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ORIGINAL ARTICLE

MICROBIOLOGICAL PROFILE OF CULTURES IN A NEONATAL INTENSIVE CARE UNIT

PERFIL MICROBIOLÓGICO DE CULTURAS EM UNIDADE DE TERAPIA INTENSIVA NEONATAL PERFIL DE CULTIVOS MICROBIOLÓGICOS EN UNIDAD DE CUIDADOS INTENSIVOS NEONATAL

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ABSTRACT

Objective: to outline the microbiological and resistance profile of strains isolated from cultures of a neonatal intensive care unit at a hospital in the country-side of the state of São Paulo, Brazil. **Method:** this is the quantitative, retrospective study, carried out by collecting results from laboratory analyses in 2008. The data were analyzed by means of descriptive statistics and expressed in simple and relative frequency. The project was approved by the Research Ethics Committee of the Integrated Colleges Teresa D'Ávila, under protocol No. 52/2009. **Results:** seven sources were considered for collection (blood; tracheal secretion; cerebrospinal fluid; urine; catheter tip; eye secretion; and faeces) in 292 cultures. From them, 38 (13%) were positive and 254 (87%) negative. Among the positive, nine were hemoculture, 11 from tracheal secretions, three from cerebrospinal fluid and 14 from catheter tips. The main microorganisms found were *Staphylococcus epidermidis* (31.6%), followed by *Klebsiella pneumoniae* (23.7%) and *Stenotrophomonas maltophilia* (13.1%). **Conclusion:** it is concluded that the culture with highest percentage of positivity was the catheter tip, highlighting multi-resistant microorganisms, commonly associated with infections in neonatology, especially bloodstream infections. The need of nursing and other health-care professionals' performance is emphasized in order to implement effective prevention and control measures against specific microbiota in their units. **Descriptors:** nursing; intensive care, neonatal; cross infection.

RESUMO

Objetivo: traçar o perfil microbiológico e de resistência de cepas isoladas em culturas de uma unidade de terapia intensiva neonatal em um hospital do interior do estado de São Paulo, Brasil. **Método:** estudo quantitativo, retrospectivo realizado por meio da coleta dos resultados das análises laboratoriais do ano de 2008. Os dados foram analisados por meio de estatística descritiva e expressos em frequência simples e relativa. O projeto foi aprovado pela Comissão de Ética em Pesquisa das Faculdades Integradas Teresa D'Ávila, sob número de protocolo 52/2009. **Resultados:** observaram-se sete sítios de coleta (sangue; secreção traqueal; líquido cefalorraquidiano; ponta de cateter; urina; secreção ocular; e fezes) em 292 culturas. Destas, 38 (13%) foram positivas e 254 (87%) negativas. Dentre as positivas, nove eram hemoculturas, 11 provenientes de secreções traqueais, três de líquido cefalorraquidiano e 14 de pontas de cateter. Os principais microrganismos encontrados foram o *Staphylococcus epidermidis* (31,6%), seguido da *Klebsiella pneumoniae* (23,7%) e *Stenotrophomonas maltophilia* (13,1%). **Conclusão:** conclui-se que a cultura com maior porcentagem de positividade foi a de ponta de cateter, destacando-se microrganismos multirresistentes, comumente associados a infecções em neonatologia, em especial às infecções de corrente sanguínea. Enfatiza-se assim a necessidade da enfermagem e demais profissionais de saúde atuarem implementando medidas de prevenção e controle eficientes frente à microbiota específica de suas unidades. **Descritores:** enfermagem; terapia intensiva; neonatal; infecção hospitalar.

RESUMEN

Objetivo: trazar el perfil microbiológico y de resistencia de las cepas aisladas en cultivos de una unidad de cuidados intensivos neonatal de un hospital del interior del estado de São Paulo en Brasil. **Método:** este es un estudio cuantitativo, retrospectivo realizado a través de la recopilación de los resultados de análisis de laboratorio en 2008. Los datos fueron analizados por medio de estadística descriptiva y expresados en frecuencia simple y relativa. El proyecto fue aprobado por el Comité de Ética en la Investigación de las Faculdades Integradas Teresa D'Ávila, en virtud del protocolo N° 52/2009. **Resultados:** fueron consideradas siete fuentes de obtención (sangre; secreción traqueal; líquido cefalorraquídeo; orina; punta de catéter; secreción ocular; y heces) en 292 cultivos. De éstos, 38 (13%) fueron positivos y 254 (87%) negativos. Entre los positivos, nueve fueron hemocultivos, 11 de secreciones traqueales, tres de líquido cefalorraquídeo y 14 de puntas de catéter. Los principales microorganismos encontrados fueron el *Staphylococcus epidermidis* (31,6%), seguido por *Klebsiella pneumoniae* (23,7%) y *Stenotrophomonas maltophilia* (13,1%). **Conclusión:** se concluye que el cultivo con mayor porcentaje de positividad fue el de punta de catéter, destacándose microorganismos multiresistentes, comúnmente asociados con infecciones en neonatología, especialmente de la corriente sanguínea. Se enfatiza la necesidad de que enfermería y otros profesionales de la salud actúen aplicando medidas eficaces de prevención y control de la microbiota específica de sus unidades. **Descriptores:** enfermería; cuidado intensivo neonatal; infección hospitalaria.

