Airway management following repair of cervical tracheal injuries: A retrospective, multicenter study

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BACKGROUND: Optimal airway management following repair of cervical tracheal injuries is unknown. This study aimed to determine the optimal airway strategy following cervical tracheal injury repair.

METHODS: Patients with cervical tracheal injuries admitted from January 2000 to January 2014 at seven US Level I trauma centers were identified. Patients were grouped depending on postoperative airway management: immediate or early extubation (≤24 hours, EXT), prolonged intubation (>24 hours, INT), and immediate tracheostomy (TRACH). Following univariate analysis, a multivariate model was then developed to evaluate for surgical site infection (SSI) and intensive care unit–free and ventilator-free days, comparing INT and TRACH with EXT as the reference.

RESULTS: A total of 120 cervical tracheal injuries were treated at seven Level I trauma centers. Ten patients were excluded for incomplete data, and seven died within 24 hours of admission, leaving 103 patients included in the study. Patients were grouped based on airway management: 40 (39%) in the EXT, 30 (29%) in the INT, and 33 (32%) in the TRACH group. There were no differences in demographics or injury mechanism. The INT and TRACH groups were more severely injured than the EXT group (median Injury Severity Score [ISS]: INT, 25; TRACH, 17 vs. EXT, 16; $p < 0.01$). Despite a higher SSI rate (TRACH, 21% vs. INT, 13% vs. EXT, 2%; $p = 0.11$), the TRACH group had a lower mortality rate (TRACH, 0% vs. INT, 13% vs. EXT, 0%, $p < 0.01$) and more ventilator-free days compared with the INT cohort. On multivariate analysis, tracheostomy was associated with an increased risk in the odds of SSI (odds ratio, 9.56; 95% confidence interval, 1.35–67.95) compared with both EXT and INT, while INT was associated with fewer ventilator-free days (correlation coefficient, −9.24; 95% confidence interval, −12.30 to −6.18) compared with both EXT and TRACH.

CONCLUSION: In patients with a cervical tracheal injury, immediate or early extubation was common and safe. However, among those with more severe injuries, immediate tracheostomy versus prolonged intubation presents a risk-benefit decision. Immediate tracheostomy is associated with increased risk of SSI, while prolonged intubation is associated with higher risk of mortality and fewer ventilator-free days. (*J Trauma Acute Care Surg.* 2016;80: 366–371. Copyright © 2016 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Therapeutic study, level IV.

KEY WORDS: Trauma; trachea; tracheal injury; tracheostomy; airway.

The true incidence of tracheal injuries is difficult to ascertain. While autopsy reports suggest an incidence of 2.8%, as many as 52% to 82% of these deaths occur within 1 hour of injury.[1,2] Thus, the incidence of patients with tracheal injuries who survive to hospital presentation is thought to be much lower but is also unknown.

As surgical care and anesthesia support have improved over time, early operative intervention became common and successful.[3–6] In the earliest reports, immediate tracheostomy was commonly performed.[1,7] More recent series have shown a gradual shift away from tracheostomy, with rates varying from 0% to 82%.[8–11] Indeed, expert opinion now recommends reserving tracheostomy for only the most severe injuries.[12,13]

While many agree that tracheostomy should be avoided unless absolutely necessary, it is clear that a significant number of patients with cervical tracheal injuries also experience concomitant injuries that preclude immediate or early extubation.[14] The complications associated with prolonged intubation and the current use of tracheostomy vary. The purposes of this project were multiple: to identify the incidence of patients arriving to trauma centers with cervical tracheal injuries, to delineate the current trends in postrepair airway management, and to determine if an optimal airway management strategy exists.

PATIENTS AND METHODS

Seven US Level 1 trauma centers participated in this project: the University of Texas Medical School at Houston (Houston, Texas), the University of Maryland School of Medicine

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This study was presented at the 74th annual meeting of the American Association for the Surgery of Trauma, September 9–12, 2015, in Las Vegas, Nevada.

