ORIGINAL ARTICLE

Antibiotic Sensitivity and Spectrum of Bacterial Isolates in Otorhinolaryngological Infection: A Retrospective Study

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SUMMARY

Objectives: To identify the common bacteria of otorhinolaryngological (ORL) infection in three general hospitals in the state of Sarawak, East Malaysia and to determine the antibiotic sensitivity of the common bacteria to update local antibiotic policy.

Methods: All specimens with positive monoclonal culture, received from inpatient and outpatient Otorhinolaryngology Department in the year 2009 and 2010 were included in the study. Patients' demographics, nature of specimens, bacterial isolates and antibiotic sensitivity were analysed by using the Statistical Package for the Social Sciences (SPSS).

Results: A total 244 positive monoclonal cultures were identified. *Staphylococcus* species and Gram negative bacilli were the commonest bacteria of ORL infections. Common ORL bacteria remain sensitive to our front line antibiotics. There are a number of multi-drug resistant isolates of MRSA, ESBL *Klebsiella pneumoniae* and *Acinetobacter baumanii* in the hospital-acquired infections.

Conclusion: Although resistance to antimicrobial agents is growing worldwide, first line antibiotics still show significant therapeutic advantage in our local setting. The low resistance of bacterial isolates in our community reflects judicious use of antibiotics in our routine clinical practices.

KEY WORDS:
Otorhinolaryngological infection, bacterial isolate, antibiotic sensitivity

INTRODUCTION

The introduction of newer generation antibiotics in the last few decades has changed the microbiology of otorhinolaryngological (ORL) infection. The injudicious use of broad spectrum antibiotics had exacerbated the development of resistance to many first line antibiotics[1]. Different antibiotic policies in various regions has resulted in different degree of antibiotic resistance. The objective of the study is to determine the spectrum of common ORL bacteria and the antibiotic sensitivity in our local community, aiming to keep our antibiotic policy up to date.

MATERIALS AND METHODS

This retrospective study was carried out in three general hospitals of the state of Sarawak, East Malaysia, namely Sarawak General Hospital, Sibu Hospital and Miri Hospital. Data was collected from the microbiology laboratories which adopted the standard laboratory protocols. All specimens with positive monoclonal culture, received from inpatient and outpatient ORL department in the year 2009 and 2010 were included. Specimens which were sterile or reported as mixed growth after forty eight hour incubation were excluded from the study. The specimens consist of swab, aspirate and tissue sample which were obtained from various sites of ORL infection. Clinical data of Methicillin Resistant *Staphylococcus aureus* (MRSA), Extended Spectrum Beta Lactamase (ESBL) *Klebsiella pneumoniae* and multi-drug resistant *Acinetobacter baumanii* cases were retrieved from medical record offices for further analysis. Patients' demographics, nature of specimens, bacterial isolates and antibiotic sensitivity were analysed by using SPSS.

RESULTS

Total 556 specimens from ORL department were received by the laboratories of three general hospitals in Sarawak from January 2009 till December 2010. Only 244 (43.9%) specimens showed positive monoclonal cultures. The mean age (±SD) was 40.1 (±20.3) years. Age ranged 2-85 years. There were 146 (59.8%) male and 98 (40.2%) female patients. Male to female ratio was 1.49:1.0.

Source of Infection and Spectrum of Bacterial Isolates:

The sources of infection were categorized conveniently according to disease location. The frequency of commonly isolated bacteria was interpreted in percentage of total cultures. The results are summarized in Table I.

Antimicrobial Sensitivity:

The sensitivity of bacterial isolates to antibiotics is summarized in Table II and Table III. There were seven cases of ESBL Klebsiella pneumoniae, one case of MRSA and nine cases of multi-drug resistant *Acinetobacter baumanii* isolated in all cultures (Table IV).

