EDITORIAL

Deconstructing DISSECT—Percutaneous Tracheostomy in India

Atul P Kulkarni

Indian Journal of Critical Care Medicine (2020): 10.5005/jp-journals-10071-23494

"In God we trust, all others must bring data."

W. Edwards Deming

The word tracheostomy originated from two Greek words: the root tom- (from Greek τομή tomḗ) meaning "to cut", and the word trachea (from Greek τραχεία tracheía). The oldest mention of tracheostomy can be found in the Hindu Medical text, RigVeda, 4,000 years back.[1,2] Later, in 1550 BC, the Ebers Papyrus described tracheostomy. Surgical tracheostomy (ST) was performed for many of those afflicted during the 1952 Copenhagen polio epidemic, sadly all 15 patients who had tracheostomy died.[3]

Sanctorius, an Italian surgeon, was probably the first to perform percutaneous tracheostomy in the 16th century, however, it was Sheldon who used the word 'percutaneous tracheostomy' in 1955.[4] We started performing percutaneous dilatational tracheostomy (PDT) in India in mid-90s, initially using the Grigg's technique. Over the last 2 decades, percutaneous tracheostomy is being increasingly done in most Indian ICUs, safely, even in coagulopathic patients.[5,6]

In this issue of IJCCM, Gupta et al., report the results of DISSECT, a multicenter prospective observational study of PDTs, carried out over 3 months in Indian ICUs.[7] Nine hundred twenty three tracheostomies were performed in 67 ICUs, majority being percutaneous tracheostomies (72.6%). Single dilator technique (60%) was the commonest technique, followed by the Guide-wire Dilating Forceps (GWDF) (29%) and Ciaglia, multiple dilator technique (11%). Most intensivists (58%) performed PDT without using either fiberoptic bronchoscopy (28%) or ultrasonography (14%) for guidance. PDT was done faster than ST, and hemorrhage or desaturation occurred less often with PDT. The authors reported that cost, as reported by the participants, was lower for PDT.

This study for the first time reports the increasing preference of Indian intensivists for PDTs in their patients. A similar trend was reported for the period 2007–2014 in USA, where the no. of tracheostomies performed by the pulmonary and critical care physicians increased from 7.2% in 2007 to 14.1% in 2014.[8] The tracheostomies were performed by pulmonary and critical care/CC physicians more often if they worked in large hospitals (>500 beds) and in major academic centers. Though we do not have data earlier than the DISSECT study from India, the large case series from Kumar et al., gives a similar signal from India.[6]

Apart from the limitations mentioned by the authors, there are other limitations to this data. That PDT is a safe procedure is generally accepted. However, PDT has some limitations. In DISSECT, there were patients where PDT was not performed, due to reasons such as absence of adequate skill, admitting consultant opinion, coagulopathy, PDT cost thought to be high, short neck, FOB or USG not being available. Disregarding coagulopathy and admitting consultant opinions as the reason for not doing PDT, literature shows that the operator may face technical difficulties during PDT.

Division of Critical Care Medicine, Department of Anesthesia, Critical Care and Pain, Tata Memorial Center, Homi Bhabha National Institute, Parel (E), Mumbai, Maharashtra, India

Corresponding Author: Atul P Kulkarni, Division of Critical Care Medicine, Department of Anesthesia, Critical Care and Pain, Tata Memorial Center, Homi Bhabha National Institute, Parel (E), Mumbai, Maharashtra, India, Phone: +91-22-24177049, e-mail: kaivalyaak@yahoo.co.in

How to cite this article: Kulkarni AP. Deconstructing DISSECT—Percutaneous Tracheostomy in India. Indian J Crit Care Med 2020; 24(7):496–497.

Source of support: Nil

Conflict of interest: None

In a systematic review comparing PDT vs. ST, Klotz et al., looked at perioperative and postoperative complications.[9] Both techniques were safe with low incidence of complications. However, the rate of technical difficulties with PDT was higher (7.3%) compared with ST (1.8%). The risk difference between the two techniques was 0.04 (95% CI 0.01–0.08, $p = 0.01$). Twelve cases in the PDT group had to be converted to ST because of technical difficulties (1.7%). Putensen et al. reported 4 main types of technical difficulties in their systematic review, difficult insertion, difficult dilatation, both difficult insertion and dilatation and false passage. The OR for technical difficulties with PDT was 4.58 (95% CI 2.21–9.47, $p < 0.0001$).[10]

