Original Article

Pattern of Microorganisms Isolated from Endotracheal Swabs of Neonates and Determination of Their Antibiotic Susceptibility

Identification of Microorganisms That Colonize the Trachea of Intubated Neonates

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ABSTRACT

Objective: The aim of this study was to identify the microorganisms that colonize the trachea of intubated neonates at 1st, 24th, 48th and 72nd hours of intubation and find their antibiotic sensitivity pattern.

Study Design: Descriptive case series study

Place and Duration of Study: This study was conducted at the Department of Pediatric Medicine Unit II, Mayo Hospital Lahore. Study duration was 2 years from August 2014 to July 2016.

Materials and Methods: This study was conducted on 189 neonates who remained intubated for more than 72 hours at the hospital. After data collection, data were processed and analyzed using statistical software SPSS, version 20.

Results: When total sample collection events (1st, 24th, 48th and 72nd hours) were considered to be 100%, the majority showed no growth (65%), whereas in positive cultures Pseudomonas topped the list with 19% positive cultures followed by E.coli (6%) and Coagulase positive Staph aureus (6%). Antibiotics resistance was most commonly seen for ampicillin and cefotaxime, 5.2% each, while most bacteria were sensitive to vancomycin, tanzo and meropenem (5.2%) each.

Conclusion: Pseudomonas is the most common bacteria causing ventilator-induced pneumonia among neonates.

Key Words: ventilation, pneumonia, sensitivity, neonates, endotracheal intubation

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INTRODUCTION

Nosocomial infections which include surgical site wound, lower respiratory tract and urinary tract infection are leading public health problems in hospital worldwide[1]. The risk of these infections increases considerably with the modern invasive medical procedures in the intensive care settings[2,3]. Ventilator-associated pneumonia poses a great risk to patient safety. More ever the use of endotracheal tube is one of the most common ways of transmission of nosocomial infections.

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The risk of pneumonia is increased by up to 6 to 20 folds among patients who require mechanical ventilation after endotracheal intubation and in such cases, the mortality rates reach up to 20 to 40 percent[4,5]. The burden of hospital-acquired infection is significant in the developed countries were 5 to 15% of the patients who are hospitalized in the wards and this burden is estimated up to 50% or even more in intensive care unit patients. In contrast to this in the developing countries, the degree of this problem is still underestimated or not known as hospital-acquired infection diagnosis is complicated and there are not enough resources and expertise for surveillance measures to guide interventions[1].

Gram-negative bacilli infections in the lower respiratory tract are a leading complication in patients with tracheal intubation and ventilator assistance.[6] VAP is the commonest hospital-acquired pneumonia. VAP represent an episode of pneumonia which develops after 48 hours or more after initiating mechanical ventilation in a patient. Aspiration of the colonized respiratory secretions in the nasopharynx has been seen as the major cause of VAP[7-15]. The colonization of trachea by such possible pathogenic organisms predispose the patients to infections and these patients present with signs and symptoms like fever, lower

respiratory signs and polymorphonuclear leucocytes in the examination of sputum[16].

There has been an unrestricted use of antibiotics especially in the ICU settings which is a major cause of development of nosocomial infections caused by resistant gram-negative organisms[17]. The main aims of this study are to see the pattern of microorganisms isolated from endotracheal tube and their antibiotics sensitivity pattern and to compare whether we are using correct antibiotics or we have to modify according to culture susceptibility. A similar study was done in Iran (2012) showed Enterobacter species, Pseudomonas aeruginosa, Escherichia coli, Coagulase negative Staphylocooci, Staphylocoocus aureus and Proteus species respectively. Antibiotic susceptibility testing has shown that P. aeruginosa was the most resistant gram negative organism with the highest resistance against Cefixime and Coagulase-negative staphylococcal were the most resistant gram-positive with the highest resistance against Oxacillin[1]. Another similar study done in Iran showed mostly Acinetobacter, Pseudomonas aeruginosa, Proteus mirabilis. Antibiotics resistance was seen mainly against Acinetobacter, Staphylococcousaureus, and Kleibsella[17]. No similar study is done in Pakistan in the last 5 year.

Every year nearly 45% of all under 5 child deaths are among newborn infants, babies in their first 28 days of life or neonatal period. Three-quarters of all newborn death occur in the first week of life. In developing countries, nearly half of all mothers and newborns do not receive skilled care during and immediately after birth.[18]

In the Southeast Asia region around 52% of under-five mortality is contributed by deaths during the neonatal period. Some factors that impact newborn consequences include the health status and care received by the mother before and during pregnancy, during childbirth and postnatal care of the mother and neonates.[19]

There are two relatively distinct syndromes of Neonatal sepsis which are based on the age of performance, early-onset and late-onset sepsis.[20]

Early-onset sepsis (EOS) boons in the first 3-5 days of life. Typically, from the maternal genital tract, the infant has acquired the organism during the antepartum or intrapartum period. Procurement of other organism is associated with the birth process. With rupture of membrane, vaginal flora or various bacterial pathogens may ascend to reach the amniotic fluid and fetus. Chorioamnionitis develops leading to fetal colonization and infections[20].