DISCUSSION

In a tropical third world country, we encounter a broad range of ORL infections with diverse presentations in our practice. Not uncommonly, the patients are often referred to us after extended periods of antibiotic therapy. Surveillance on ORL bacteriology and antibiotic sensitivity in local setting invariably become necessary to ensure accurate and targeted antimicrobial therapy.

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Table I: Source of Infection and Spectrum of Bacterial Isolates:

Source of Infection	Number of Culture (Total Cultures, n=244)	Common Bacterial Isolates	Percentage %
Deep Neck Infection	109	Klebsiella pneumonia	24.8%
		Staphylococcus. aureus	18.3%
		Staphylococcus epidermidis	9.2%
Oropharynx and Nasal Cavity infection	57	Group A β Haemolytic Streptococcus	37.8%
		Staphylococcus aureus	26.7%
		Klebsiella pneumoniae	11.1%
Otologic infection	42	Pseudomonas aeruginosa	45.2%
		Staphylococcus aureus	23.8%
		Proteus mirabilis	9.5%
Lower Respiratory Tract Infection	21	Klebsiella pneumoniae	33.3%
		Staphylococcus aureus	28.6%
		Pseudomonas aeruginosa	9.5%
Head and Neck Surgical Wound Infection	15	Acinetobactor baumanii	25%
		Klebsiella pneumoniae	21.4%
		Pseudomonas aeruginosa	14.2%

Table II: Percentage of Antibiotics Sensitivity of Common Gram Positive Bacteria

	Penicillin	Oxacillin	Erythromycin	Gentamicin	Fusidic acid	Vancomycin	Rifampicin	Cephalexin
Staphylococcus aureus (n=53)	63.2%	92.5%	94.0%	96.2%	94.3%	100%	100%	-
Staphylococcus epidermidis (n=14)	33.3%	85.7%	71.4%	92.9%	92.9%	100%	100%	-
β -haemolytic Streptococcus (n=31)	100%	-	77.8%	88.9%	-	-	-	100%

Table III: Percentage of Antibiotics Sensitivity of Common Gram Negative Bacteria

	Amikacin	Gentamicin	Cefuroxime	Ceftriaxone	Cefoperazone	Ceftazidime	Cefepime	Ciprofloxacin	Imipenem	Meropenem	Piperacillin	Piperacillin + Tazobactam	Amoxycillin + Clavulanate
Klebsiella pneumoniae (n=41)	100%	83.9%	83.9%	85.7%	85.7%	83.9%	-	89.3%	100%	98.2%	-	-	87.5%
Pseudomonas aeruginosa (n=34)	97.1%	97.1%	-	-	85.3%	91.2%	94.1%	94.1%	97.1%	94.1%	88.2%	97.1%	-
Proteus mirabilis (n=20)	100%	95.0%	100%	100%	100%	100%	-	95.0%	100%	100%	-	-	100%
Acinetobacter baumanii (n=9)	88.9%	77.8%	0%	0%	0%	55.6%	-	66.7%	77.8%	77.8%	-	-	-

Table IV: Characteristics of the seventeen cases of multi-drug resistant isolates

Multi-Drug Resistant Isolates	ESBL Klebsiella pneumoniae : 7 cases
	Methicillin Resistant Staphylococcus aureus : 1 case
	Acinetobacter baumanii : 9 cases
Mean age (±SD)	59 (±7.3) years.
	Associated pre-morbidities Diabetes mellitus : 76.5%
	Cardiovascular disease (e.g. hypertension and ischaemic heart disease) : 58.8%
	Chronic renal impairment : 47.1%
Sources of specimen	Sputum : 9
	Tracheal secretion : 4
	Surgical wound swab : 4
Duration of hospitalization	Mean : 21 days Range : 16-43 days

Common deep neck infections are parapharyngeal abscess, retropharyngeal abscess, Ludwig's angina and submandibular abscess. *Klebsiella pneumoniae* (24.8%) was the commonest bacteria, followed by *Staphylococcus aureus* (18.3%) and *Staphylococcus epidermidis* (9.2%). C. Srivanitchapoom *et al* reported Streptococcus viridians as the commonest bacteria, accounting for 46.9% in northern Thailand, followed by *Klebsiella spp*. (9.0%) and *Staphylococcus spp.* (7.0%) [2]. Similar patterns of isolates were reported in Taiwan and United State of America [3,4]. Overall, the deep neck infection isolates in our study are comparable with other studies. The low percentage of *Streptococcus viridians* in our study is because of few odontogenic neck infection specimens collected.

