Does Nasotracheal Intubation Increase Complications in Patients With Skull Base Fractures?

Kenneth J Rhee, MD*
Carrie B Muntz, RN*
Paul J Donald, MD†
Judy M Yamada, RN*

From Life Flight, University of California, Davis, Medical Center; and Department of Otolaryngology, University of California, Davis.†*

Received for publication April 1, 1992. Revision received October 15, 1992. Accepted for publication October 20, 1992.

Study objectives: To determine if the complications associated with skull base fractures are increased when nasotracheal intubation is performed in the field.

Design: Retrospective, case-control study over a five-year period.

Setting: A helicopter service returning to a Level I trauma center.

Type of participants: All injured patients treated in the field who had either radiographic or clinical evidence of skull base fractures in whom nasotracheal intubation was attempted (38) compared with all patients with skull base fractures in whom nasotracheal intubation was not attempted (48) and a convenience sample of patients without skull base fractures in whom nasotracheal intubation was attempted (45). Patients with obvious midface motion on initial examination were excluded. Complications of skull base fractures were categorized as cerebral spinal fluid leak of longer than 24 hours and/or meningitis, cranial nerve injury, diabetes insipidus, and intracranial placement of the endotracheal tube.

Interventions: Blind nasotracheal intubation was performed by experienced flight nurses.

Results: There were no patients in whom an endotracheal tube was placed intracranially. There was no significant difference in complication rate between the two groups with skull base fractures (with nasotracheal intubation, 24%; 95% confidence interval, 11% to 40%; without nasotracheal intubation, 25%; 95% confidence interval, 14% to 40%). The group without skull base fracture had none of the complications usually associated with skull base fractures.

Conclusion: Patients with skull base fracture have a significant complication rate (25%). The complications associated with skull base fractures are not markedly increased by attempts at nasotracheal intubation in the field.

[Rhee KJ, Muntz CB, Donald PJ, Yamada JM: Does nasotracheal intubation increase complications in patients with skull base fractures? *Ann Emerg Med* July 1993;22:1145-1147.]

INTRODUCTION

Nasotracheal intubation may have special usefulness in prehospital care because it can be done rapidly and without the aid of neuromuscular blockade.[1,2] Concern has been expressed regarding the use of nasotracheal intubation in patients with skull base fractures.[3-5] Because signs of such a fracture may require hours to develop[6] and because time, space, and light may make examination suboptimal, the exclusion of a skull base fracture may be difficult or impossible in the field. The purpose of this study was to determine if the complications associated with skull base fractures are increased when nasotracheal intubation is performed in the field.

MATERIALS AND METHODS

We conducted a retrospective case-control study to examine the experience of a helicopter emergency medical service during the five-year period of 1987 to 1991. All transported patients with available medical records who had either radiographic or clinical evidence of skull base fracture were identified. Those in whom nasotracheal intubation was attempted (group 1) were compared with those in whom nasotracheal intubation was not attempted (group 2). In addition, a convenience sample of patients without skull base fractures in whom nasotracheal intubation was attempted (group 3) were compared with groups 1 and 2. Patients with obvious midface motion on initial examination were excluded.

A skull base fracture was defined as a fracture identified by either plain radiographs or computed tomography (CT) scan, blood in the sphenoid sinus, intracranial air, or a discharge diagnosis of a skull base fracture based on clinical signs. Prehospital, emergency department, operating room, radiologic, and in-hospital records were reviewed by one of two flight nurses who used abstract forms designed for this study. Complications of skull base fracture were categorized as cerebral spinal fluid leak of longer than 24 hours and/or meningitis, cranial nerve injury, diabetes insipidus, and intracranial placement of the endotracheal tube. The total number of patients with at least one complication also was noted.

Flight nurses who had received special training in airway management performed all intubations during the study period. Decisions concerning the indications for nasotracheal intubation were guided by an algorithm described elsewhere.[7] In general, all patients who were breathing, had a markedly decreased Glasgow Coma Scale (GCS),[8] and did not have gross movement of the midface were intubated nasally.

Nasal intubation was done in a manner similar to that described in detail elsewhere.[9,10] The technique consisted of verifying that nasotracheal intubation was indicated and that there was no midface motion on examination. Next, the nasal passage was sprayed with a vasoconstrictor spray. Then, a 7-mm-internal-diameter tube was introduced into the nose, passed into the posterior pharynx, and then passed into the trachea using breath sounds as a guide.

Binomial confidence intervals (95% CI) were calculated for the proportion of patients with complications in each group. The groups then were compared using Fisher tests. Groups 1 and 2 were compared for age, GCS, and Trauma Score (TS)[11] using Mann-Whitney tests. The proportion of male patients and female patients in groups 1 and 2 were compared using 2×2 contingency table. Statistical significance was defined as a test of significance that yielded a $P < .05$.

RESULTS

There were 38 patients in group 1, 48 patients in group 2, and 45 patients in group 3. As expected, no skull base fracture complications were found in group 3. A breakdown of skull base fracture-associated complications for groups 1 and 2 is given (Table). Comparison of groups 1 and 2 demonstrated no significant difference in complications associated with skull base fractures (overall complication rate, $P = 1.00$; cerebral spinal fluid and/or meningitis, $P = .53$; cranial nerve injury, $P = .17$; diabetes insipidus, $P = .40$). There were no patients in whom an endotracheal tube was placed intracranially.

