



Research Paper

Tracheostomy colonisation and microbiological isolates of patients in intensive care units-a retrospective study



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KEYWORDS

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Abstract *Objective:* To find out the type of bacteria colonising the tracheostomy tube and to determine the antibiotic sensitivity pattern and resistance in patients who have had tracheostomy in intensive care unit (ICU) set up and to initiate proper empirical treatment in such patients.

Methods: The study was a retrospective review of patients who underwent tracheostomy at Ministry of Health, Sur Hospital, Oman January 2005 and December 2015. The Hospital has 4 bedded pediatric intensive care unit (PICU) and 10 bedded adult ICU which is headed by consultant anaesthetists, consultant physicians, ICU trained nurses and respiratory therapists. All patients who required mechanical ventilation and were therefore subject to an orotracheal intubation and those who underwent a conventional tracheostomy were considered for inclusion. Patients who had been intubated in other hospitals or ICUs, other airways infection issues were excluded from this study. Data's were collected from computer based hospital management system, operation theatre and registers in Medical records department and entered in a preformed questionnaire before thorough analysis. The specimens for swab was obtained from the cut tracheostomy tube tips and the samples were sent to microbiology laboratory for isolation of the organism and obtain an antibiogram to know the susceptibility and resistance to antibiotics. Data were analyzed by Statistical Package for Social Sciences (SPSS, version 16, Chicago, Inc) and the values are reported as number (%). The commonest isolated organism was *Pseudomonas* followed by *Acinetobacter*.

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Results: During the ten year retrospective study, there were 108 patients included in our study with 56 males and 51 females. Fourteen different microorganisms were isolated during our study which included *Pseudomonas aeruginosa* ($n = 39$), *Acinetobacter baumannii* ($n = 28$), *Klebsiella* ($n = 10$) and coagulase negative staphylococcus ($n = 6$). The most commonest organisms in both genders was *Pseudomonas aeruginosa* closely followed by *Acinetobacter baumannii*. In children under age of 12, it was *Pseudomonas aeruginosa* and in adults the impending organism was *Acinetobacter baumannii*. In terms of antibiograms, 89% of *Acinetobacter*, 38% of *Staphylococcus aureus*, 37% of *Klebsiella* and 54% of *Proteus mirabilis* were resistant to ciprofloxacin. These organisms were resistant to ceftazidime in 97%, 83%, 89% and 57% of the cases, respectively and resistant to imipenem in 7.4%, 18.2%, 1.8% and 8.1%.

Conclusions: In summary, this study presents the most common microorganisms colonized from tracheostomy of hospitalized patients and their pattern of antibiotic resistance. As our study showed, *Pseudomonas* is the most common microorganism isolated from tracheostomy tube. Ciprofloxacin was also the most prevalent antibiotic revealing resistant pattern. Moreover, most of the microorganisms were sensitive to imipenem and piperacillin-tazobactam.

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Introduction

Hospital acquired nosocomial infection is quite commonest type of infection which affects 10% of hospitalized patients which results in frustrating, burdening economical and financial issues due to increased hospitalization timing, prolonging their duration of stay, increasing the bed occupancy rates and would lead to additional diagnostic and therapeutic interventions, thereby escalating the chances of morbidity and mortality to the patient population and imposing heavy burden on health care resources.¹ There is a high chance of respiratory tract infection and ventilator associated pneumonia in patients who are intubated or tracheotomised. The main reason being increased leakage of secretions around the tracheostomy or endotracheal tube cuff, reducing the clearance of bacteria by disabling the ciliary beat. As the flow of saliva is reduced, the oropharynx would eventually become colonized with gram negative bacteria.

There is a 20 fold increase in the development of respiratory tract infection following mechanical ventilation in tracheotomised or mechanically ventilated patients,² the incidence vary between 4% and 28%. The commonest microorganism colonising the tracheostomy tube leading to respiratory infections include *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, methicillin resistant *Staphylococcus aureus*,³ some of these organisms are antibiotic resistant which in turn increase the morbidity and costs involved.

The main objective of our study is to find out the type of bacteria colonising the tracheostomy tube and to determine the antibiotic sensitivity pattern and resistance in patients who have had tracheostomy in intensive care unit (ICU) set up and to initiate proper empirical treatment in such patients.

Materials and methods

The study was a retrospective review of patients who underwent tracheostomy at Ministry of Health, Sur Hospital,

Oman between January 2005 and December 2015. The Hospital has 4 bedded pediatric intensive care unit (PICU) and 10 bedded adult ICU which is headed by consultant anaesthetists, consultant physicians, ICU trained nurses and respiratory therapists. All patients who required mechanical ventilation and were therefore subject to an orotracheal intubation and those who underwent a conventional tracheostomy were considered for inclusion. Patients who had been intubated in other hospitals or ICUs, those that had an intubation method other than orotracheal (i.e. nasopharyngeal, larynx mask) and patients that already had a tracheostomy, those with an incomplete or missed records, patients with previous pneumonia, other airways infection issues were excluded from this study. Data's were collected from computer based hospital management system, operation theatre and registers in Medical records department and entered in a preformed questionnaire before thorough

Table 1 Incidence of organisms isolated.