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INTRODUCTION

The Units of Intensive Neonatal Therapy (UTIN) based by the technic-scientific development of its staff and frequent and rigorous attention, have done continuously positive impacts for the survival of newborns (RN) and children.¹

The technological development and the consecutive improvement of the assistant of newborns pre-term (RNPT), turned frequent the use of invasive proceedings, such as mechanic airing (VM), umbilical catheterisms (venous or arterial), catheter epicutaneous central of peripheral insertion (PICC), parenteral nutrition (NPP); and extended interns which became to the elevation of the taxes of infections, forming actually a challenge for the multidisciplinary staff which follow them, because represent important morbidity and mortality for these customers.²

When interned in UTIN, the RN seriously ill is subject to the involvement by infectious surges, frequent surges in these units, generated by diverse multiresistant microorganisms capable to survive in the environment and, also, transitory, in the hands of the health professionals who manipulate the babies, favoring the dissemination child-child.³

In cases of surges of hospital infection (IH), mainly by resistant microorganisms, some times, habitual measures as the criterious hygienic cleaning of the hands and cares with the patients they are not enough to prevent an epidemy, being also necessary to the inquiry of the colonized professionals of health and that they would need specific treatment.³

A study observed between 15038 just-born interned, one high delayed prevalence of sepsis neonatal caused by gram-negative bacteria, associated to important mortality. The newborn infections can be divided in: precocious that they are those that after occur between 48 to 72 hours the birth, and, they are associates to microbiota maternal; and, delayed ones, those that attack the child from the fourth day of birth, that they are related to the assistance and the hospital environment.

By this way, the process of prevention of the transmission of infections for the fetus/RN is initiated with the adequate prenatal pursuing of the pregnant woman, since the risks for precocious sepsis are associated to the presence of systemic infectious focus in the pregnant, as pneumonia, meningitis,

osteomyelitis, infection of the urinary treatment, ruptured with more than 18 hours, beyond association with partner-economic precarious conditions.

For in such a way, the knowledge of habitual microbiota of the sector favors the agile recognition of surges, becoming more efficient the corrective and preventive performance.

Thus, looking for contribute and add efforts for the improvement of the control of hospital infection and conscious of the importance to recognize micro biota of the unit in challenge it was objectified:

OBJECTIVE

- To map the microbiological profile and of isolated resistance of isolated strains in cultures of a Unit of Intensive Neonatal Therapy in a hospital of the countryside of the State of São Paulo.

METHOD

Retrospective, quantitative study, being the population consisting of handbooks of the RN attended between January the December of 2008 in a Unit of Intensive Neonatal Therapy of a maternal-infant hospital of the countryside of the State of São Paulo. The sample was composed by the results of the analyses of collected laboratorial cultures in the investigated period.

The Hospital Unit selected for study is composed by 41 stream beds for maternity, pediatrics and surgical clinic, six stream beds of UTIN and four stream beds of Unit of Intermediate Neonatal Cares. The monthly average of carried through childbirths is of 150, being approximately Caesarean 20% and 80% of natural childbirths.

The data had been collected in August 2009, by means of instrument of collection, that contained identified information about the type of culture, microorganisms, profile of resistance and sensitivity. The information had been analyzed by means of descriptive statistics and expresses in simple and relative frequency and the results are presented of descriptive form in figures and tables.

The project was submitted to the appreciation of the Commission of Ethics in Research, of the Integrated Faculties Teresa D `Ávila (FATEA), receiving approval under number from protocol 52/2009.

RESULTS

During the analyzed year, 292 cultures had been collected, of which 13% had been positive and 87% refusals.