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(Baltimore, Maryland), the University of Southern California Keck School of Medicine (Los Angeles, California), the Vanderbilt University School of Medicine (Nashville, Tennessee), the Johns Hopkins University School of Medicine (Baltimore, Maryland), the University of Tennessee Health Science Center (Memphis, Tennessee), and the University of Cincinnati College of Medicine (Cincinnati, Ohio). After each institution obtained institutional review board approval, the trauma registry of each site was queried for laryngotracheal injuries from January 1, 2000, through January 31, 2014. Inclusion criteria for this cohort were cervical tracheal injury (cricoid to sternal notch) and age greater than 15 years. Exclusion criteria included death within 24 hours of admission and lack of patient data.

Patient demographics, injury characteristics, prehospital vital signs, emergency department (ED) vital signs, laboratory values, resuscitation volumes, and information regarding operative technique were recorded. Destructive tracheal injuries were defined as either two or more fractures in two consecutive rings or an head/neck Abbreviated Injury Scale (AIS) score greater than 3. The primary outcome was in-hospital mortality. Secondary outcomes included surgical site infection (SSI) of the neck, intensive care unit (ICU)–free days, and ventilator-free days. ICU-free days were defined as days alive and not admitted to the ICU (30 − total ICU days = ICU-free days). For those who died before 30 days and had no days free of the ICU, this was recorded as 0. Similarly, ventilator-free days were defined as days alive and free from the ventilator. This was calculated as 30 − total ventilator days = ventilator-free days. Hospital-free days were defined as days alive and free from the hospital. This was calculated as 30 − total hospital days = hospital-free days.

Patients were grouped according to the method of airway management following tracheal repair: immediate or early extubation (≤24 hours, EXT), prolonged intubation (>24 hours, INT), or immediate tracheostomy (TRACH).

Continuous data are presented as medians with 25th and 75th interquartile range (IQR) with comparison among the three groups performed using the Kruskal-Wallis rank test. When significant values were observed, the Wilcoxon rank-sum test was used to determine differences between two groups. Categorical data are reported as proportions and, where appropriate, tested for significance using χ^2 or Fisher's exact tests. All statistical tests were two tailed, with a $p < 0.05$ set as significant.

Following univariate analysis, a purposeful multivariate model was developed to evaluate for SSI, ICU-free days, and ventilator-free days, comparing INT and TRACH with EXT as the reference group. Stata Statistical software (version 13.1, Stata Corporation, College Station, TX) was used for analysis.

RESULTS

During the 14-year period, a total of 382,529 patients were admitted to the seven Level 1 trauma centers. Laryngeal injuries were more common than tracheal injuries (327 vs. 267). Thoracic tracheal injuries were slightly more common than cervical tracheal injuries (147 vs. 120). Of the 120 cervical tracheal injuries identified, 17 were excluded—10 because of a lack of data and 7 because of death within 24 hours of arrival. Of the seven who were excluded because of death within 24 hours of arrival, five died because of hemorrhage and two because of anoxic brain injuries. The 103 patients included in this cohort were grouped according to airway management: 40 (39%) in the EXT; 33 (32%) in the TRACH; 30 (29%) in the INT group.

There were no differences in demographics or mechanism of injury among the three groups (Table 1). The Injury Severity Score (ISS) of the EXT group was significantly lower than those of the INT and TRACH groups. There was no significant difference in the head/neck AIS scores between the groups (median head/neck AIS score: EXT 3 [3–4] vs. INT 4 [3–4] vs. TRACH 4 [3–4]; $p = 0.75$).

The EXT group arrived with a lower heart rate and higher Glasgow Coma Scale (GCS) score than did the INT group (Table 2). The EXT group was also less likely to be intubated in the prehospital setting or ED, compared with both the INT and TRACH groups. The INT groups received significantly more fluids in the ED than did both the EXT and TRACH groups. There was no difference in ED time between the three groups.