We need to be cautious while accepting that cost of PDT is lower than surgical tracheostomy, based on DISSECT study alone.[7] The study was not actually designed to look at the costs and these were not actually measured, which in in itself is not easy to do. You have to take into account apart from the cost of the disposables, the costs of manpower (amount of time spent per individual who performed PDT), the cost of other equipment (disposable and reusable i.e., FOB or USG), the cost of drugs used, cost of platelet transfusion, etc. The previous studies concluding PDT to be cheaper bank on two facts: need for operating room time and the surgical charges, which are both not applicable to the PDT at the bedside. Levin et al. compared the costs of ST performed in OT or ICU with PDT.[11] They found that the costs of ST in OT (2071$) and ICU (1997$), which included OT, surgical and anesthesia charges and staff charges, were nearly same. The surgeon charges were the same for PDT, however, there were no anesthesia or staff charges and reduced equipment charges. Due to additional cost of bronchoscopy (628$), the total charge, even for PDT was 1632$. They estimated that if the ST were done at the bedside, without anesthesia charges, it would be cheaper (1542$). Pattnaik et al. showed in over 300 patients that PDT can be done safely without fiberoptic guidance, while Kumar et al. found that PDT can be performed safely even in coagulopathic patients.[5,6]

In contrast, a recent study reported that while it was safe to do PDT without the bronchoscope, use of the bronchoscope was significantly associated with complications (adjusted OR, 6.7; 95% CI, 1.3–43.4; $p = 0.04$) after adjusting for other factors. This is surprising to say the least and needs to be confirmed in other studies. Overall it appears that PDT can be done at the bedside even without FOB or real-time USG. A prospective study is therefore needed to ascertain the exact cost benefit conferred by a bedside PDT.

The other aspect of PDT that remains unexplored is the long-term outcomes of the patients who have undergone PDT as compared to the ST. An animal study looked at the acute tracheal injuries, caused by different PDT techniques and concluded that similar posterior tracheal wall injuries occurred with all techniques.[12] In an earlier postmortem histopathological study, Stoeckli et al. reported that there was minimal trauma to the pretracheal tissues in patients who had undergone PDT. However at the site of introduction of PDT, there were extensive injuries to the tracheal wall as compared to ST. There were cartilage fractures with displaced fragments of cartilage and scarring in one third of patients, who had undergone PDT. They suggested that theoretically there was higher risk of tracheal stenosis with PDT.[13] Raghuraman et al. reported the findings of a combined prospective and retrospective study on surgical repair of tracheal stenosis caused by PDT (15 patients) and ST (14 patients), over a 10-year period (1993–2003).[14] The stenotic lesions caused by PDT were significantly closer to the vocal cords, mean distance of lesion from vocal cords with PDT was 1.6 cm [95% CI, 1.1–2.1) vs 3.4 cm (95% CI, 2.3–4.5), with ST. (p value < 0.04). This translated into the need for partial resection of cricoid cartilage and mucosal flap in 7 of 15 patients in PDT group when compared to only 1 of 14 patients in the ST group. Kim et al. reported similar findings in 2017.[15] They found that patients who developed tracheal stenosis after PDT had higher incidence of proximal (subglottic) stenosis when compared to those with ST or intubation-related stenosis. The patients therefore needed more complex subglottic tracheal resection followed by trachea-to-thyroid cartilage anastomosis. The proximal location of the stenosis after PDT can possibly be attributed to the failure to identify the tracheal cartilages correctly, tracheostomy tube malpositioned through either the cricoid cartilage or the first tracheal ring. The fracture of the tracheal cartilages during the PDT can also be responsible for these findings. In a recent study from the United States of 71,446 tracheostomies performed in 2013, 739 (1.05%) patients visited the emergency department within 1 year. Of the total patients readmitted, tracheal stenosis after tracheostomy comprised of 27.0% (95% CI, 25.4–28.6%) of all admissions. Of these, 3.7% (95% CI, 2.7–5.1%) patients died. However, this study does not tell us about the incidence of significant (enough to make patient symptomatic) tracheal stenosis over a longer length of follow-up, which is very likely higher.[16] Further long-term studies are needed to elucidate the risk factors for complex stenotic lesions after PDT. Studies are therefore needed to develop strategies for more accurate placement of the tracheostomy tube, while performing PDT, to avoid this dreaded complication.

