Editorial

Percutaneous dilatational tracheostomy: Guided well with real-time ultrasound

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Percutaneous dilatational tracheostomy (PDT) has almost replaced conventional surgical tracheostomy in the intensive care unit (ICU). PDT is a bedside procedure, performed conveniently by the intensivist and obviates the need for transporting an unstable patient on high FIO_2 and positive end-expiratory pressure (PEEP) maybe with multiple inotropes for hemodynamic instability to the operating room for conventional tracheostomy, which may involve travel to a remote/distant part of the hospital with its associated hazards. Particularly in India where cost and availability of operating theater and ear, nose and throat surgeons can also be an issue in smaller hospitals/nursing homes this may not only delay the procedure but also substantially add to the total cost of hospital care. Several studies have demonstrated that PDT is as safe and cheaper than conventional surgical (open) tracheostomy.[1]

Traditionally, PDT has been associated by bronchoscopic guidance to avoid injury to surrounding structures, high placement of the tracheostomy tube, injury to the posterior tracheal wall and in confirming correct placement in the tracheal lumen.[2] Bronchoscopy has the disadvantage of requiring the equipment and trained staff, which may be difficult to obtain in a short period of time particularly in an environment of resource crunch in smaller centers. This also may be hazardous in terms of hypoxemia in severe acute respiratory distress syndrome requiring high PEEP, which is lost during bronchoscopy and also risk of hypercarbia and raised intracranial pressure in patients with acute brain injury.[3] It also fails to identify the soft-tissues and vessels in the neck to avoid bleeding and thyroid injury. Furthermore bronchocopy adds to the cost of the procedure in patients who are already under substantial financial strain in the ICU.

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In this issue of Indian Journal of Critical Care Medicine Mitra *et al*. in a retrospective analysis have described a series of 12 patients who underwent PDT under ultrasound guidance with 100% success.[4] The authors themselves have described the limitations of this study as being retrospective, without bronchoscopic confirmation, with small numbers, no control group and limited follow-up. Still this is an important paper from the Indian perspective.

When compared to the larynx, the trachea lies at a deeper plane and visual aid to facilitate needle insertion might be a great help. Bedside ultrasound equipment is a commonly available tool in most ICUs. The intensivist regularly uses it for vascular access and nerve blocks and in the West central venous cannulation requires mandatory use of ultrasound. In India short courses for ultrasound training for ICU are regularly conducted through the Indian Society of Critical Care Medicine which end with certification.

The structures visualized are the thyroid and cricoid cartilages, vocal cords, thyroid gland, tracheal rings, endotracheal tube and cuff, tracheal lumen and vascular

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structures in that area. Sonographic identification of the vessels may help preventing bleeding from pretracheal vascular structures and accidental placement of the tracheostomy tube above the first tracheal ring, fracture of tracheal rings or tube insertion into a false passage. It also shows indentation of the soft-tissue and the anterior tracheal wall by the insertion needle,[5] while avoiding vascular structures in the surrounding neck area. This also may make the procedure safer and easier in either the patients in whom the anatomy is not easily palpable like in morbidly obese patients or those in whom the neck cannot be extended, e.g., in patients with cervical spine precautions. In obese patients the thickness of the soft tissues between the skin and the trachea at that level with head in the neutral position was successfully performed in all 13 patients by Rajajee *et al*.[5] They used a Sonosite M turbo (Sonosite Inc., Bothell UA, USA) machine with 10-5 MHz linea array probe and sterile sheath. The route of imaging was set to maximal resolution and the depth of imaging adjusted to keep the trachea just within the screen. Transverse/axial rather than longitudinal/sagittal real time imaging was performed. The needle path is clearly visualized up to the midline of the anterior tracheal wall. On axial imaging the airway in the neck is clearly seen in the midline with mixed hyperechogenicity within the air filled lumen.

The cricoid cartilage has relatively larger acoustic shadow, caudal to the thyroid cartilage and the tracheal rings have thinner acoustic shadows within the anterior tracheal wall. The anterior tracheal wall is punctured ideally between the 2nd and 3rd tracheal ring avoiding the vascular structures. The needle is introduced perpendicular to the skin and the needle path is seen as a clearly visible acoustic shadow ahead of the needle followed by soft-tissue displacement with the needle passage, along with indentation of the anterior tracheal wall. The needle can be visualized in out of plane mode, i.e., needle path is determined by distinct acoustic shadow ahead of the needle on a transverse section. The guide wire is visualized as a hyperechoic signal on transverse and longitudinal sections. The operator may change the puncture site because of tracheal coverage by the thyroid gland, aberrant vessels or tracheal deviation.

Finally, confirmation of correct endotracheal positioning can be done by “sliding sign” i.e., movement of the visceral over the parietal pleura on imaging through intercostal the space. The whole process adds only 10-15 min to the procedure time. Ultrasonography in the ICU is here to stay. Its utility for performing PDT is well-established although in small, single centers, non-randomized studies. It does reduce complications of PDT and ensures correct placement of the tracheostomy tube making the procedure safer and cheaper.

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