MATERIALS AND METHODS

It is a descriptive case series study. Place of the study was Mayo hospital Lahore, department of paediatrics medicine. Duration of study was 2 years.

Operational definitions:

Nosocomial infections (hospital-acquired infection) refer to infections that a patient acquires after hospital admission and these infections were not present at admission. In this study nosocomial infection refers to those which occur after at least 48 hours of admission.

Ventilator-Associated Pneumonia (VAP) was defined as pneumonia that develops more than 48 hours after initiation of mechanical ventilation.

Antibiotics sensitivity: Antibiotics sensitivity was defined as the susceptibility of bacteria to antibiotics. Antibiotics susceptibility testing (AST) usually carried out to determine which antibiotics were most successful in treating a bacterial infection in vivo. Testing for antibiotics sensitivity was done by Kirby Bauer Method.

If the bacteria are sensitive to the antibiotics a clear ring or zone of inhibition was seen around wafer indicating poor growth.

The study aimed to identify the microorganisms that colonize the trachea of intubated neonates at 1st, 24th, 48th and 72nd hours of intubation and find their antibiotic sensitivity pattern. This study was conducted on 189 neonates who remained intubated for more than 72 hours at the Department of Pediatric Medicine Unit II, Mayo Hospital Lahore. Informed written consent was taken from parents or guardians. Endotracheal swabs were collected after following aseptic measures and were immediately submitted for culture and sensitivity to the hospital laboratory. All samples were analysed separately by the one laboratory person to avoid subjective variation in the analysis. The analysis was done following hospital laboratory protocols. Possibility of error was reduced by avoiding delay in submission of samples and multiple laboratories. After data collection, data were processed and analyzed using statistical software SPSS, version 20.

RESULTS

The overall findings of the study are described under the following sections:

4.1 Age

4.2 Gender

4.3 Indication for Intubation

4.1 Age: Mean±SD of neonates was 41.6±93.0 hours (1.7±3.9 days). Median age of the neonates was 15 hours (0.6 days), whereas age ranged from 1-480 hours since birth (0.04-20 days) (Table 4.1).

4.2 Gender: In terms of gender distribution, there was male predominance with 122 (64.6%) males and 67 (35.4%) females (Figure 4.2).

4.3 Indication for Intubation: The majority were indicated for intubation due to apnea (n=95, %=50.3), whereas bradycardia (n=6, %=3.1) was the least indication for it. After apnea, respiratory distress (n=61, %=32.3) was another major reason to intubate the neonates (Figure 4.2).

Table No. 4.1: Age

Time	Mean	Standard Deviation	Median	Range
In hours	41.6	93.0	15.0	1-480
In days	1.7	3.9	0.6	0.04-20.0

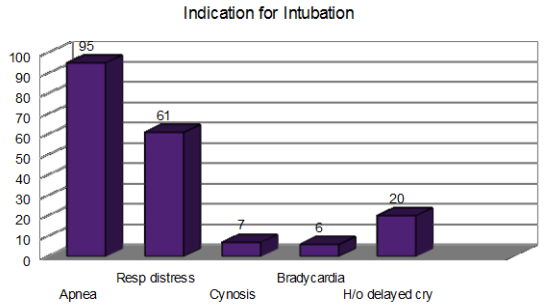

Figure No. 4.2: Indication for intubation

Table No. 4.2: Organisms Isolated

Organisms	1st hour of intubation	24th hour of intubation	48th hour of intubation	72nd hour of intubation
No growth	179 (94.7)	136 (72.0)	91 (48.1)	88 (46.6)
Pseudomonas	6 (3.2)	37 (19.6)	49 (25.9)	49 (25.9)
E coli	0 (0.0)	3 (1.6)	21 (11.1)	24 (12.7)
Coagulase positive Staph aureus	0 (0.0)	10 (5.3)	19 (10.1)	19 (10.1)
Proteus	4 (2.1)	0 (0.0)	6 (3.2)	6 (3.2)
Coagulase negative Staph aureus	0 (0.0)	3 (1.6)	3 (1.6)	3 (1.6)
Total	189 (100.0)	189 (100.0)	189 (100.0)	189 (100.0)