The support given by the research committee of Indian Society of Critical Care Medicine to undertake an important study evaluating many facets of a commonly performed procedure, such as PDT, must be appreciated. Time has come for us to utilize the immense potential of the clinical material at our disposal to conduct more such studies.

References

1. Borman J, Davidson JT. A history of tracheostomy: Si spiritum ducit vivit (Cicero). Br J Anaesth 1963;35:388–390. DOI: 10.1093/bja/35.6.388.
2. Pierson DJ. Tracheostomy from A to Z: historical context and current challenges. Respir Care 2005;50(4):473–475.
3. Lassen HCA. A preliminary report on the 1952 epidemic of poliomyelitis in Copenhagen with special reference to the treatment of acute respiratory insufficiency. Lancet 1953;1(6749):37–41. DOI: 10.1016/S0140-6736(53)92530-6.
4. Petros S. Percutaneous tracheostomy. Crit Care 1999;3(2):R5–R10. DOI: 10.1186/cc340.
5. Pattnaik SK, Ray B, Sinha S. Griggs percutaneous tracheostomy without bronchoscopic guidance is a safe method: a case series of 300 patients in a tertiary care intensive care unit. Indian J Crit Care Med 2014;18(12):778–782. DOI: 10.4103/0972-5229.146303.
6. Kumar P, Govil D, Patel SJ, Jagadeesh KN, Gupta S, Srinivasan S, et al. Percutaneous tracheostomy under real-time ultrasound guidance in coagulopathic patients: a single-center experience. Indian J Crit Care Med 2020;24(2):122–127. DOI: 10.5005/jp-journals-10071-23344.
7. Gupta S, Tomar DS, Dixit S, Zirpe K, Choudhry D, Govil D, et al. Dilatational percutaneous vs surgical tracheostomy in intensive care UniT: a Practice pattern observational multicenter study (DISSECT). Indian J Crit Care Med 2020;24(7):514–526.
8. Nishi SPE, Shah SK, Zhang W, Kuo YF, Sharma G. Timing and outcomes of tracheostomy performed by pulmonary and/or critical care physicians. J Intensive Care Med 2020;35(6):576–582. DOI: 10.1177/0885066618770380.
9. Klotz R, Probst P, Deininger M, et al. Percutaneous vs surgical strategy for tracheostomy: a systematic review and meta-analysis of perioperative and postoperative complications. Langenbecks Arch Surg 2018;403(2):137–149. DOI: 10.1007/s00423-017-1648-8.
10. Putensen C, Theuerkauf N, Guenther U, Vargas M, Pelosi P. Percutaneous and surgical tracheostomy in critically ill adult patients: a meta-analysis. Crit Care 2014;18(6):544. DOI: 10.1186/s13054-014-0544-7.
11. Levin R, Trivikram L. Cost/benefit analysis of open tracheotomy, in the or and at the bedside, with percutaneous tracheotomy. Laryngoscope 2001;111(7):1169–1173. DOI: 10.1097/00005537-200107000-00008.
12. Demirel CB, Haltaş H, Pampal HK, Unal Y, Işşk B, Uysal M. Comparison of the effects of different percutaneous tracheotomy techniques on acute tracheal trauma. Turk J Med Sci 2014;44(1):68–72. DOI: 10.3906/sag-1212-62.
13. Stoeckli SJ, Breitbach T, Schmid S. A clinical and histologic comparison of percutaneous dilational vs conventional surgical tracheostomy. Laryngoscope 1997;107(12 Pt 1):1643–1646. DOI: 10.1097/00005537-199712000-00012.
14. Raghuraman G, Rajan S, Marzouk JK, Mullhi D, Smith FG. Is tracheal stenosis caused by percutaneous tracheostomy different from that by surgical tracheostomy? Chest 2005;127(3):879–885. DOI: 10.1378/chest.127.3.879.
15. Kim SS, Khalpey Z, Hsu C, Little AG. Changes in tracheostomy- and intubation-related tracheal stenosis: implications for surgery. Ann Thorac Surg 2017;104(3):964–970. DOI: 10.1016/j.athoracsur.2017.03.063.
16. Johnson RF, Saadeh C. Nationwide estimations of tracheal stenosis due to tracheostomies. Laryngoscope 2019;129(7):1623–1626. DOI: 10.1002/lary.27650.