ORIGINAL ARTICLE

Bacteriology of Bronchial Aspirates in Patients with Endotracheal Intubation and Mechanical Ventilation

by

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Abstract

On 30 patients with endotracheal tubes and mechanical ventilation, bacteriological culture has been done using a simple, safe and quite reliable technique. During this study we found that gram negative bacteria especially pseudomonas aeruginosa were the most frequent bacteria isolated. Other bacteria found were staphylococcus, pseudomonas species and Klebsiella pneumoniae.

Based on sensitivity tests, the aminoglycoside especially amikacin is the recommended antibiotic against gram negative bacteria.

As for gram positive bacteria, sulbenicillin, cloxacillin and cotrimoxazol are the potent antibiotics.

The data presented in this study clearly support the usefulness and reliability of the technique.

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Introduction

In recent years, the use of endotracheal intubation and mechanical ventilation in the Pediatric I.C.U., Cipto Mangunkusumo Hospital, Jakarta, has increased and has brought about complications.

Cox (1973) mentioned that one of the complications most often found is tracheobronchial and pulmonary infection. Contamination of humidifiers, nebulizers and suction apparatus are some factors which cause these complications.

In the Pediatric ICU Cipto Mangunkusumo Hospital Jakarta, the incidence of complications are found more often due to the many referred bronchopneumonia cases. Even when signs and symptoms are characteristic of pneumonia, a specific etiological diagnosis is complicated by upper airway colonization.

Percutaneous transtracheal aspiration (Percora, 1969), the most widely used technique for bypassing the upper airway flora, cannot be used in these patients.

Transthoracic needle aspiration is probably contraindicated in patients who require positive pressure ventilation. Bronchoscopy and bronchial brushings are useful (Sackner, 1975), but may not be readily available. Lately, a simpler, faster and safer method, which does not require any special training was introduced by Matthew et al. (1977).

Through this paper we intend to share our experience in determining the micro-organism details found in the lower respiratory tract of patients on mechanical ventilation and its resistance to antibiotics.

Materials and methods

A series of 30 intubated infants and children at the Pediatric ICU Cipto Mangunkusumo Hospital Jakarta was studied. All patients had clinical and X-ray evidence of bronchopneumonia.

The procedure of the method is as follows :

The patient is preoxygenated for 10 minutes on 100% oxygen.

The usual vein catheter used for central vein catheterization, 16 f, is prepared by aseptically removing the needle. The patient is disconnected from the ventilator and the catheter with stylet in place is introduced into the endotracheal tube as far as possible.

When further advance is impossible, the stylet is withdrawn, a dry 10 cc syringe is attached to the catheter and aspiration performed until a sense of negative pressure develops. It indicates a closed system in which the catheter is wedged in a very small airway.

If negative pressure cannot be obtained, the catheter should be manipulated by withdrawing it 1 - 2 cm, then readvancing as far as possible and aspirating again. Once the wedge position is achieved, the syringe is detached, the catheter, which then contains specimen is quickly withdrawn, and the patient reconnected to the mechanical ventilator

at the usual setting. The outer surface of the catheter is wiped with an alcohol sponge. The end of the catheter is then cut off, and is planted aerobically on the sheep's blood agar and thioglycolate broth. Anaerobic cultures are planted on sheep's blood agar.

A sensitivity test is done on the bacteria identified, towards several antibiotic disc methods of Kirby Baure.

Results

The procedure was applied to 30 patients, who were chosen at random since May, 1981 until April, 1982.

Those patients consisted of 7 neonates, 9 infants and 14 children. No complications were detected.

In most of the patients, the presence of the catheter within the tracheobronchial tree was well tolerated. No hemoptysis was observed.

Patients with cardiac monitoring devices in place showed no arrhythmias during or immediately after the application of the procedure.

In the investigation, 17 patients had a single pathogen recovered from their bronchial secretions, 12 patients had 2 kinds of bacteria, while fungi was isolated in one patient. Table 1 shows the types of organisms found from the bronchial secretion of the 30 patients diagnosed as pneumonia clinically and radiologically.

The pseudomonas species especially pseudomonas aeruginosa were the most frequent bacteria found in this study (23 = 53%), followed by Staphylococcus aureus (9 = 21%) and Klebsiella pneumoniae (6 = 14%).

Other organisms found in our series were group A Beta hemolytic streptococcus, Coliform bacteria, Escherichia coli and fungi.

Table 2 shows that Pseudomonas aeruginosa is most sensitive to amikacin, sulbenicillin, dibekacin and sisomicin. The other pseudomonas species are most sensitive to amikacin, dibekacin, sisomicin, gentamycin and sulbenicillin.

Staphylococcus aureus is most sensitive to sulbenicillin, cotrimoxazol, cloxacillin and amikacin. While klebsiella pneumoniae is most sensitive to amikacin, dibekacin, cefalexin and sisomicin.

As it is known, one of the main difficulties for patients with endotracheal tubes and mechanical ventilation is pneumonia which is mostly caused by gram negative bacteria. In the pediatric ICU of Dr. Cipto Mangunkusumo Hospital, Jakarta, the incidence of bronchopneumonia was 31,5% (Hasan and Kasim, 1981).