The median age, GCS, TS, and sex distribution for groups 1 and 2 are given (Table). Sex and age were not significantly different (sex, $P = .98$; age, $P = .85$). GCS

Table.
Patients with complications

	Group 1		Group 2	
	No. (%)	95% CI	No. (%)	95% CI
Total no. of patients	38		48	
Cerebral spinal fluid leak and/or meningitis	6 (16)	(6% – 31%)	5 (10)	(3% – 23%)
Cranial nerve injury	2 (5)	(1% – 18%)	8 (17)	(7% – 30%)
Diabetes insipidus	4 (11)	(3% – 25%)	2 (3)	(1% – 14%)
Patients with complication	9 (24)	(11% – 40%)	11 (25)	(14% – 40%)
Age	21		24	
GCS*	7		13	
TS*	12		15	
Male/female	26/12		33/15	

*Significantly different (see text).

and TS were significantly different (GCS, $Z = -4.7$, $P < .01$; TS, $Z = -4.3$, $P < .01$).

DISCUSSION

The most important potential bias of this study was that the groups were not prospectively randomized and therefore may not have been comparable. The evidence suggests that patients with skull base fractures who had nasotracheal intubation performed had lower overall GCS and TS. As previously discussed, the management of patients was guided by an algorithm that included consideration of the GCS. This should have biased the study in the direction of more complications in group 1 than in group 2. In fact, the data indicate a remarkably similar pattern and overall rate of complications in groups 1 and 2.

Another concern is that the small sample size would detect only large differences in complication rates. The 95% CIs are wide (group 1, 6% to 40%; group 2, 14% to 40%), and there is roughly an 80% power to detect a 25% difference in overall complication rates. Finally, the number of patients studied makes detection of a very rare complication, such as intracranial placement of an endotracheal tube, remote. Only one report of the intracranial placement of a nasotracheal tube exists in the English literature,[12] suggesting that this must be an extraordinarily rare event. The case report does not contain any details on the technique used or the person performing the procedure. Other reports that sometimes are cited acutally involve the passage of a nasogastric tube into the cranial vault.[13-16] We do not believe that nasotracheal intubation and nasogastric tube placement are equivalent procedures.

It must be emphasized that there were only a small number of specially trained flight nurses. These results should not be generalized to personnel who are not trained thoroughly and who do not routinely perform this procedure.

CONCLUSION

Patients with skull base fracture have a significant complication rate (25%). The complications associated with skull base fractures are not markedly increased by attempts at nasotracheal intubation in the field.

REFERENCES

1. O'Brian D, Danzl D, Sowers B, et al: Airway management of aeromedically transported patients. *J Emerg Med* 1988;6:49-54.

2. O'Brian D, Danzl D, Hooker E, et al: Prehospital blind nasotracheal intubation by paramedics. *Ann Emerg Med* 1989;18:612-617.

3. Hall D: Nasotracheal intubation with facial fractures. *JAMA* 1989;261:1198.

4. Tyson G: *Head Injury Management for Providers of Emergency Care*, ed 1. Baltimore, Williams & Wilkins, 1987, p 187.

5. Kastendieck J: Airway management, in Rosen P (ed): *Emergency Medicine: Concepts and Clinical Practice*. St Louis, CV Mosby, 1988, p 41-68.

6. Subcommittee on Advanced Trauma Life Support. Head trauma, in: *Advanced Trauma Life Support Program-Instructor Manual*. Chicago, American College of Surgeons, 1989, p 133-155.

7. Rhee K, O'Malley R: The effect of an airway algorithm on flight nurse behavior. *J Air Med Transport* 1990;9:6-8.

8. Teasdale G, Jennett B: Assessment of coma and impaired consciousness: A practical scale. *Lancet* 1974;2:81-84.

9. Morris I: Techniques of endotracheal intubation and muscle relaxation, in Rosen P, Baker F, Barkin R, et al (eds): *Emergency Medicine: Concepts and Clinical Practice*. St Louis, CV Mosby, 1988, p 72-73.

10. Finucane B, Santora A: *Principles of Airway Managment*. Philadelphia, FA Davis, 1988, p 142-143.

11. Champion H, Sacco W, Carnazzo A, et al: Trauma Score. *Crit Care Med* 1981;9:672-676.

12. Horellou M, Mathe D, Feiss P: A hazard of naso-tracheal intubation. *Anaesthesia* 1978;33:73-74.

13. Wyler A, Reynolds A: An intracranial complication of nasogastric intubation. *J Neurosurg* 1977;47:297-298.

14. Seebacher J, Nozik D, Mathieu A: Inadvertent intracranial introduction of a nasogastric tube: A complication of severe maxillofacial trauma. *Anesthesiology* 1975;42:100-102.

15. Bouzarth W: Intracranial nasogastric tube insertion. *J Trauma* 1978;18:818-819.

16. Fremstad J, Martin S: Lethal complication from insertion of nasogastric tube after severe basilar skull fracture. *J Trauma* 1978;18:820-821.

Address for reprints:

Kenneth Rhee, MD
Division of Emergency Medicine
Trailer 1219
University of California, Davis
Medical Center
2315 Stockton Boulevard
Sacramento, California 95817