Tonsillitis, peritonsillar abscess, pharyngitis and sinusitis are the common oropharyngeal and sinonasal infections. Group A β-haemolytic *Streptococcus* (37.8%) is the commonest organism isolated, followed by *Staphylococcus aureus* (26.7%) and *Klebsiella pneumoniae* (11.1%). Similar pattern of bacterial isolates were reported in studies in other continents[5,6,7]. Anaerobic pathogens play an important role in oropharyngeal infection as well. However, they were excluded from our analysis due to incomplete data.

The majority of our otologic isolates were derived from ear swab cultures of otitis media. *Pseudomonas aeruginosa* (45.2%) was the commonest organisms involved in ear infection, followed by *Staphylococcus aureus* (23.8%) and *Proteus mirabilis* (9.5%). Maji PK *et al* reported similar findings in India, *Pseudomonas aeruginosa* (64.4%), *Staphylococcus aureus* (33.8%)[8]. A recent study in Nigeria had shown a constant trend of Gram negative rods isolates e.g. *Pseudomonas* (57.4%), *Klebsiella* (16.4%), and Proteus species (11.5%) [9].

The specimens of lower respiratory tract infection were obtained mainly from sputum and tracheal secretion. *Klebsiella pneumonia* (33.3%), *Staphylococcus aureus* (28.6%) and *Pseudomonas aeruginosa* (9.5%) were the common bacteria isolated. The pattern of bacterial isolates was consistent with hospital-acquired infection [10]. Patients with risk factors such as prolonged hospital stay, pre-existing morbidities, old age and malnutrition are invariably predisposed to nosocomial pneumonia.

Surgical wound infection in the head and neck region is uncommon due to abundant blood supply which promotes rapid wound healing. Common risk factors for wound infection are poor health status of patients, diabetes mellitus and exposure to irradiation prior to surgery. The surgical wound infections are mainly hospital-acquired in patients with prolonged hospital stay. *Acinetobacter baumanii, Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were commonly isolated. A prospective study by Umesh K *et al* on general surgical sites infection had shown similar isolates patterns[11]. On a large scale, a five year study of surgical site infections in all surgical disciplines in the United State, Methicillin Sensitive *Staphylococcus aureus* (MSSA) accounted 26.8% of total 8302 isolates, whereas MRSA accounted 19.1% of all isolates. There are only 8.0% of Gram negative organisms isolated among all positive cultures[12].

Group A β-haemolytic *Streptococci* are still sensitive to penicillin and cephalexin. Oral phenoxymethylpenicillin (Penicillin V) as the first line antibiotic for the treatment of acute tonsillitis and peritonsillar abscess is still useful in our daily practice. *Staphylococcus aureus* is sensitive to oxacillin and macrolides, accounted 92.5% and 94% respectively. There is only one case of MRSA isolate reported in two years. ESBL *Klebsiella pneumoniae* and multi-drug resistant *Acinetobacter baumanii* were exclusively isolated in patients with prolonged hospital stay. Majority of these cases had pre-existing morbidities that had increased their risk to nosocomial infection. The acquisition of resistance to multiple antimicrobials is common due to genetic evolution in response to prolonged exposure to antibiotics. In overall, most of the common bacteria of community-acquired ORL infection are still sensitive to basic front line antibiotics.

