

Rigid Tracheobronchoscopy–Induced Bacteremia in the Pediatric Population

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Objective: To assess the incidence of bacteremia following rigid tracheobronchoscopy in children to determine whether use of prophylactic antibiotics is warranted in pediatric patients at risk for perioperative endocarditis.

Design: Prospective nonrandomized clinical study.

Setting: Specialty care referral center.

Patients: Patients younger than 18 years undergoing diagnostic rigid tracheobronchoscopy for airway assessment. Twenty-five patients (14 boys and 11 girls) were enrolled. The mean age was 5.2 years (range, 10 months to 13 years).

Interventions: Blood samples for culture were obtained intraoperatively at 2 time intervals. The first culture was obtained after the induction of mask anesthesia prior to airway instrumentation; the second,

within 5 minutes following the completion of tracheobronchoscopy. Blood cultures were performed under sterile technique and were placed into 20 mL of brain heart infusion broth. All cultures were incubated at 35°C and observed for growth over a 14-day period.

Results: There were no documented cases of bacterial growth in blood cultures. All blood cultures, obtained before and after tracheobronchoscopy, were negative for bacterial growth after incubation for 14 days. Two culture bottles yielded contaminant organisms.

Conclusions: Rigid tracheobronchoscopy in the pediatric population is a low-risk procedure for the development of bacteremia. This may bear on present guidelines regarding perioperative antibiotic prophylaxis for endocarditis in the high-risk population.

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RIGID tracheobronchoscopy for pediatric airway assessment is a commonly performed otolaryngologic procedure. The American Heart Association (AHA) recommends a standard prophylactic antibiotic regimen for patients undergoing rigid tracheobronchoscopy who are at risk for developing endocarditis.¹ The rationale for this recommendation is based on the likelihood of this procedure's inducing bacteremia with organisms commonly associated with endocarditis. Endocarditis prophylaxis is not recommended by the AHA for patients undergoing flexible bronchoscopy whether or not biopsy is performed (**Table 1**).

In 1960, Burma² documented a 15% incidence of bacteremia in adults undergoing bronchoscopy. No prospective study evaluating the association between rigid tracheobronchoscopy and bacteremia has been subsequently performed. In fact, there is no literature concerning the incidence of bacteremia associated with rigid bron-

choscopy in the pediatric population. Flexible bronchoscopy has largely replaced rigid bronchoscopy in the adult population. Recent studies have found the risk of bacteremia associated with flexible bronchoscopy to be very low.³⁻⁶

The objective of this study was to assess the risk of bacteremia during pediatric airway endoscopy using rigid bronchoscopic instrumentation and modern preoperative sterilization techniques. Documentation of the presence of perioperative bacteremia can allow a more accurate evaluation of the necessity of antibiotic prophylaxis in children both at low risk and at high risk for bacterial endocarditis.

RESULTS

Twenty-five patients were sequentially entered into the study—14 boys and 11 girls. The mean age was 5.2 years (range, 10 months to 13 years). The most common indication for bronchoscopy was diagnostic airway evaluation (22 patients). Three patients underwent excision of tracheal or

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PATIENTS AND METHODS

Following approval by our institution's Human Studies Committee, informed parental consent was requested of all children aged 13 years and younger undergoing rigid tracheobronchoscopy with 2 categorical exceptions: (1) patients who were receiving antibiotics at the time of bronchoscopy or within the week prior to bronchoscopy and (2) patients with known congenital cardiac defects. The latter group was given prophylactic antibiotics based on current AHA guidelines (Table 2).

All patients entered in the study underwent diagnostic direct laryngoscopy and bronchoscopy under general anesthesia using standard pediatric bronchoscopic equipment. The first blood culture was obtained by sterile venipuncture technique after the induction of general anesthesia and immediately before airway manipulation; the second blood culture was obtained within 5 minutes of completion of tracheobronchial instrumentation. The skin was cleansed with povidine-iodine using 3 scrubs. Samples of 3 to 5 mL of blood were obtained and placed into 20 mL of brain heart infusion broth (BBL, Cockeysville, Md). All blood cultures were incubated at 35°C using the BBL Septi-Chek Slide system. The culture bottles were inverted daily, incubated, and observed for growth for 14 days. Identification of organisms was performed by the standard technique of our bacteriology laboratory.

Tracheobronchial secretions were aspirated during tracheobronchoscopy and cultured on a MacConkey-Brunell 5% horse blood chocolate agar. This was done to correlate potential blood-borne organisms with bacteria colonizing the patient's tracheobronchial airway.

All patients were observed postoperatively to document fever or any other potential complications related to the surgical procedure.

peristomal granulation tissue at the time of bronchoscopy. No patient underwent foreign body removal or had an active tracheobronchial infection. One patient experienced a mucosal abrasion of the proximal posterior trachea wall during endoscopy.