They had been observed as positive cultures: 36.8% of tips of catheters, 31.6% tracheal secretion cultures, 23.7% blood cultures and 7.9% of cerebrospinal liquid (LCR) (Table 1).

Tabela 1. Tipo de culturas colhidas na UTI Neonatal no ano de 2008, segundo local e presença de crescimento microbiano, 2011.

Type of material	Bacterial growth				Total	
	Negative		Positive			
	n	%	n	%	n	%
Blood culture	126	49,6	9	23,7	135	46,2
Catheter tip	49	19,3	14	36,8	63	21,6
Cerebrospinal Fluid	30	11,8	3	7,9	33	11,3
Urine	31	12,2	–	–	31	10,6
Tracheal Secretion	8	3,2	12	31,6	20	6,9
Ocular Secretion	9	3,5	–	–	9	3,1
Faeces	1	0,4	–	–	1	0,3
Total	254	100	38	100	292	100

In Table 2 the microorganisms found in the positive cultures in the period investigated in the UTIN are verified. The microorganism (MILLSTONE) mostly found was Staphylococcus epidermidis in 31.6%, followed by the Klebsiella pneumoniae in 23.7%, maltophilia Stenotrophomonas in 13.1% cases, the Enterobacter cloacae and the aeruginosa

Pseudomonas with 7.9% situations each, Escherichia coli and the Enterobacter aerogenes, with 5.2% cultures respectively, and aureus the hemolítico alpha Streptococcus and the Staphylococcus with 2.6% event each, totalizing nine species of MILLSTONE joined.

Tabela 2. Classificação e número de microrganismos encontrados nas culturas colhidas na UTI Neonatal, 2011.

Microorganisms	n	%
Staphylococcus epidermidis	12	31,6
Klebsiella pneumoniae	9	23,7
Stenotrophomonas maltophilia	5	13,1
Enterobacter cloacae	3	7,9
Pseudomonas aeruginosa	3	7,9
Escherichia coli	2	5,3
Enterobacter aerogenes	2	5,3
Streptococcus alfa hemolítico	1	2,6
Staphylococcus aureus	1	2,6
Total	38	100

Amongst the 38 positive cultures, 63.2% of them represented MO gram negative (Klebsiella pneumoniae, maltophilia Stenotrophomonas, Enterobacter cloacae, aeruginosa Pseudomonas, Escherichia coli, Enterobacter aerogenes) and 36.8% gram positive (Staphylococcus epidermidis, Staphylococcus aureus and the hemolitic alpha Streptococcus).

and hemolytic alpha Streptococcus, respectively in blood and tip of catheter that had not presented resistance to none of tested antibiotics.

In Figures 1 and 2 the profiles of sensitivity of the isolated microorganisms had been presented, second type of collected material.

It is observed in Figure 1, that similar microorganisms in the blood cultures and tip of catheter exist, even so, in the cultures of catheter tip the joined microorganisms as the maltophilia Stenotrophomonas presents greater resistance to tested antibiotics. However, in two situations it had the isolation of microorganism, Staphylococcus epidermidis

Collection site	n	Microorganisms found	Resistance	%
Blood	1	Enterobacter cloacae	Amoxicillin Amoxicillin + Clavulanic Acid Cephalothin Cefoxitin Cefuroxime	100
	3	Staphylococcus epidermidis	— — —	----
	1	Klebsiella pneumoniae	Amoxicillin Netilmicin Peperacilina Ticarcillin Tobramycin	100 50 50 50 50
	1	Stenotrophomonas maltophilia	Amikacin Ampicillin Colistin Gentamicin Imipenem Sulbactam Ticarcillin + Clavulanic Acid Tobramycin Piperacillin	100 100 100 100 100 100 100 100 50
	1	Escherichia coli	Amoxicillin Ticarcillin	100
Tip Catheter	1	Stenotrophomonas maltophilia	Amikacin Ampicillin + Sulbactam Cefepime Colistin Gentamicin Imipenem Mereponem Piperacillin + Tazobactam Ticarcillin Ticarcillin + Clavulanic acid Tobramycin Ureidopen	100
	3	Klebsiella pneumoniae	Amoxicillin Piperacillin Ticarcillin	66,6 33,3 33,3
	8	Staphylococcus epidermidis	Penicillin Clindamycin Cotrimoxazole Erythromycin Gentamicin Levofloxacin Coagulase oxacillin Quinuspristine Dalforis Tetracycline Teicoplanin	100 87,5 87,5 87,5 87,5 87,5 87,5 12,5 12,5 12,5
	1	Staphylococcus aureus	Erythromycin Penicillin	100
	1	Streptococcus alfa hemolítico	—	—
	1	Pseudomonas aeruginosa	Ampicillin + Sulbactam Cotrimoxazole	100

Figure 1. Isolated microorganisms and resistance to the antibiotics in blood cultures and catheter, collected at UTI Neonatal, 2011.

