

Comparison of Nasotracheal Intubation and Tracheostomy in Management of Acute Epiglottitis

TAE H. OH, M.D.,* AND ETSURO K. MOTOYAMA, M.D.†

Acute epiglottitis is a life-threatening respiratory emergency of early childhood. The disease may progress so rapidly that complete upper airway obstruction occurs within hours.¹ Tracheostomy has been the procedure of choice²⁻⁴ to relieve airway obstruction; however, in recent years several investigators have reported the encouraging results of nasotracheal intubation⁵⁻¹² as an alternate procedure in the management of acute epiglottitis.

The purpose of this report is to evaluate the relative effectiveness of two procedures, nasotracheal intubation and tracheostomy, using an interdisciplinary protocol.

METHODS

As soon as acute epiglottitis was suspected in a pediatric patient (history of upper respiratory tract infection, sudden onset of fever, hoarseness, drooling, and acute difficulty in breathing or swallowing), one of two protocols was immediately activated.

Protocol A: Management of Acute Epiglottitis by Nasotracheal Intubation

1. The patient is placed in a sitting or tripod position. A supine position must be avoided.
2. a. The anesthesiology, otolaryngology, and pediatric residents and the pediatric anesthesiology staff attending on call are notified immediately.
- b. The operating room staff is alerted to prepare for direct laryngoscopy in a child.
- c. Equipment includes pediatric bronchoscope, laryngoscope with proper blades, polyvinylchloride endotracheal tubes (sizes #3.0 to #6.5) with stylets, self-inflating bag, face mask and oxygen tank.
- d. Tracheostomy set, suction and catheter are on hand.
3. Unless respiratory arrest or severe bradycardia necessitates immediate endotracheal intubation,

no examination of the throat or laryngoscopy is attempted until the patient is in the operating room.

4. A lateral radiograph of the neck is taken in the emergency room when the patient's condition permits.
5. Under no circumstances is the patient left unattended.
6. Intubation and tracheostomy equipment accompany the patient at all times.
7. In the operating room, general anesthesia is induced with halothane and oxygen, with the patient in a sitting position. Vital signs are monitored by a precordial stethoscope, blood pressure cuff, and electrocardiogram. As soon as adequate levels of anesthesia are established the patient is placed in a supine position carefully for laryngoscopy. Muscle relaxants must not be given.
8. The following laryngoscopic findings confirm the diagnosis of acute epiglottitis: 1) the large, edematous, cherry-red epiglottis and 2) intense inflammation in the areas surrounding the epiglottis, in the aryepiglottic folds and the vocal cords.
9. When the diagnosis is proven the trachea is intubated orally. The larynx and the epiglottis are re-examined and the severity of inflammation and the size of the epiglottis are graded after orotracheal intubation (grade 0, normal or near normal; grade 1, mild; grade 2, moderate; grade 3, severe).
10. The orotracheal tube is replaced by a nasotracheal tube under direct vision with or without succinylcholine, 1 mg/kg, iv.
11. A throat swab and blood sample for culture are taken.
12. Adequacy of the airway, position of the endotracheal tube, and status of the lungs are evaluated by auscultation and by radiographs. Humidified oxygen (40 per cent) is administered in the recovery room. The child's hands are wrapped with "gauze mittens" and the elbows restrained in an extended position to avoid accidental extubation. The patient is observed in the pediatric intensive care unit.
13. Chloramphenicol is given as the initial antibiotic, followed by ampicillin according to the results of a sensitivity test of the infecting organisms.¹³

* Assistant Professor of Anesthesiology.

† Associate Professor of Anesthesiology and Pediatrics; Director, Section of Pediatric Anesthesia.

Received from the Departments of Anesthesiology and Pediatrics, Yale University School of Medicine, 333 Cedar Street, New Haven, Connecticut 06510. Accepted for publication September 28, 1976.

Address reprint requests to Dr. Oh.