This high incidence, however, was not only caused by the complications risen by using mechanical ventilation but also due to the large number of bronchopneumonia patients referred to the pediatric ICU.

Harris et al. (1976) and Storm (1980) have also reported how easily pulmonary infections are obtained even by trans-

ient bacteriemia in patients with endotracheal intubation followed by bronchial suctioning.

The longer a patient is intubated and treated with mechanical ventilation, the bigger the possibility he will get pulmonary infection.

According to Bryant et al. (1972), bacteria colonization on the tracheobronchi can exist on most of the patients who receive endotracheal intubation in 48 hours. As we know the isolation of a potential pathogen from bronchial secretions is an indication for specified treatment directed against the pathogen. It is very simple to determine the bacteria, by gathering the bronchial secretions as reported by Matthew et al. (1977) because it does not need any special equipment and training.

It is also safe because it does not hurt the patient, and the results are reliable enough because it was designed to bypass the upper airway colonization. Matthew et al. (1977) in their hypothesis were of the opinion that the stylet in place, ending near the catheter tip, might retard the entry of contaminating upper airway secretions. Similarly, due to its small size, as compared with a bronchoscope or an ordinary suction catheter, a 16 F veincatheter would not carry a significant amount of upper airway flora into the bronchi. As a final precaution, the outside of the catheter was wiped with a 70% alcohol sponge. No effort was made to direct the catheter into a particular bronchus, since in most bacterial pneumonias, the organisms and polymorphonuclear leucocytes are probably dispersed throughout the bronchial tree. In our experience, the technique of gathering bronchial secretions is far more advantageous than the diagnostic lung puncture with the possibility of pneumothorax and hemoptysis as reported by Klein (1969).

The bacteria found most frequently in our series was Pseudomonas aeruginosa which was also reported by Phillips (1967) and Bryant et al. (1972).

Gram negative bacteria such as Pseudomonas, Klebsiella, which are commensal in the upper respiratory tract, is often the cause of infections, including bronchopneumonia in the ICU (Stoddart, 1974). And according to Sanford (1974), inhalation therapy equipment is a potential vector of gram negative bacteria.

However, the role of gram positive bacteria such as Staphylococcus and Pneumococcus as the important microorganisms can not be ignored.

Halm and Beaty (1970) also reported a high incidence of gram negative bacteria and Staphylococcal infections in their series.

From sensitivity test against antibiotics, it is clearly seen that aminoglycoside such as amikacin, sisomicin, dibekacin and gentamycin are the most recommended antibiotics against gram negative bacteria.

While sulbenicillin, cotrimoxazol, cloxacillin and midekamicin are potent against gram positive bacteria. From the aminoglycosides, amikacin is the most potent one against gram negative bacteria. It has also been stated by Tally et al. (1976) that amikacin is efficacious in the treatment of serious gram negative infections, including those involving gentamycin resistent strains.

The results of the use of sulbenicillin and dibekacin are quite beneficial, as far as sisomicin, a new aminoglycoside whose chemical structure is closely related to gentamycin, the results are quite effective too.

According to del Rosal et al. (1980), sisomicin is significantly more active than gentamycin, both in vitro and in vivo and it has been proved to be effective for the treatment of severe infections in mankind, including some infections caused by gentamycin resistent bacteria.

TABLE 1: *Organisms isolated from bronchial secretion*

Organisms	No of patients
1. Pseudomonas	15
2. Staphylococcus aureus	9
3. Pseudomonas species	8
4. Klebsiella pneumonia	6
5. Group A Beta hemolytic streptococcus	2
6. Escherichia coli	1
7. Coliform bacteria	1
8. Fungi	1

TABLE 2: *The sensitivity of organisms to various antibiotics*

Antibiotic	Pseudomonas aeruginosa	Staphylococcus aureus	Pseudomonas species	Klebsiella pneumonia	Streptococcus	Coliform bacteria	E. Coli
1. Gentamicin	6	3	4	2	2	1	1
2. Ampicillin	1	—	1	—	—	—	—
3. Tetracyclin	2	1	1	1	1	—	—
4. Chloramphenicol	—	1	—	—	1	—	—
5. Erythromicin	1	3	1	—	1	—	—
6. Streptomycin	1	2	—	1	1	—	—
7. Cotrimoxazol	1	8	—	2	1	1	1
8. Cloxacillin	—	7	—	—	2	—	—
9. Dibekacin	9	4	5	4	2	1	—
10. Kanamycin	3	1	—	2	2	1	1
11. Midekamicin	1	7	—	1	2	—	—
12. Sulbenicillin	10	9	4	—	2	—	—
13. Penicillin	—	—	—	—	1	—	—
14. Sisomicin	8	4	5	3	2	1	—
15. Thiamphenicol	—	1	—	—	1	—	—
16. Nalidixic acid	—	—	1	1	—	—	—
18. Cefalexin	—	—	—	1	—	—	—
17. Nitrofurantoin	3	3	3	3	1	1	1
19. Amikacin	12	5	7	4	2	1	1

No tests were done on fungi.

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