The tracheal secretions from 12 individuals grew various organisms, with *Streptococcus*, *Pseudomonas*, and *Klebsiella* species being most common.

| Organism | No. of Isolates |
|----------------------------------|-----------------|
| <i>Streptococcus pneumoniae</i> | 6 |
| <i>Pseudomonas aeruginosa</i> | 4 |
| <i>Klebsiella pneumoniae</i> | 4 |
| Group A streptococci | 3 |
| <i>Staphylococcus aureus</i> | 3 |
| α -Hemolytic streptococci | 3 |
| Diphtheroid bacilli | 1 |

No case of bacteremia was documented in the 25 patients who underwent rigid tracheobronchoscopy.

One blood culture obtained following rigid bronchoscopy yielded *Staphylococcus kloosii*, and 1 blood culture done prior to bronchoscopy yielded *Staphylococcus*

Table 1. American Heart Association Criteria for Endocarditis Prophylaxis for Commonly Performed Head and Neck Surgical Procedures*

| |
|---|
| Endocarditis prophylaxis recommended |
| Tonsillectomy and/or adenoidectomy |
| Surgical operations that involve the respiratory mucosa |
| Bronchoscopy with a rigid bronchoscope, with or without biopsy |
| Endocarditis prophylaxis not recommended |
| Endotracheal intubation |
| Myringotomy with or without tube placement |
| Bronchoscopy with a flexible bronchoscope, with or without biopsy |

*Data from Dajani et al.¹

Table 2. American Heart Association Antibiotic Administration Guidelines for Endocarditis Prophylaxis*

| Situation | Agent | Regimen |
|---|-----------------------------------|--|
| Standard general prophylaxis | Amoxicillin | Adults: 2.0 g Children: 50 mg/kg orally 1 h before procedure |
| Unable to take oral medication | Ampicillin | Adults: 2.0 g IV or IM Children: 50 mg/kg IM or IV within 30 min before procedure |
| Allergic to penicillin | Clindamycin | Adults: 600 mg Children: 20 mg/kg orally 1 h before procedure |
| | Cephalexin or cefadroxil | Adults: 2.0 g Children: 50 mg/kg orally 1 h before procedure |
| | Azithromycin or clarithromycin | Adults: 500 mg Children: 15 mg/kg orally 1 h before procedure |
| Allergic to penicillin and unable to take oral medication | Clindamycin | Adults: 600 mg Children: 20 mg/kg IV within 30 min before procedure |
| | Cefazolin | Adults: 1.0 g Children: 25 mg/kg IM or IV within 30 min before procedure |

*Reprinted with permission from Dajani et al.¹ IV indicates intravenously; IM, intramuscularly.

hominis. Both species are coagulase-negative nonhemolytic bacteria and are considered to be skin contaminants in our bacteriology laboratory.

None of the patients demonstrated a postoperative fever, and there were no airway or systemic complications.

COMMENT

The AHA recommends prophylactic antibiotics for several surgical procedures of the upper and lower aerodigestive tract. These include dental procedures with mucosal disruption, tonsillectomy and adenoidectomy, esophageal dilatation, and rigid tracheobronchoscopy. Antibiotic prophylaxis is not recommended for dental procedures without mucosal disruption, endotracheal intubation, and, interestingly, flexible bronchoscopy.¹

Instrumentation and operative disruption of the upper airway have been shown to cause a transient bacteremia that rarely persists for longer than 15 minutes.

In most patients, this bacteremia is of no clinical consequence. However, patients with a history of endocarditis, congenital cardiac malformations, rheumatic heart disease with valvular dysfunction, hypertrophic cardiomyopathies, mitral valve prolapse with valvular regurgitation, and prosthetic valves are at risk for developing bacterial endocarditis. Current AHA recommendations for antibiotic prophylaxis are aimed at the prevention of endocarditis in such high-risk patients.

The incidence of bacteremia in patients undergoing upper airway surgery and instrumentation has been documented to vary greatly depending on the procedure. For example, the incidence of bacteremia during tonsillectomy approximates 35%,⁷ the incidence during nasotracheal intubation approximates 5%,⁸ and the incidence following myringotomy with or without tube placement is virtually zero.⁹

Studies assessing flexible bronchoscopy have found little or no incidence of associated bacteremia. Kane et al³ found no case of bacteremia in 43 patients undergoing flexible bronchoscopy. Similarly, Pereira et al⁴ found no cases of bacteremia in 100 patients undergoing flexible bronchoscopy. Smith et al⁵ reported an extremely low incidence of positive blood cultures (1 of 50) following flexible bronchoscopy; the 1 patient who developed bacteremia had purulent tracheobronchitis as well as an anaerobic lung abscess at the time of endoscopic evaluation. Transbronchial needle biopsy at the time of flexible bronchoscopy does not appear to increase the risk of bacteremia as Witte et al⁶ found no cases of bacteremia in 22 patients undergoing these combined procedures.

