Bacteriology of Granulation Tissue in Laryngotracheal Stenosis Patients

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Background: *The formation of granulation tissue is an important factor promoting recurrence after surgical treatment of laryngotracheal stenosis. Bacterial infection was claimed to be the cause.*
Objective: *The present study aimed to identify the bacteriology of granulation tissue in laryngotracheal stenosis patients.*
Material and Method: *Data was collected prospectively. Granulation tissue found in the site of laryngotracheal stenosis was removed and sent to the microbiologic study to identify the organisms.*
Results: *Twenty-four specimens from 17 patients were included in the present study. Coagulase-positive Staphylococcus (45.8%) was the most common gram-positive organism and Pseudomonas aeruginosa as well as Enterobacter species (16.7%) were the most common gram-negative bacteria. Ciprofloxacin may be the oral antibiotic that should be recommended.*
Conclusion: *Coagulase-positive Staphylococcus, Pseudomonas aeruginosa as well as Enterobacter species were the common organisms identified from the granulation tissue in recurrent laryngotracheal stenosis. Oral antibiotics, such as ciprofloxacin, may have benefit in reducing the formation of this granulation tissue.*

Keywords: *Laryngotracheal stenosis, Granulation tissue, Bacteriology*

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Laryngotracheal stenosis is a serious sequelae of endotracheal intubation and tracheotomy. There is a high possibility of treatment failure after surgical treatment by endoscopic technique or external approach. The formation of granulation tissue is an important factor for recurrence. Although bacterial infection was accepted to be the cause of granulation tissue formation[1,2], bacteriologic studies are still limited.

Objective

The main purpose of the present study was to identify the bacteriology of granulation tissue in laryngotracheal stenosis patients. Results from the present study may provide a guideline in selecting appropriate antibiotics in order to prevent granulation tissue formation.

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Material and Method

Data was collected prospectively from patients who were diagnosed with laryngotracheal stenosis and received treatment either endoscopically or open laryngotracheal surgery at the Department of Otolaryngology, Srinagarind Hospital, Khon Kaen University, Thailand, from 1st January to 31st December 2000. The present study included only patients who had granulation tissue at the stenotic site and did not receive any antibiotics for at least one month prior to the present study. Granulation tissue was removed during endoscopic or external approach surgery and sent to the microbiologic laboratory immediately. Each specimen of tissue was washed with one ml of 70% alcohol and followed by one ml of sterile distilled water. Three hundred microliters of Brain Heart Infusion (BHI) was added to the tissue and was thoroughly ground. The suspension was then spread onto the blood agar and nutrient agar plate. Conventional biochemical tests

were used to count and identify the bacteria. Isolated bacteria were tested for drug sensitivity by disc diffusion method.

Results

Seventeen patients were included in the present study. There were 11 male and 6 female patients. The ages ranged from 9 to 48 years. Nine cases had endotracheal intubation between 1-2 weeks, three cases had endotracheal intubation between 2-4 weeks and one case was endotracheal intubated about 8 weeks. There was no available data of intubation period in two cases. The causes of intubation in these patients were head injury from a motorcycle accident in five cases, encephalitis in two cases, and abdominal operation in two cases. There was one case each of near-drowning, juvenile spinal muscular atrophy, organophosphate ingestion, diabetes mellitus with cardiac arrhythmia, TOF with total correction, and malaria.Two cases had upper airway obstruction and were tracheotomied without previous endotracheal intubation. One case had bilateral true vocal cord paralysis after total thyroidectomy for papillary thyroid carcinoma, and in another case the diagnosis was suspicion of mycobacterium tracheitis. Twenty-four specimens were taken for bacteriologic culture. The results showed that eight specimens had single bacterial organism, 14 specimens had polymicrobial cultures while two specimens yielded no growth (Table 1).

The most common gram-positive organism was coagulase-positive Staphylococcus followed by coagulase-negative Staphylococcus. Pseudomonas aeruginosa as well as Enterobacter species were the most common gram-negative bacteria.

Table 1. Types of bacterial cultured from laryngotracheal granulation tissue

Organisms	Number of specimens
Staphylococcus coagulase +ve	11
Staphylococcus coagulase -ve	8
Diphtheroides	6
Streptococcus not group. A, B, D	4
Pseudomonas aeruginosa	4
Enterobacter spp.	4
Acinetobacter anitratus	2
Neisseria spp.	2
Streptococcus group A	1
Pseudomonas spp.	1
Acenetobacter lwoffii	1
Proteus mirabilis	1
Xanthomonas maltophilia	1
Providencia spp.	1
No growth	2

Coagulase-positive Staphylococcus was susceptible to cephalothin (90%), ciprofloxacin (90%), ofloxacin (90%), and trimethoprim-sulfamethoxazole (90%), but resisted against amoxicillin (90%). Coagulase-negative Staphylococcus was susceptible to amikacin (85%), cephalothin (85%), ciprofloxacin (85%), gentamicin (100%), ofloxacin (100%), and cotrimoxazole (100%). Pseudomonas aeruginosa was susceptible only to ciprofloxacin (50%), amikacin (75%), and gentamicin (75%) while Enterobacter species were susceptible to several antimicrobial agents such as ciprofloxacin (100%), ofloxacin (75%), and trimethoprim-sulfamethoxazole (75%).

