*S.*viridans	AC	*S.*viridans *
27	*S.*viridans *S. coag neg*	AC	*S. coag neg* *	*S.*viridans *S. coag neg*	AC	*S. coag neg* *	NC	NC	NC
28	*K. pneum*	AC	AC	*K. pneum*	AC	*K. pneum* *	NC	NC	NC
29	*S.*viridans *S. coag neg*	AC	AC	*S.*viridans *S. coag neg*	AC	AC	NC	NC	NC
30	*S.*viridans	AC	*S.*viridans *	*S.*viridans	AC	*S.*viridans *	NC	NC	NC

Legend: * Bacterial translocation; AC – Growth absence; NC – culture no performed; *A baum* – *Acinetobacter baumanii*; *Cand* spp – *Candida* spp; *E.coli* – *Escherichia coli*; *Enter* spp – *Enterobacter* spp; *K pneumon* – *Klebsiella pneumoniae*; *K oxyt* – *Klebsiella oxytoca*; *Mora* spp – *Moraxella* spp; *P aerugin* – *Pseudomonas aeruginosa*; *S.*coag neg – *Staphylococcus* coagulase negativa; *S.* viridans – *Streptococcus* do grupo viridans; *S aureus* – *Staphylococcus aureus*.

All the children in this study remained intubated for a minimum period of 48 hours and around 30% of them were submitted to a re-intubation process. It was observed that 80% of these patients presented some type of bacterial translocation, and that as from 48 hours of study, there was an increase in the number of children with tracheal colonization by potentially pathogenic bacteria, corroborating the work of researchers who consider the time of tracheal intubation of longer than 48 hours to be a factor of elevated risk for the development of pneumonia.

Aspiration of gastric contents is another potential risk factor for the occurrence of pneumonia, since the stomach serves as a reservoir for bacteria. The majority of critically ill patients are submitted to gastric or post-pyloric intubation for gastric decompression, nutritional or therapeutic support. The insertion of tubes into the nostril has been associated with greater risk for the development of sinusitis, which consequently increases the possibility of alteration in oropharyngeal colonization, since the bacteria present in the paranasal sinuses may migrate to this region.[7] Moreover, when gastric or post-pyloric tubes are used, occlusion of the esophageal sphincter is harmed, generating a potential risk for gastric reflux. Once reflux occurs, the upper airways are exposed to a high number of bacteria that may still migrate to the oropharynx by means of the external wall of the tubes.[7] In the present study, only two children were not submitted to gastric or post-pyloric intubation.

Around 90.0% of the children included in this investigation received medications that alter gastric pH. The elevation of gastric pH, as occurs in patients submitted to stress ulcer prophylaxis, may favor an increase in the concentration of gram-negative bacilli in the gastric secretion, causing retrograde colonization from the stomach to the oropharynx and trachea, thus making these patients more susceptible to respiratory infections.[4]

Nevertheless, in spite of this fact, recent researches have suggested that although the stomach is frequently colonized by enteric gram-negative bacilli, it is not the primary source for colonization of the lower respiratory tract by nosocomial pathogens. Microorganisms responsible for the occurrence of pneumonia in adult patients submitted to intensive therapy have been commonly identified, primarily in the oropharyngeal region.[8,9] In a similar matter, a study conducted in a Brazilian PICU revealed that around 41.8% of the 55 studied children presented potentially pathogenic species of microorganisms colonizing the oropharynx at the time of admission to the unit.[10]

All the children included in this study presented oropharyngeal colonization within the first 24 hours of tracheal intubation, either by bacteria of the normal oropharyngeal microbiota or by potentially pathogenic bacteria, whereas gastric colonization in this period was identified in 14 of the 30 children. Of these 14 children, 7 presented enterobacteria in the gastric secretion.

A study conducted in critically ill adult patients without infection on admission to an ICU, demonstrated a 90% rate of colonization, with predominance of gram-negative bacilli, such as *K. pneumoniae, P. aeruginosa, E. coli* and *Enterobacter spp* in addition to gram-positive microorganisms such as *S.aureus* and *S. bovis*. It was verified that the oropharynx was the first site to be colonized, within approximately 36 hours of hospitalization, followed by the gastric region, and finally the lower respiratory tract.[11] Similar results were found by other researchers who verified that the main source of microorganisms for secondary colonization of the trachea in critically ill adult patients was the oropharynx, and the oropharynx and stomach concomitantly. [12,13]

In a similar manner, it was verified that up to the time interval of 48 hours of study, there was a rise in the number of children who presented oropharyngeal colonization, consequently, translocation of microorganisms from the oropharynx to the trachea was also more frequent, followed by absence of translocation. Gastric translocation was shown to be less frequent as it occurred in only 3.3% of the children.

