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Clinical Science

Incidence of overall complications and symptomatic tracheal stenosis is equivalent following open and percutaneous tracheostomy in the trauma patient

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Abstract

BACKGROUND: While percutaneous tracheostomy (PT) is becoming the procedure of choice for elective tracheostomy, there is little late complication data. This study compared incidence of, and factors contributing to, tracheal stenosis following PT or open tracheostomy (OT).

METHODS: A 10-year review was conducted of trauma patients undergoing tracheostomy. Data on demographics, injury severity, tracheostomy type, complications, and outcomes were compared between patients receiving PT or OT and for those with or without tracheal stenosis.

RESULTS: Of 616 patients, 265 underwent OT and 351 underwent PT. Median injury severity score was higher for PT (26 vs 24, $P = .010$). Overall complication rate was not different (PT = 2.3% vs OT = 2.6%, $P = .773$). There were 9 tracheal stenosis, 4 (1.1%) from the PT group and 5 (1.9%) from the OT group ($P = .509$). Mortality was higher in OT patients (15.5% vs 9.7%, $P = .030$). Patients developing tracheal stenosis were younger (29.8 vs 45.2 years, $P = .021$) and had a longer intensive care unit length of stay (28.3 vs 18.9 days, $P = .036$).

CONCLUSION: Risk of tracheal stenosis should not impact the decision to perform an OT or PT.

Percutaneous tracheostomy (PT) is becoming the procedure of choice for elective tracheostomy in trauma patients. Many studies have proven this more prevalent technique to be safe, and possibly more cost-effective, than the traditional open tracheostomy (OT).[1–3] Most of the literature consists of observational data or small prospective studies, therefore debate still continues as to which method is preferred.

The literature is less clear on late complications, specifically tracheal stenosis. The exact incidence of tracheal stenosis following tracheostomy is difficult to quantify because many patients are critically ill and may die before decannulation, are lost to follow-up after being dismissed from a level-I trauma center, or are asymptomatic.[4–6] With a shortage of evidence, some postulate that the percutaneous technique predisposes patients to tracheal stenosis, more so than the open technique. They cite that the

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ostomy is often times placed higher on the trachea percutaneously than it is when performed open and there is more trauma and granulation tissue to the trachea when passing dilators percutaneously.[7]

The purpose of this investigation was to compare outcomes and complications between OT and PT. All major complications, including tracheal stenosis, were recorded to determine the incidence of, and any risk factors for, tracheal stenosis.

Patients and Methods

A retrospective review of all trauma patients who received a tracheostomy from August 1, 2001 to July 31, 2011 was conducted. Patients were identified using the trauma registry of an established American College of Surgeons-verified level-1 trauma center. Patient demographics, mechanism of injury, injury severity score (ISS), Glasgow coma scale (GCS) score, time from injury to tracheostomy creation, method of performing tracheostomy (open vs percutaneous), complications associated with tracheostomy (tracheo-innominate artery fistula, tracheal stenosis, scar and excess granulation tissue requiring surgical scar revision, loss of airway requiring conversion to open, and bleeding requiring conversion to open), intensive care unit (ICU) length of stay (LOS), mechanical ventilator days, overall LOS, and patient disposition were collected using the trauma registry and patient records. Tracheal stenosis was identified based on clinical symptoms (ie, difficulty with decannulation or shortness of breath with exertion). Complications were defined as being early, those occurring within the first 48 hours of tracheostomy, or late, those occurring more than 48 hours post-tracheostomy. Outcomes and complication data were collected from the in-hospital stay and from rehospitalizations. Study subjects were not contacted for long-term follow-up.

Analyses were conducted using IBM SPSS Statistics for Windows, Version 19.0. (IBM Corp, Armonk, NY). Data were initially summarized. Primary analyses were conducted comparing outcomes between patients based on the method of tracheostomy creation (OT vs PT). Secondary analyses were conducted comparing outcomes between patients who developed tracheal stenosis and patients who did not develop tracheal stenosis. Quantitative data were analyzed using the Student t test. If heterogeneity of variance was identified, the Mann–Whitney test was used. Comparisons of ordinal data were analyzed with the Mann–Whitney test. Qualitative data were analyzed with chi-square analysis or the Fisher's exact test in instances where cell size was 5 or less observations. All analyses were conducted as 2-tailed tests and statistical significance was defined as $P < .05$.

This study was reviewed and approved for implementation by the Institutional Review Board of Via Christi Hospitals Wichita, Inc.

Results

During the 10-year study period, 629 tracheostomies were performed on trauma patients. We excluded 13 patients who had an emergency cricothyroidotomy or whose LOS was for more than 1 day. Of the remaining 616 patients, the average age was 45.0 ± 20.6 years, the majority were male (n = 458, 74.4%), white (n = 534, 86.7%), and median ISS and GCS scores were 25 (25th and 75th percentiles = 17 and 33) and 5 (25th and 75th percentiles = 3 and 14), respectively. Forty-three percent (n = 265) had an OT and 57% (n = 351) had a PT. There were no significant differences in age, sex, GCS score, mechanism of injury, interval from admission to tracheostomy formation, ICU LOS, ventilator days, or hospital LOS between the 2 groups (Table 1). There was a significant

Table 1 Comparison of demographics, injury severity, mechanism of injury, and hospitalization details for patients who received a tracheostomy through an open or percutaneous procedure

Parameter	Open procedure	Percutaneous procedure	P value
No. of subjects (%)	265 (43.0%)	351 (57.0%)	
Age (years)*	45.0 ± 21.3	44.9 ± 20.1	.932
Sex (male)	204 (77.0%)	254 (72.4%)	.194
Injury severity score†	24.0 (17.0, 30.0)	26.0 (18.0, 34.0)	.010
Glasgow coma scale score†	6.0 (3.0, 15.0)	3.0 (3.0, 14.0)	.116
Mechanism of injury			.068
Blunt	244 (92.1%)	337 (96.0%)	
Penetrating	18 (6.8%)	13 (3.7%)	
Drowning	1 (.4%)	1 (.3%)	
Burn	2 (.8%)	0 (.0%)	
Admission to tracheostomy interval (days)	7.0 ± 5.4	7.0 ± 4.7	.988
Intensive care unit days*	19.3 ± 15.2	18.9 ± 11.8	.223
Mechanical ventilation days*	16.7 ± 12.9	15.8 ± 11.2	.945
Hospital length of stay (days)*	27.6 ± 19.9	26.7 ± 29.2	.643

*Mean ± standard deviation.
†Median (25th and 75th percentile).