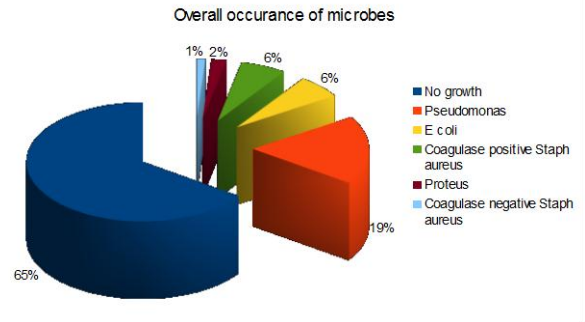

Figure No. 4.3: Total percentage of Microbes when overall (1st, 24th, 48th and 72nd hour) taken as 100%

4.4 Organisms isolated at different hours (1st, 24th, 48th and 72nd): At different times, different microorganisms were isolated from the tracheal swab of the intubated neonates. After 1st hour of intubation nearly 95% (n=179) showed no growth whereas 10 patients had growth with Pseudomonas (n=6, %=3.2) and Proteus (n=4, %=2.1). After 24th hour of intubation, no growth was seen in 136 (72.0%) neonates. Majority of the neonates had Pseudomonas growth (n=37,%=19.6), coagulase-positive Staph aureus (n=10, %=5.3) was 2nd to the list in terms of growth in 24th-hour post-intubation. Growth of microbes continued to increase after 48th hour of intubation with only 91 (48.1%) having no growth. The list was again topped by Pseudomonas (n=49, %=25.9) and the least culture-positive microbe was coagulase-negative Staph aureus (n=3, %=1.6). After 72 hours of intubation, more than 55% samples showed culture-positive samples among which Pseudomonas (n=49, %=25.9) has 49 positive cultures followed by E.coli (n=24, %=12.7) and the least was coagulase-negative Staph aureus (n=3, %=1.6). There was not much difference in culture positive status of 48th and 72nd hour post intubation (Table 4.2).

Table No. 4.3: Antibiotic sensitivity at 1st hour

Antibiotics	Sensitive n (%)	Resistant n (%)	Not done n (%)
Cefotaxime	0 (0.0)	10 (5.2)	0 (0.0)
Ceftriaxone	6 (3.2)	4 (2.1)	0 (0.0)
Ceftazidime	6 (3.2)	4 (2.1)	0 (0.0)
Gentamycin	3 (1.6)	7 (3.7)	6 (3.2)
Vancomycin	10 (5.2)	0 (0.0)	3 (1.6)
Ampicillin	0 (0.0)	10 (5.2)	24 (12.7)
Meropenem	10 (5.2)	0 (0.0)	0 (0.0)
Tanzo	10 (5.2)	0 (0.0)	3 (1.6)
Amikacin	6 (3.2)	4 (2.1)	0 (0.0)
Sulzone	3 (1.6)	7 (3.7)	73 (38.6)
Not required (culture negative)	179 (94.7)		
Sensitive to none of Antibiotics	0 (0.0)		

4.5 Total percentage of Microbes (1st, 24th, 48th and 72nd hour)when overall is taken as 100%: When total sample collection events (1st, 24th, 48th and 72nd hours) were considered to be 100%, the majority showed no growth (65%), whereas in positive cultures Pseudomonas topped the list with 19% positive cultures followed by E.coli (6%) and Coagulase positive Staph aureus (6%)(Figure 4.3).

DISCUSSION

Nosocomial infections including surgical wound, urinary tract infection and lower respiratory tract infection are major public health problems in hospital worldwide[1]. Invasive medical procedures in the intensive care unit remarkably increase the risk of such infections[2,3]. Ventilator-associated pneumonia has been shown to cause the greatest risk to patient safety. More ever the use of endotracheal tube is one of the most common ways of transmission of nosocomial infections. Intubation with mechanical ventilation increases the risk of pneumonia 6 to 20 folds more among patients and is associated with a case mortality rates of 20 to 40 percent[4,5]. The burden of hospital-acquired infection is already substantial in developed countries where it affects from 5% to 15%of hospitalized patients in regular wards and as many as 50%or more of patients in intensive care units. In developing countries, the magnitude of the problem has remained underestimated or even not known mostly because hospital-acquired infection diagnosis is complex and surveillance measures to guide interventions require expertise and enough resources[1].

CONCLUSION

This study allowed us to find out the pattern of microorganism colonizing the trachea after 48 hrs of intubation and determine the antibiotics sensitivity pattern. The results of this study would help us to know the percentages of gram-positive and gram-negative microorganism and their sensitivity pattern, the resistant pattern if presence, to change or adjust antibiotics according to sensitivity and the result can be used as a reference in primary and secondary health care where laboratory facilities are lacking.

Author's Contribution:

Concept & Design of Study:	Shreekrishna Devkota
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Data Analysis:	Muhammad Jareer Alam, Amrit Dhungel, Maryam
Revisiting Critically:	Shreekrishna Devkota, Sarfaraz Alam
Final Approval of version:	Shreekrishna Devkota

Conflict of Interest: The study has no conflict of interest to declare by any author.

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