In the operating room, 39 patients (98%) in the EXT group had a repair performed by a trauma surgeon, as opposed to an otolaryngologist or other consultant (Table 3). This was significantly different from the INT and TRACH groups (77% and 71%, respectively). There was no difference in the percentage of patients with a destructive tracheal injury, but the TRACH group was most likely to undergo a tracheal ring resection. In all groups, the majority of surgeons used absorbable suture, and approximately half used monofilament suture. The INT and TRACH groups were more likely to have a concomitant esophageal injury, while there was no significant difference between the three groups in the percentage of associated arterial and venous injuries.

In Figure 1, the rates of airway management use and rates in the use of consulting services during cervical tracheal injury repair are shown. Institution 7 had a higher rate of immediate tracheostomy compared with the other institutions, while Institution 4 had no patients undergoing immediate or early extubation.

TABLE 1. Demographics and Injury Characteristics

	EXT (n = 40)	INT (n = 30)	TRACH (n = 33)	p
Age, y	34 (24–45)	25 (20–43)	31 (24–38)	0.15
Sex				0.47
Female	6 (15%)	4 (13%)	2 (6%)	
Male	34 (85%)	26 (87%)	31 (94%)	
Race				0.64
White	14 (35%)	7 (23%)	14 (41%)	
Black	17 (43%)	16 (53%)	14 (41%)	
Hispanic	8 (20%)	7 (23%)	4 (12%)	
Other	1 (3%)	0 (0%)	1 (6%)	
Mechanism				0.35
Blunt	2 (5%)	3 (10%)	5 (15%)	
Penetrating	38 (95%)	27 (90%)	28 (85%)	
ISS	16 (10–17)	25 (16–29)*	17 (12–33)*	<0.01

*Significant difference versus EXT group
Continuous variables are displayed as median (25th quartile to 75th quartile).

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TABLE 2. ED Vital Signs, Laboratory Values, and Resuscitation

	EXT (n = 40)	INT (n = 30)	TRACH (n = 33)	*p*
Systolic blood pressure, mm Hg	140 (122 to 154)	128 (112 to 145)	129 (113 to 145)	0.17
Heart rate, beats/min	92 (79 to 108)[a]	114 (96 to 124)[a]	97 (88 to 118)	0.02
GCS score	15 (15 to 15)[a]	12 (3 to 15)[a]	15 (7 to 15)	<0.01
Prehospital or ED intubation	9 (23%)	16 (53%)	17 (52%)	0.01
pH	7.35 (7.28 to 7.38)	7.29 (7.18 to 7.38)	7.31 (7.22 to 7.38)	0.28
Base excess	−2.4 (−4.5 to 1.6)	−4.1 (−9.3 to −1.0)	−1.0 (−4.5 to 3.0)	0.28
Fluids, mL	500 (0 to 1,350)[a]	1,250 (225 to 2,850)[a,c]	500 (0 to 1,300)[c]	0.03
Red blood cells, U	0 (0 to 0)[a]	0 (0 to 2)[a]	0 (0 to 0)	0.03
Time in ED, min	23 (14 to 60)	29 (15 to 45)	26 (15 to 44)	0.99

Continuous variables are displayed as median (25th quartile to 75th quartile).
Superscript letters denote significant difference from two groups.

Institution 4 also used consulting services more often than did the other institutions.

The EXT group was significantly more likely to be discharged home (Table 4). The EXT group had significantly more hospital-free, ICU-free, and ventilator-free days. There was a trend toward a higher rate of tracheal suture line failure and tracheoesophageal fistula in the INT group, but this failed to reach statistical significance. The rate of postoperative sepsis was higher in the INT and TRACH groups (INT, 20% and TRACH, 15% vs. EXT, 0%; $p < 0.01$). There were no deaths in the EXT or TRACH group and was four (13%) in the INT group.