Organism	Frequency	Percentage
<i>Pseudomonas aeruginosa</i>	39	37.0
<i>Proteus</i>	3	39.8
<i>Stenotrophomonas maltophilia</i>	1	40.7
<i>Providencia</i>	1	41.7
<i>Extended spectrum Beta lactamase producing E coli</i>	1	42.6
<i>Carbapenam resistant Klebsiella</i>	1	43.5
<i>Streptococcus</i>	2	45.4
<i>Klebsiella</i>	10	54.6
<i>Enterobacter coliform</i>	2	56.5
<i>Acinetobacter</i>	1	57.4
<i>Acinetobacter</i>	28	83.3
<i>Escherichia coli</i>	2	85.2
<i>Staphylococcus aureus</i>	3	88.0
<i>coagulase Negative staphylococcus</i>	6	93.5
Negative swab	7	100.0
Total	108	100

Table 2 Prevalence of bacterial resistance to antibiotics.

Bacteria	Ciprofloxacin	Ceftazidime	Imipenem	Cefepime	Pipracillin-tazobactam	Ampi-sulbactam	Penicillin
<i>Acinetobacter</i>	89%	97%	8%	100%	9%	37%	100%
<i>S. Aureus</i>	38%	83%	22%	—	—	—	93%
<i>Proteus mirabilis</i>	54%	57%	8%	89%	7%	59%	—
<i>Klebsiella</i>	37%	89%	2.3%	65%	17%	59%	—
<i>E. coli</i>	—	—	—	79%	—	—	—
<i>S. epidermidis</i>	—	—	—	—	—	—	85%

Table 3 Comparison with other author studies.

Author	Most common isolated organism	Sensitive towards	Resistant to
Nazal et al ⁵	Gram Negative	Ciprofloxacin (Most)	Amikacin 7%, cafamandole 57%, cefotaxime 50%, tobramycin 30%
Khosravi et al ⁶	<i>Enterobacter</i> (41%), 15% <i>Pseudomonas</i> , 11% <i>E.Coli</i> , 14% <i>Coagulase negative staphylococci</i> , 13% <i>Staphylococcus aureus</i> and 0.79% <i>Proteus</i>	—	<i>Pseudomonas</i> resistant to cefixime 71%, <i>Coagulase negative staphylococci</i> resistant to oxacillin 84%
McShane et al ⁷	<i>Coagulase negative staphylococci</i>	—	—
Amini et al ⁸	<i>S. aureus</i> (23.6%), <i>Klebsiella</i> spp. (23.3%), <i>Acinetobacter</i> spp. (20.7%), <i>P. aeruginosa</i> (18.2%), <i>E. coli</i> (7.7%), and <i>Enterobacter</i> spp	—	—

analysis. The specimens for swab was obtained from the cut tracheostomy tube tips (obtained by cutting the tip with sterile knife) while patient had tube change and the samples were sent to microbiology laboratory for isolation of the organism and obtain an antibiogram to know the susceptibility and resistance to antibiotics. Antibiotic susceptibility was evaluated by disc diffusion method on Mueller Hinton agar according to clinical and laboratory standards institute (CLSI) guidelines. The samples were obtained from patients admitted to the intensive care unit of our hospital and patient relatives filled an informed consent to enrol them for the study, approved by the ethical committee involved in research. Data were analyzed by Statistical Package for Social Sciences (SPSS, version 16, Chicago, Inc) and the values are reported as number (%).

Results

During the ten year retrospective study, there were 108 patients included in our study with 56 males and 51 females. Fourteen different microorganisms were isolated during our study which included *Pseudomonas aeruginosa* ($n = 39$), *Acinetobacter baumannii* ($n = 28$), *Klebsiella* ($n = 10$) and coagulase negative staphylococcus ($n = 6$) and many other organisms as included in the Table 1. The most commonest organisms in both genders was *Pseudomonas aeruginosa* closely followed by *Acinetobacter baumannii*. In children under age of 12, it was *Pseudomonas aeruginosa* and in adults the impending organism was *Acinetobacter baumannii* (Table 1).

In terms of antibiograms, 89% of *Acinetobacter*, 38% of *Staphylococcus aureus*, 37% of *Klebsiella* and 54% of *Proteus mirabilis* were resistant to ciprofloxacin. These organisms

were resistant to ceftazidime in 97%, 83%, 89% and 57% of the cases, respectively and resistant to imipenem in 7.4%, 18.2%, 1.8% and 8.1% of the cases, respectively. In addition, 100% of *Acinetobacter*, 79% of *Escherichia coli*, 65% of *Klebsiella* and 89% of *Proteus mirabilis* were resistant to cefepime. On the other hand, 93% of *Staphylococcus aureus*, 100% of *Acinetobacter* and 85% of *Staphylococcus epidermidis* were resistant to penicillin (Table 2).

Discussion

Of all hospitalized patients requiring mechanical ventilation, approximately 10% will receive a tracheostomy. Infections are among the most important and the leading cause of mortality and morbidity in ICU.⁴ The findings of this study would be helpful in selection of appropriate antibiotics. In this study, all the positive colonies obtained from the tracheostomy cases were considered. In our study, Gram negative bacteria were the most common isolated organisms including *Acinetobacter* and *Pseudomonas aeruginosa* (Table 3).

In summary, this study presents the most common microorganisms colonized from tracheostomy of hospitalized patients and their pattern of antibiotic resistance. As our study showed, *Pseudomonas* is the most common microorganism isolated from tracheostomy tube. Ciprofloxacin was also the most prevalent antibiotic revealing resistant pattern. Moreover, most of the microorganisms were sensitive to imipenem and pipracillin-tazobactam.

Declaration of Competing Interest

The authors declare no conflict of interest in publishing the article.

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