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antibiotics of the maltophilia
Stenotrophomonas.

In Figure 2 isolated diverse microorganisms
in tracheal secretion culture are observed and
again it is stood out resistance the diverse

Collection site	n	Microorganisms found	Resistance	%
Tracheal Secretion	2	Enterobacter cloacae	Amoxicillin	100
			Cephalothin	100
			Cefoxitin	100
			Amoxicillin + Clavulanic Acid	50
			Ticarcillin	50
			Ticarcillin + Clavulanic Acid	50
	2	Stenotrophomonas maltophilia	Amikacin	100
			Ampicillin + Sulbactam	100
			Cefepime	100
			Ceftazidime	100
			Colistin	100
			Gentamicin	100
			Imipenem	100
			Meropenem	100
			Piperacillin + Tazobactam	100
			Ticarcillin	100
			Tobramycin	100
			Ciprofloxacin	50
			Piperacillin	50
			Ticarcillin + Alavulanic Acid	50
			Ureidopen	50
	4	Klebsiella pneumoniae	Amoxicillin	100
			Ticarcillin	75
			Piperacillin	75
			Cephalothin	25
	1	Pseudomonas aeruginosa	Ampicillin + Sulbactam	100
			Ticarcillin	
			Ticarcillin + Clavulanic Acid	
			Piperacillin	
			Piperacillin + Tazobactam	
			Cefepime	
			Ceftazidime	
			Amikacin	
	1	Escherichia coli	Gentamicin	
			Cotrimoxazole	
			Amoxicillin	100
			Cephalothin	
			Cefuroxime	
	1	Staphylococcus aureus	Cefoxitima	
			Ticarcillin	
			Penicillin	100
			Erythromycin	
LCR	2	Enterobacter aerogenes	Norfloxacin	
			Levofloxacin	
			Amoxicillin	100
			Piperacillin	100
			Ticarcillin	100
			Amoxicillin + Clavulanic Acid	50
			Cephalothin	50
			Cefoxitin	50
			Ticarcillin + Clavulanic Acid	50
	1	Pseudomonas aeruginosa	Ampicillin + Sulbactam	100
			Cefepime	
			Ceftazidime	
			Cotrimoxazole	
			Piperacillin	
			Piperacillin + Tazobactam	
			Ticacilina	
			Ticarcillin + Clavulanic Acid	

Figure 2. Isolated microorganisms and resistance to the antibiotics in cultures of tracheal secretion and LCR collected at UTI Neonatal, 2011.

DISCUSSION

Although the technological innovations come contributing for the increase of the survival of the RN, it still observes considerable prevalence of infectious cases and internments for drawn out periods, associated to the RN survival extremely premature.⁴

It was observed in the present inquiry, that 13% of the collected cultures had been positive for some microorganisms, and although the blood cultures to be the examinations most requested, are not those that have greater positiveness for microorganisms in the investigated unit, therefore, the examinations of tracheal secretion and catheter tip had presented greater microbiano growth and

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profiles of sensitivity the antibiotics most preoccupying.

The becoming of fever not clarified, motivated, in the practical clinic, the withdrawal of the catheters and sending of its tip to the laboratorial examination, considering it as reservoir of microorganisms. Currently, by the new recommendations, the infections related to the catheter (IRC) are diagnosed based in clinical criteria, and not only in the becoming of non clarified fever.⁵

Thus, in many services of health still the use of the culture of tip of catheter for diagnostic confirmation of infection is practical chain, as observed in recent prospective study that pointed the utility of the culture of the tip of the catheter in the diagnosis of neonatal infection, verifying the biggest epidermidis occurrence of contamination for *Staphylococcus*. The authors stand out that it is the main colonizer of the RN and for this aspect more would be related to the infectious pictures in this population, given that he comes of meeting to the findings of the gift investigação.⁶

In the sequence, the evidenced positive trachea cultures, had corresponded 31.5% of the positive cases. The qualitative tracheal secretion culture, even so presents considerable sensitivity the detention of microorganisms, around 90%, has a specificity low, about 40%, what it does not favor the differentiation between settling and true infection.⁷

Thus, for the diagnosis of the pneumonia associated with the mechanical fan (PAV), the anatomopatologic examination is considered the "standard-gold", ally the clinical data as, fever, auscultates pulmonary, bigger necessity of ventilation, secretion in the aspiration of the cannula; added the two x-rays of new or gradual pulmonary thorax with infiltrated and infectious CBC. Although the evaluation recommendation in such a way, the anatomopatológico examination is not part of the routine of many services of health.⁷

Already the liquor culture represented only 7.9% of the positive examinations. This examination is basic for the diagnosis of infections of the central nervous system, as for example, meningitis, that are associated to high mortality and complications.