When using the EXT group as reference in a multiple logistic regression model, the odds of developing an SSI was 9.56 higher in patients undergoing immediate tracheostomy (95% confidence interval [CI], 1.35–67.95; $p = 0.02$) (Table 5). While prolonged intubation was not associated with SSI, there were significantly fewer ventilator-free and ICU-free days. The correlation coefficients listed on Table 5 are analogous to the slope in the equation for a straight line ($y = mx + b$), with m being the correlation coefficient and x being a binary variable (1 = yes, 0 = no). As expected, prolonged intubation was associated with 9 fewer ventilator-free days (95% CI, 12–16 fewer

TABLE 3. Tracheal Repair Data

	EXT (n = 40)	INT (n = 30)	TRACH (n = 33)	*p*
Type of surgeon				<0.01
Trauma	39 (98%)	23 (77%)	22 (71%)	
ENT	1 (2%)	6 (20%)	9 (29%)	
Other	0 (0%)	1 (3%)	0 (0%)	
Incision				0.07
SCM	15 (39%)	7 (26%)	4 (12%)	
Collar	21 (55%)	17 (63%)	24 (73%)	
Wound	1 (3%)	0 (0%)	3 (9%)	
Other	1 (3%)	3 (11%)	2 (6%)	
Destructive injury	5 (13%)	6 (20%)	11 (34%)	0.08
Ring resection	0 (0%)	1 (3%)	5 (15%)	0.02
Suture				1.00
Absorbable	31 (82%)	22 (81%)	21 (84%)	
Nonabsorbable	7 (18%)	5 (19%)	4 (16%)	
Suture				0.72
Monofilament	19 (50%)	16 (59%)	12 (50%)	
Braided	19 (50%)	11 (47%)	12 (50%)	
Esophageal injury	2 (5%)	8 (27%)	8 (25%)	0.02
Arterial injury	1 (3%)	4 (13%)	1 (3%)	0.15
Venous injury	8 (21%)	10 (33%)	4 (13%)	0.14
Local flap	13 (33%)	13 (43%)	9 (27%)	0.59

Continuous variables are displayed as median (25th quartile to 75th quartile).
SCM, sternocleidomastoid.

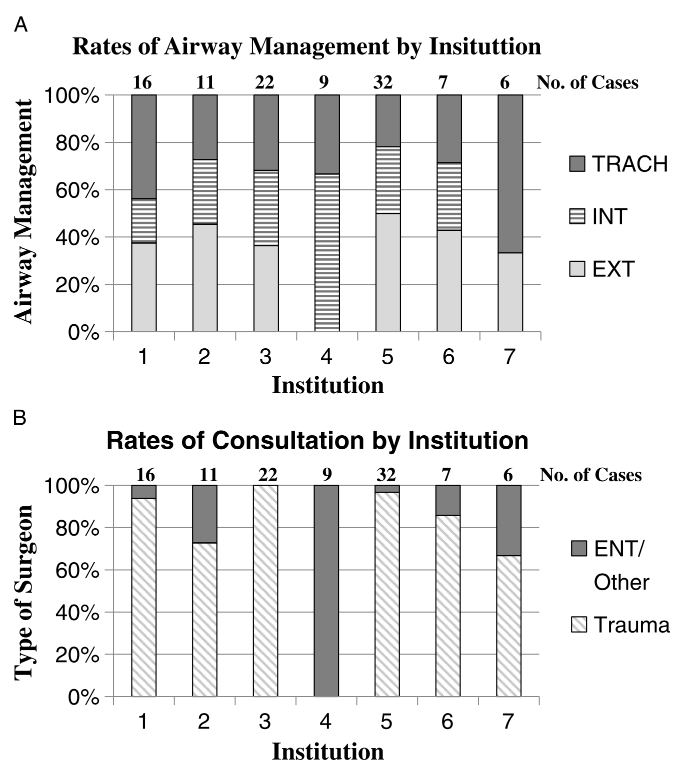

Figure 1. *A*, Rates of immediate or early extubation (EXT), prolonged intubation (INT), and immediate tracheostomy (TRACH) by participating institution. *B*, Rates in the use of consulting surgical services for repair of cervical tracheal injury by participating institution.