TABLE 1. Patients Treated Using Protocol A, Age, Sex, Clinical Signs and Durations of Intubation and Hospitalization

	Age (Months), Sex	Croup Score	Grade	Onset Prior to Admission (Hours)	Emergency Room Stay (Hours)	Temperature (C)	Duration of Intubation (Hours)	Hospital Stay (Days)
Patient 1	12, M	3	2	3	1.5	39.0	62	4
Patient 2	15, F	5	3	3	1.0	38.8	48	5
Patient 3	30, M	5	2	4	2.5	38.7	70	5
Patient 4	24, M	4	3	6	0.5	39.4	48	5
Patient 5	35, F	2	2	36	1.0	39.0	72	5
Patient 6	44, F	4	2	2	2.5	39.4	48	5
Patient 7	31, F	4	2	8	1.5	38.8	24	4
Patient 8	45, M	3	3	9	0.5	39.4	72	5
Patient 9	74, M	5	3	9	1.0	41.0	63	4
Patient 10	51, M	2	3	3	1.0	39.6	45	4
Patient 11	64, F	3	3	5	0.0	39.1	52	4
Patient 12	63, M	4	2	8	0.5	39.0	50	4
MEAN	40.7	3.7	2.5	8.0	1.12	39.3	54.5	4.5
SEM	5.7			2.7	0.22	0.3	4.0	0.2

TABLE 2. Patients Treated Using Protocol B, Age, Sex, and Durations of Tracheostomy and Hospitalization

	Age (Months), Sex	Onset Prior to Admission (Hours)	Temperature (C)	Duration of Tracheostomy (Hours)	Hospital Stay (Days)
Patient 13	30, M	2	39.6	96	8
Patient 14	55, M	12	38.5	56	6
Patient 15	29, M	6	38.8	55	5
Patient 16	41, M	10	38.8	104	7
Patient 17	30, M	3	39.0	65	6
Patient 18	71, M	4	40.0	164	9
Patient 19	13, M	5	40.0	62	8
Patient 20	20, M	24	40.6	120	6
Patient 21	33, F	8	40.6	93	5
Patient 22	36, M	2	40.0	67	7
Patient 23	33, F	4	41.0	63	7
MEAN	32.8	7.1	39.7	85.9*	6.7*
SEM	5.8	2.0	0.2	10.2	0.4

* Significantly ($P < 0.01$) longer than that of the nasotracheal intubation group.

- The epiglottis is examined under direct laryngoscopy every 12 to 24 hours in the pediatric intensive care unit. For this procedure thiopental, 2 mg/kg, atropine, 0.02 mg/kg, and succinylcholine, 1 mg/kg are administered intravenously and adequate ventilation and oxygenation are maintained.
- When the epiglottis and the larynx appear normal or near normal (grade 0) and the patient is afebrile, the endotracheal tube is removed. The patient receives nebulized racemic epinephrine treatment¹⁴ after extubation of the trachea.

Protocol B: Management of Acute Epiglottitis by Tracheostomy

- Tracheostomy is performed under general anesthesia in the operating room after oro-

tracheal intubation following procedures 1 through 9 in Protocol A.

- The position of the tracheostomy tube and the status of the lungs are evaluated by auscultation and radiographs. Humidified oxygen (40 per cent) is administered in the recovery room.
- The patient is transferred to the pediatric intensive care unit.
- Ampicillin is administered.
- Decannulation is attempted 48 hours post-operatively and repeated every 24 hours thereafter in the pediatric intensive care unit.

SUBJECTS

Fifteen patients suspected to have acute epiglottitis underwent direct laryngoscopy in a period of 14 months from November 1974 to December 1975. Twelve of them had acute epiglottitis and

were treated by nasotracheal intubation using Protocol A. In addition, a clinical croup score¹⁵ was obtained for each patient by the same physician (THO). During this period an additional 23 patients were admitted and treated for subglottic croup.

Data were also obtained retrospectively from the cases of 11 patients who were treated by tracheostomy using Protocol B in a period of 24 months (November 1972 to October 1974).

RESULTS

Table 1 shows the clinical data for 12 children managed by Protocol A. A clinical croup score did not correlate with the severity of inflammation and the size of the epiglottis. Lateral radiographs of the neck demonstrated abnormal supraglottic structures^{16,17} in all ten patients who were so examined. Two patients did not have radiographic examinations because of rapid deterioration of their clinical condition, necessitating immediate treatment, however, none of them needed endotracheal intubation prior to arrival in the operating room. All tolerated the nasotracheal tube well without accidental extubation. Neither assist ventilation nor sedation was necessary.