These data suggest that although the stomach may represent a source of microorganisms that colonized the tracheobronchial tree, in the pediatric population also, it is not the most significant source of bacteria causing respiratory infections. Thus the importance is emphasized, of the oropharyngeal area as a reservoir of microorganisms that cause tracheal colonization.

The normal microbiota of the oropharynx in non intubated patients is predominantly composed of gram-positive species and anaerobic microorganisms. During the period of hospitalization in the ICU the oral microbiota is replaced by gram-negative and gram-positive pathogenic aerobic bacilli.[14] Research conducted in adults has shown that on admission to an ICU, patients were mainly colonized by species of microorganisms such as *S. aureus, H. influenzae* and *S. pneumoniae,* and that during the course of hospitalization there was rapid replacement of the normal oropharyngeal microbiota by gram-negative bacilli, such as *P. aeruginosa.*[15]

The predominance of the species of normal microbiota such as, coagulase-negative *Staphylococcus*, *viridans Streptococcus* and *Moraxella spp*, in the oropharynx and trachea cultures of the children included in this study was similar to the results shown by an epidemiological study developed in populations of children at risk for the acquisition of gram-negative aerobic bacilli. [16]

There was also predominance of pathogenic bacteria such as *Enterobacter spp, K. pneumoniae and P. aeruginosa,* in the cultures of oropharyngeal and tracheal secretions, a result similar to that found in other studies that demonstrated that colonization of the oropharynx by gram-negative pathogens is an almost universal occurrence in critical patients submitted to MPV. [8,13,17]

Risk factors for the development of pneumonia may be divided into three categories: those related to the host, equipment and devices, and to the professionals. Host-related risk factors include: pre-existent conditions such as immunosuppression and chronic diseases, acute respiratory diseases, position in the bed, level of consciousness, number of tracheal intubations, and use of medications such as antibiotics and sedative.[17]

The children included in this study consisted of a group of patients with varied characteristics, which may be considered risk factors for the increase in oropharyngeal, gastric and later tracheal colonization. Among these factors, the use of drugs that may alter the pattern of colonization may be pointed out, such as antibiotics, central nervous system depressants, and gastric protectors, gastric tubing and the process of tracheal intubation itself.

Preventive measures must be implemented to diminish bacterial translocation to the trachea, particularly in groups of patients who have diverse risk factors for the occurrence of this event, such as the children who participated in this study. Moreover, extra-careful attention must be paid to populations that are known to present oropharyngeal and gastric colonization by potentially pathogenic bacteria at the time of admission to intensive care units.

In this context, nurses have been considered the first line of defense in the prevention of bacterial colonization of the oropharynx and gastrointestinal tract and translocation of bacteria to the lungs, with the exception of interventions that must be implemented by these professionals, such as: meticulous hand hygiene, oral hygiene, tracheal aspiration without the instillation of saline solution, aspiration of oral cavity secretions, maintenance of adequate pressure of the tracheal cuff, evaluation of the need for changing the circuits of MPV apparatuses, changes of the patient's decubitus position in the bed, maintenance of the decubitus position elevated to 30º, monitoring the distension and residual gastric volume and the careful use of sedative drugs.

Knowledge of the characteristics of the population attended, of the prevailing bacterial colonization pattern and the risks for the occurrence of bacterial translocation, which expose the child to elevated risk for developing health-care related infections, provide the nurse with scientific knowledge that contributes to improvement of the assistance rendered and a reduction in adverse events arising from a practice without foundation.

Limitation of the Study

It was not possible to attain a larger sample of children with data collection in the PICU of a single hospital in a reasonable period of time.

CONCLUSION

Critically ill children may present factors for an increase in bacterial colonization and translocation from the gastrointestinal region to the trachea. In a sample of 30 children hospitalized in a Pediatric Intensive Care Unit, a high frequency of oropharyngeal colonization by pathogenic microorganisms and translocation of these bacteria to the trachea was found in around half of the children admitted to this study.

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