Discussion

Endotracheal intubations and tracheotomies are important causes of internal trauma of the laryngotracheal lumen resulting in airway stenosis. If pressure of the endotracheal tube cuff that contacts with the mucosa exceeds the capillary pressure, it causes ischemic tracheal mucosal injury and is followed by mucosal necrosis[3,4]. Perichondritis may progress within 96 hours after intubation[2]. Infection antimicrobials can cover the causative organisms and help to decrease the damage to the infected tissue.

Granulation tissue formation after surgical treatment by endoscopic technique or external approach is common. It is accepted that it is the result of bacterial infection and antibacterial treatment will decrease this incidence[5]. There were few reports about its bacteriology. Staphylococcus aureus is the most common gram-positive organism found from microbiological culture and Pseudomonas aeruginosa is the most common gram-negative organism[6-8]. A combination of amoxicillin-clavulanate and ciprofloxacin for perioperative prophylactic antibiotics was recommended to cover the most common organisms both gram-positive and gram-negative[8]. In addition, the use of nonabsorbable suture may be associated with formation of granulation tissue due to foreign body reaction[6].

In the present study, the most common organism is coagulase-positive Staphylococcus (22%), which is sensitive to cehpalothin, ciprofloxacin, ofloxacin, and trimethoprim-sulfamethoxazole.The most common gram negative organisms are Pseudomonas aeruginosa and Enterobacter spp. The authors give antimicrobial to cover these organisms. They are sen-

sitive to several antimicrobial agents such as ciprofloxacin, ofloxacin, and trimethoprim-sulfamethoxazole. Therefore, ciprofloxacin, ofloxacin, and trimethoprim-sulfamethoxazole alone may be sufficient to cover these organisms and should be used as perioperative antimicrobial agents for the cases of laryngotracheal stenosis after surgical treatment to reduce granulation tissue formation. However, further prospective studies about benefits of prophylactic antibiotics and the most appropriate antibiotics are still needed.

Conclusion

The formation of granulation tissue is an important factor for recurrence after surgical treatment of laryngotracheal stenosis and bacterial infection was accepted to be the cause. Coagulase-positive Staphylococcus, for gram-positive organism, and Pseudomonas aeruginosa and Enterobacter species, for gram-negative, were the common organisms identified from the granulation tissue in recurrent laryngotracheal stenosis. Oral antibiotics, such as ciprofloxacin, may have a benefit in reducing the formation of these granulation tissues.

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เชื้อแบคทีเรียของเนื้อเยื่อแกรนูเลชั่นในผู้ป่วยกล่องเสียงและหลอดลมตีบ

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ที่มา: *เนื้อเยื่อแกรนูเลชั่นเป็นสาเหตุสำคัญของการกลับเป็นซ้ำหลังการผ่าตัดรักษาภาวะกล่องเสียงและหลอดลมตีบ และเชื่อว่าการติดเชื้อแบคทีเรียเป็นสาเหตุของการเกิดเนื้อเยื่อแกรนูเลชั่น*

วัตถุประสงค์: *การศึกษานี้มีวัตถุประสงค์เพื่อหาเชื้อที่อาจจะเป็นสาเหตุของการเกิดเนื้อเยื่อแกรนูเลชั่นในผู้ป่วยที่มีภาวะกล่องเสียงและหลอดลมตีบ*

วัสดุและวิธีการ: *การศึกษานี้เป็นการศึกษาแบบไปข้างหน้าโดยการตัดเนื้อเยื่อแกรนูเลชั่นที่พบในกล่องเสียงหรือหลอดลมที่มีการตีบและส่งไปเพาะหาเชื้อแบคทีเรีย*

ผลการศึกษา: *การศึกษานี้ได้เนื้อเยื่อเพื่อเพาะเชื้อ 24 ตัวอย่างจากจำนวนผู้ป่วย 17 คน เชื้อแกรมบวกที่พบมากที่สุด คือ Coagulase-positive Staphylococcus (ร้อยละ 45.8) ส่วนเชื้อแกรมลบที่พบมากที่สุดคือ Pseudomonas aeruginosa และ Enterobacter species (ร้อยละ 16.7) และพบว่ายา ciprofloxacin อาจจะเป็นยาต้านจุลชีพชนิดรับประทานมีประโยชน์ในการรักษาภาวะนี้*

สรุป: *Coagulase-positive Staphylococcus, Pseudomonas aeruginosa และ Enterobacter species เป็นเชื้อแบคทีเรียที่พบมากที่สุดจากการเพาะเชื้อเนื้อเยื่อแกรนูเลชั่นที่ได้จากกล่องเสียงและหลอดลมที่มีการตีบและเป็นซ้ำหลังการรักษาด้วยการผ่าตัด และการให้ยาต้านจุลชีพเช่นยา ciprofloxacin อาจจะมีประโยชน์ในการลดการเกิดเนื้อเยื่อแกรนูเลชั่นเหล่านี้*