Table 2 shows the data for 11 patients managed by Protocol B.

Throat and blood cultures were positive for *Hemophilus influenzae*, type b, in all cases. There was no serious complication or mortality in either group of patients (Protocol A or B).

The significant differences between the two groups were in the durations of intubation (5.5 *vs.* 8.6 hours) and hospital stays (4.5 *vs.* 6.7 days).

DISCUSSION

Successful management of patients who have acute epiglottitis depends mainly upon extraordinary cooperation and understanding among pediatricians, otolaryngologists, and anesthesiologists. Establishment of an inter-disciplinary protocol has greatly improved such teamwork and efficiency in our institution and prevented serious complications^{4,8,11,12} reported to occur elsewhere.

The results obtained in our series have been gratifying. Including 15 cases previously reported by Margolis *et al.*,³ a total of 38 patients with the proven diagnosis of acute epiglottitis have been treated using the "epiglottitis protocol." Both tracheostomy and nasotracheal intubation were employed in the management of these 38 cases, and it would appear

that the two methods of handling airway obstruction were equally satisfactory.

Our present report suggests that nasotracheal intubation is superior to tracheostomy in terms of the durations of intubation (2.3 *vs.* 3.6 days) and hospitalization (4.5 *vs.* 6.7 days). These findings support previously reported⁵⁻¹² views; however, the two techniques were not compared under similar circumstances in earlier studies.

REFERENCES

1. Baxter JD: Acute epiglottitis in children. *Laryngoscope* 77:1358-1367, 1967
2. Bass JW, Steele RW, Wiebe RA: Acute epiglottitis: A surgical emergency. *JAMA* 229:671-675, 1974
3. Margolis CZ, Ingram DL, Meyer JH: Routine tracheostomy in *Hemophilus influenzae* type b epiglottitis. *J. Pediatr* 81:1150-1153, 1972
4. Rapkin RH: Tracheostomy in epiglottitis. *Pediatrics* 52:426-429, 1973
5. Geraci RP: Acute epiglottitis: Management with prolonged nasotracheal intubation. *Pediatrics* 41:143-145, 1968
6. Sweeney DB, Allen TH, Steven IM: Acute epiglottitis: Management by intubation. *Anaesth Intens Care* 1:526-528, 1973
7. Milko DA, Marchak G, Striker TW: Nasotracheal intubation in the treatment of acute epiglottitis. *Pediatrics* 53:674-677, 1974
8. Schuller DE, Birck HG: The safety of intubation in the epiglottitis: An eight-year follow-up. *Laryngoscope* 85:33-45, 1975
9. Rapkin RH: Nasotracheal intubation in epiglottitis. *J. Pediatr* 84:110-112, 1975
10. Battaglia JD, Lockhart CH: Management of acute epiglottitis by nasotracheal intubation. *Am J Dis Child* 129:334-336, 1975
11. Weber ML, Desjardins R, Perreaut G, et al: Acute epiglottitis in children—Treatment with nasotracheal intubation: Report of 14 consecutive cases. *Pediatrics* 57:152-155, 1976
12. Adair JC, Ring WH: Management of epiglottitis in children. *Anesth Analg (Cleve)* 54:622-625, 1975
13. Report of Committee on Infectious Diseases: Ampicillin resistant strains of *Hemophilus influenzae* type b. *American Academy Pediatrics, Newsletter*, August 1974
14. Jordan WS: New therapy for postintubation laryngeal edema and tracheitis in children. *JAMA* 212:585-588, 1970
15. Downes JJ, Raphaely RC: Pediatric intensive care. *ANESTHESIOLOGY* 43:238-250, 1975
16. Rapkin RH: The diagnosis of epiglottitis: Simplicity and reliability of radiographs of the neck in the differential diagnosis of the croup syndrome. *J Pediatr* 80:96-98, 1972
17. Poole CA, Altman DH: Acute epiglottitis in children. *Radiology* 80:798-805, 1963