There are several limitations in the study. The sample of cases is limited to three general hospitals which were located in the cities of Sarawak. The majority of the cases were city-dwellers. They might not represent the vast population of Sarawak widely distributed around the state. Secondly, there is lack of complete clinical data such as patients' premorbidity and history of previous antibiotics exposure before specimens taking. Furthermore, the anaerobic cultures and tuberculosis cultures were not discussed because of incomplete data retrieved from laboratories. Lastly, the inherent weaknesses of a retrospective study can create bias to our analysis and result validation.

CONCLUSION

Although resistance to antimicrobial agents is developing worldwide, first line antibiotics still show significant therapeutic advantage in our local settings. Penicillin V and cephalexin remain reasonable choices for tonsillitis, peritonsillar abscess and sinusitis. Gentamicin and ciprofloxacin are still valuable in the treatment of otitis media. Amoxicillin with clavulanate and second and third generation cephalosporins such as cefuroxime, ceftriaxone, cefoperazone, ceftazidime are still the primary options in deep neck infections. Culture for uncommon pathogens is indicated for cases that fails first-line treatment. In the face of nosocomial infections, aggressive treatment with carbapenems and amikacin or in combinations deems necessary to eradicate the multi-drug resistant Gram negative rods. The low resistance of bacterial isolates in our community reflects judicious use of antibiotics in our general practices.

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REFERENCES

1. Thomas MA. Current concepts in antibiotic resistance. Curr Opin Otolaryngol Head Neck Surg. 2003; 11: 409-15.
2. Srivanitchapoom C, Sittitrai P, Pattarasakulchai T, Tananuvat R. Deep neck infection in Northern Thailand. Eur Arch Otorhinolaryngol. 2012; 269: 241-6.
3. Huang TT, Tseng FY, Yeh TH. Factors affecting the bacteriology of deep neck infection: a retrospective study of 128 patients. Acta Otolaryngol. 2006; 126: 396-401.
4. Parhiscar A, Har-El G. Deep neck abscess: a retrospective review of 210 cases. Ann Otol Rhinol Laryngol. 2001; 110: 1051-4.
5. Kieff DA, Bhattacharya N, Siegel NS, Salman SI. Selection of antibiotics after incision and drainage of peritonsillar abscesses. Otolaryngol Head Neck Surg. 1999; 120: 57-61.
6. A. Verghese, VN Chaturvedi, AKK Singh, RM Raizada, M P Puttewar. Ind J Otolaryngol Head Neck Surg. 2001; 53: 112-5.
7. Brendan CH, Ronan MM, Geraldine G, Sara H. The epidemiology of peritonsillar abscess disease in Northern Ireland. J Infect. 2006; 52: 247-53.
8. PK Maji, TK Chatterjee, S Chatterjee, J Chakrabarty, BB Mukhopadhyay. The investigation of bacteriology of chronic suppurative otitis media in patients attending a tertiary care hospital with special emphasis on seasonal variation. Ind J Otolaryngol Head Neck Surg. 2007; 59: 128-31.
9. Nnebe U, Okike O, Orji I, Ibekwe RC. Childhood suppurative otitis media in Abakaliki: isolated microbes and in vitro antibiotic sensitivity pattern. Niger J Clin Pract. 2011; 14: 159-62.
10. Eliane MC, Paulo CBM, Anna SL, Maria RMI, Wilson LP. Comparative study of etiological diagnosis of nosocomial pneumonia. Braz J Infect Dis. 2008; 12: 67-74.
11. Umesh SK, AMA Fereirra, MS Kulkarni, DD Motghare. A prospective study of surgical site infections in a teaching hospital in Goa. Ind J Surg. 2008; 70: 120-4.
12. John AW, Benjamin AL, Ying PT, Karen GD, Myoung K, Vikas G. Surgical site infections: Causative pathogens and associated outcomes. Am J Infect Control. 2010; 38: 112-20.