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TABLE 4. Outcomes

	EXT (n = 40)	INT (n = 30)	TRACH (n = 33)	p
Disposition				<0.01
Home	40 (100%)	21 (71%)	27 (82%)	
Skilled nursing facility	0 (0%)	1 (3%)	1 (3%)	
Rehabilitation facility	0 (0%)	1 (3%)	3 (9%)	
Other	0 (0%)	3 (10%)	2 (6%)	
Death	0 (0%)	4 (13%)	0 (0%)	
Hospital-free days	27 (24–28)	12 (5–22)	16 (10–22)	<0.01
ICU-free days	29 (28–30)	22 (8–25)	26 (21–29)	<0.01
Ventilator-free days	30 (29–30)	25 (12–27)	28 (28–30)	<0.01
In-hospital mortality	0 (0%)	4 (13%)	0 (0%)	<0.01
Complications				
SSI	2 (5%)	4 (13%)	7 (21%)	0.11
Leak from repair	3 (8%)	4 (13%)	1 (3%)	0.31
TEF	0 (0%)	0 (0%)	2 (7%)	0.08
Pneumonia	0 (0%)	7 (23%)	3 (9%)	<0.01
Sepsis	0 (0%)	6 (20%)	5 (15%)	<0.01

Continuous variables are displayed as median (25th quartile to 75th quartile).

ventilator-free days, $p < 0.01$) and 10 fewer ICU-free days (95% CI 13–6 fewer ICU-free days, $p < 0.01$).

DISCUSSION

In this retrospective, multicenter study, immediate or early extubation following cervical tracheal injury repair was common and safe. However, among those with more severe tracheal or extratracheal injuries, immediate tracheostomy versus prolonged intubation presents a risk-benefit decision. While immediate tracheostomy placement is associated with increased risk of SSI, prolonged intubation is associated with a higher risk of pneumonia and mortality and fewer ICU-free and ventilator-free days. These findings are important for several reasons.

First, patients undergoing immediate or early extubation remained free of airway issues postoperatively. The ventilator-free (median, 30; IQR, 29–30) and hospital-free (median, 27; IQR, 24–28) days reveal that few patients were reintubated after extubation, and the majority had short hospital stays. The maximum number of ventilator days in the EXT group was 2, indicating a single, brief reintubation. All patients were discharged home, and the overall SSI rate was 5%.

Second, this is the first report that begins to quantify the risks and benefits associated with prolonged intubation and immediate tracheostomy. In a report of 29 penetrating cervical tracheal injuries, Levy et al. reported that all wound infections occurred in patients undergoing tracheostomy but were unable to identify an association.[9] Immediate or early extubation is not always feasible as a result of alcohol or drug intoxication or concomitant brain, chest, or other significant injuries. While immediate tracheostomy may result in more ventilator-free days, it is associated with increased rates of SSIs, which contribute to increased hospital lengths of stay and costs. Prolonged intubation may mitigate this risk of SSI but is associated with fewer ICU-free and ventilator-free days.

Lastly, the difference in postoperative airway management by type of surgeon and institution is intriguing. Head/neck AIS values and the rate of destructive injuries were not significantly different among the three groups. While this suggests that it is the extratracheal injuries that ultimately determine airway management postoperatively, the background and training of trauma surgeons and consulting surgeons may also influence the subsequent airway management. In addition, local institutional practices may also be a predominate factor influencing either the consultation of another service or the choice of postoperative airway management.

The limitations of this study are multiple. First, while the number of patients included are quite large compared with the incidence of the injury, they remain small for some statistical modeling. Second, no long-term follow-up is available for the patients in this cohort. Third, indication bias for the treatment of choice may be present as we cannot retrospectively determine why some patients had tracheostomies placed or why some had consultations.

CONCLUSION

In conclusion, immediate or early extubation following cervical tracheal injury repair is safe for appropriate patients. However, among those with more severe extratracheal injuries, immediate tracheostomy versus prolonged intubation presents a risk-benefit decision. While immediate tracheostomy placement is associated with increased risk of SSI, prolonged intubation is associated with a higher risk of pneumonia and mortality and fewer ICU-free and ventilator-free days.