In this context, the results of the study of cohort carried through with 503 RN interned in UTIN, that evidenced taxes of 43.8% infection associates the pneumonia, 31.6% associates the primary blood chain infection and 11% associates meningitis, excite to come of

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meeting, approximately, to evidenced in the present inquiry how much cultures of liquor.

Carried through national study in neonatal UTI of a tertiary hospital is also stood out, where the occurrence of neonatal meningitis during the last decade was of 0,6% and the mortality of 59% of the cases caused for bacteria gram-negative.⁹

About the isolated microorganisms in the analyzed cultures, they come to the meeting to the recent findings in literature. The main isolated agent in the epidermidis cultures was the *Staphylococcus*, a MO gram positive, that appears as important neonatal causer of sepsis, characterizing for its pathogenic potential and capacity adaptativa¹⁰; followed by the recognized *Klebsiella pneumoniae* as one of the first microbiological agents they gram inside negative responsible for hospital infections of a UTIN.^{2,3,11}

Aspects also evidenced in study that analyzed 596 RN and observed the epidermidis predominance of the *Staphylococcus* as causing agent of pneumonias associates the ventilation chain mechanics and blood infections.¹²

In this exactly direction, another study pointed the isolation of 52,3% of Gram-positive bacteria, being the most joined *Staphylococcus coagulase negative*, followed of the Gram-negative, with predominance of the *Klebsiella pneumoniae* e, in third place, fungi.¹¹

In the present inquiry the microorganism maltophilia *Stenotrophomonas* was also distinguished generally associated to the opportunist infections, attacked with high imunocompromised patient prevalence and severity, associated mainly to chain blood infections.¹³⁻⁴

As observed in study of cohort retrospective Chinese between patients interned in UTI Neonatal the occurrence of sanguineous chain infections and pneumonias had mainly been associated to the microorganisms *Klebsiella pneumoniae*, followed by *Acinetobacter baumannii*, *Staphylococcus epidermidis*, *aeruginosa* *Pseudomonas*, *Enterobacter cloacae* and *Stenotrophomonas maltophilia*.¹⁵

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The maltophilia *Stenotrophomonas* currently proves for its resistance to the great part of available antibiotics for the therapeutical one, for its association to the mechanic ventilation, presence of central venous access, drawn out periods of internment and high mortality, what it makes it if to detach each time more inside of therapy environments intensive.¹⁶ All these aspects seem to come of meeting to the data found in this inquiry, therefore the profiles of bigger resistance to antibiotics had been exactly the associates to this microorganism.

By this way, in view of the high prevalence of resistant microorganisms and the use of innumerable techniques of invasive treatment and diagnosis, the contamination risk becomes in accordance with necessary that the Hospital Units establish protocols and standardized routines for the job of rules of precautions and isolation standard. Moreover, when knowing in local depth its micro biota, can determine the endemic standards, for adjusted performance in exceeding cases and adequacy of its antimicrobial therapy.¹⁷

FINAL CONSIDERATIONS

Front to the evidenced results, the culture with bigger percentage of positivity was of catheter tip, being distinguished mainly epidermidis the multiresistant microorganisms, *Staphylococcus*; *Klebsiella pneumoniae* and maltophilia *Stenotrophomonas*, commonly associated to the infections in neonatologia, this last in special one to the infections of sanguineous chain and pneumonias.

Of this form, this study points out the sprouting of new causing microrganismos of infections related to the health services, as maltophilia *Stenotrophomonas*, that is distinguished for raised morbidity-mortality in the customers taken care of in the UTIN.

Thus, it is standed out multiprofessional team of health, with prominence for the Nursing, that must be intent and to deeply know the profile microbiological of its units, therefore fits it, in face of its constant performance next to the patients, to recognize the signals and initial symptoms of infectious pictures, attempting against for the possible occurrence of surges, in special, when it is about the taken care of population in UTIN, given its extreme fragility.

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