The AHA recommendation for antibiotic prophylaxis with rigid tracheobronchoscopy does not appear to be firmly supported by the clinical studies published to date. Burma's 1960 study² performed in adults is the only documentation of a significant risk of bacteremia associated with rigid tracheobronchoscopy in the current literature; he found that 8 (15%) of 52 adults who underwent rigid bronchoscopy became bacteremic.² Our data are contradictory in this regard.

In our study, no case of bacteremia was seen in 25 children undergoing rigid tracheobronchoscopy. Because the number of children in this study was small, one cannot conclude that the actual risk is zero. With a study group of 25 patients and no positive blood cultures, the exact 1-sided 95% confidence interval for the rate of bacteremia following bronchoscopy can be quantified at 0% to 11%; in other words, the perioperative bacteremia rate is no greater than 11%. Expanding the study group to 30 or 60 patients would decrease the upper boundary of this confidence interval to 10% and 5%, respectively, in the event of successively negative blood cultures.

Blood cultures were obtained at 5 minutes following tracheobronchoscopy, and it is possible that we missed some cases of delayed transient bacteremia. Review of the literature, however, suggests that the bacteremia following tracheobronchoscopy occurs within 1 to 5 minutes and rarely more than 15 minutes following airway in-

strumentation.¹⁰ Our timing for blood cultures was in accordance with results of these previous studies.

Our data demonstrating a negligible incidence of bacteremia following rigid tracheobronchoscopy in children are consistent with the negative findings of studies assessing the risk of bacteremia in adults undergoing flexible bronchoscopy. The difference in the documentation of bacteremia in adult patients undergoing rigid vs flexible bronchoscopy has been attributed to the greater trauma to the teeth and airway mucosa incurred by the inflexible metal instruments used during rigid tracheobronchoscopy. We find that during rigid tracheobronchoscopy in children, the bronchoscope can often be passed atraumatically without mucosal disruption or injury to the smaller teeth and oral cavity structures. The dentition is also typically healthier in children. These observations may account for the absence of bacteremia in our pediatric series in contrast to Burma's findings in adult patients.

In conclusion, diagnostic rigid tracheobronchoscopy in the pediatric population appears to be associated with a negligible incidence of concurrent bacteremia. Otherwise healthy pediatric patients at low risk for the development of bacterial endocarditis may not require perioperative antibiotic coverage. Our results may have implications regarding current AHA guidelines advising perioperative antibiotic prophylaxis for this procedure in children who are at high risk for the development of bacterial endocarditis. Larger prospective trials are needed to fully evaluate the role of antibiotic prophylaxis in such children.

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REFERENCES

1. Dajani AS, Taubert KA, Wilson W, et al. Prevention of bacterial endocarditis: recommendations by the American Heart Association. *JAMA*. 1997;277:1794-1801.
2. Burma SO. Bronchoscopy and bacteremia. *J Thorac Cardiovasc Surg*. 1960;40:635-639.
3. Kane RC, Cohen MH, Fossieck BE, Tvardzik AV. Absence of bacteremia after fiberoptic bronchoscopy. *Am Rev Respir Dis*. 1975;111:102-104.
4. Pereira W, Kovnat DM, Khan MA, et al. Fever and pneumonia after flexible bronchoscopy. *Am Rev Respir Dis*. 1975;112:59-64.
5. Smith RP, Sahetya GK, Baltch AL, et al. Bacteremia associated with fiberoptic bronchoscopy. *N Y State J Med*. 1983;83:1045-1047.
6. Witte MC, Gilbert JG, Thomas DA, Perry ME. Incidence of fever and bacteremia following transbronchial needle aspiration. *Chest*. 1986;89:85-87.
7. Francois M, Bingen EH, Zechovsky NY, et al. Bacteremia during tonsillectomy. *Arch Otolaryngol Head Neck Surg*. 1992;118:1229-1231.
8. Dinner M, Tjeuw M, Artusio JF. Bacteremia as a complication of nasotracheal intubation. *Anesth Analg*. 1987;66:460-462.
9. Brown OE, Manning SC, Phillips DL. Lack of bacteremia in children undergoing myringotomy and tympanostomy tube placement. *Pediatr Infect Dis J*. 1995;14:1101-1102.
10. Everett ED, Hirschmann JV. Transient bacteremia and endocarditis prophylaxis: a review. *Medicine*. 1977;56:61-77.