TABLE 5. Regression Models

Multiple Logistic Regression Model Predicting SSI			
	Odds Ratio	**95% CI**	***p***
Prolonged intubation	3.58	0.47 to 27.21	0.22
Tracheostomy	9.56	1.35 to 67.95	0.02
ISS	1.02	0.95 to 1.09	0.61
Blunt mechanism	6.57	0.51 to 84.76	0.15
Black race	0.17	0.30 to 1.03	0.05
Destructive injury	0.54	0.05 to 6.42	0.63
Multiple Linear Regression Model Predicting Ventilator-Free Days			
Prolonged intubation	−9.24	−12.30 to −6.18	<0.01
Tracheostomy	−1.44	−4.44 to 1.55	0.34
Age, y	−0.12	−0.22 to −0.01	0.03
Male sex	−2.35	−6.02 to 1.33	0.21
Blunt mechanism	−1.37	−5.58 to 2.85	0.52
Black race	0.002	−2.84 to 2.84	1.00
ISS	−0.16	−0.28 to −0.04	<0.01
Multiple Linear Regression Model Predicting ICU-Free Days			
Prolonged intubation	−9.64	−12.66 to −6.62	<0.01
Tracheostomy	−2.69	−5.60 to 0.23	0.07
Age, y	−0.13	−0.23 to −0.03	<0.01
Male sex	−2.17	−0.58 to 1.47	0.24
Blunt mechanism	−4.16	−8.31 to −0.01	0.05
Black race	0.88	−1.89 to 3.65	0.53
ISS	−0.21	−0.33 to −0.09	<0.01

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AUTHORSHIP

J.A.H. conceived and designed the study. J.A.H, E.A.T., D.M.S., E.D., M.A. V., L.M.K., C.R.E., and M.D.G. acquired the data. J.A.H., E.A.T., B.A.C., J.B., D.M.S., E.D., K.I., M.A.V., O.G., L.M.K., E.R.H., C.R.E., J.A.W., M.D.G., B.R. H.R., and J.B.H. analyzed and interpreted the data. J.A.H. drafted the manuscript. J.A.H., E.A.T., B.A.C., J.B., D.M.S., E.D., K.I., M.A.V., O.G., L.M.K., E.R.H., C.R.E., J.A.W., M.D.G., B.R.H.R., and J.B.H. critically revised the manuscript. J.A.H. and B.A.C. performed the statistical analysis.

DISCLOSURE

The authors declare no conflicts of interest.

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DISCUSSION

Dr. J. Wayne Meredith (Winston-Salem, North Carolina): I don't know if you noticed it during the talk, but this began as a question that comes up on rounds, and was then translated into trying to find a way to answer that practical question. I think that's how science is best done and I applaud you for that tremendously. It doesn't always work. Sometimes it's harder to figure out an answer than one might hope or expect. But I do think that is terrific.

This group has done a multicenter trial. My mental model of this is you go to your friends and say, "Here, fill out this form for all the cervical tracheal injuries you have had for the last ten years"—turns out it is 14 years—and they fill out a form on each of those patients. You get a database and you hand it to statisticians and you just keep grinding away at it until it confesses, right? That's sort of my mental model, and I will get back to that later because I think there are things you can learn about how to get more from this.

A couple of points that are important from this paper. It is a very rare injury, seven very busy trauma centers, 14 years, 100 patients, basically 120 cervical tracheal injuries. These are less common than thoracic injuries and way less common than laryngeal injuries. To put this in perspective, this is something that if you see 4,000 injuries a year you're going to see this once a year, on average. I think that really puts it in perspective.

In reading the manuscript, I had hoped to ask you to break out blunt and penetrating, break out if there were any outlier centers. I think you did that very nicely in your talk. And I think it elucidates some of the points to try to do this kind of work in that a lot of the decisions you describe are personal preference—how manage it, a lot of this comes from carry-over mythology of what is going on.

To some extent you need to do a tracheostomy. You can protect a tracheostomy of an injury that is pretty proximal if you protect that airway. And it's hard to do a tracheostomy of the injury is very close to the larynx. And I think you missed some of that flavor in how to look at this.

If you could break out in your manuscript how those things work—I would also recommend the authors look at the paper when Dr. Peitzman studied splenic injuries and the nonoperative management of splenic injuries. The best paper from that was the second paper where he had the authors send operative notes and discharge summaries and he went through those. With 100 patients you could do that.

You could get from those operative notes the logic behind why the surgeons chose what they chose and see if that logic worked. I think that would tell us a lot more than the associations which you have described here.

I congratulate these authors. These data are very clearly and very candidly described. I think it is the biggest paper on this subject that we have seen and I think it is an excellent contribution to the literature. There is even more you can glean from this by doing some of these other steps.

Dr. Robert Wilson (Detroit, Michigan): I think that the way you manage this is largely related to the severity of the injury and its location. However, Grillo had a number of things that could be added to help.

One of the things that is particularly important, if there is an associated vascular injury, putting a muscle patch over the repair can be helpful. And the strap muscle that you mobilize to put over that may improve blood supply and healing.

Grillo also pointed out that for some of these cases using sutures from a ring above and a ring below to take the tension off the repair would help in the healing of the primary repair.

I think anybody who might be involved in this would do well to read some of Grillo's literature on managing tracheal injuries. On some of these bad ones, you might even have to do a laryngeal or lung release to try to keep tension off the repair.

Dr. Nicholas Namias (Miami, Florida): The paper was beautifully presented but I think I would be less self-deprecating in your limitations. Your limitations are actually your strengths.

You have 14 years from seven major Level I busy trauma centers. You answered a question in a way that nobody else will ever answer it. There will never be a prospective, randomized

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controlled trial of this. And sometimes we need a leader in the field to tell us this.

Jean Louis Vincent in 2010 in CCM had an editorial I came across that really sparked some energy in me. He said in the title, "We should abandon randomized, controlled trials in the intensive care unit."

Now that might be a little extreme but the point is large dataset observation that is possible now because of our electronic records really might provide the best evidence there is. Congratulations on a great paper.

Dr. David V. Feliciano (Indianapolis, Indiana): Retrospective data are interesting to look at, but there was never any proof that adding a tracheostomy made healing of a tracheal repair better.

This paper should suggest to the younger members of the audience that there is a tremendous tie-in between elective practice and trauma practice in many areas. If you are going to repair tracheal injuries and you have not read Drs. Grillo and Mathisen's papers, you are in the wrong business. All the things Bob just mentioned are in those papers about how to do it right—namely, don't devascularize the trachea and don't get real fancy with your sutures.

In the one center that was highlighted here, you have all these tracheostomies done and there is absolutely no indication for it. I agree with Bob that, if you have a huge hole, it becomes a tracheostomy and you can reconstruct it later. If you have a smaller hole you fix it. We never used permanent sutures at Grady because they can cause inflammation in the tracheal lumen. And you put a muscle flap on top of a complex repair, but it shouldn't be a strap. It should be a sternocleidomastoid muscle flap using the sternal head.

Dr. John A. Harvin (Houston, Texas): Thank you all for your comments. Dr. Meredith, thank you for reviewing the paper.

While I did not review the operative notes of all patients in the study, we did try to get a feel for the severity of the injury. On the dataset, we attempted to get the specific number of rings that were injured and in how many different places each ring was injured to get a feel for the severity of tracheal injury.

Unfortunately, retrospectively, we really were not able to do that in a majority of papers. The operative notes were not specific enough.

Dr. Wilson, thank you for your comments. In a similar vein, we tried to describe the severity of tracheal injuries so that we could understand why people got tracheostomies. We were unable to do so retrospectively.

Dr. Namias and Dr. Feliciano, thank you both for your comments. I appreciate them both. Thank you.

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