

# The Role of Cricothyrotomy, Tracheostomy, and Percutaneous Tracheostomy in Airway Management

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## KEYWORDS

- Cricothyrotomy • Airway management • Percutaneous dilational tracheostomy
- Surgical tracheostomy

## KEY POINTS

- Cricothyrotomy (CRIC), percutaneous dilational tracheostomy (PDT), and surgical tracheostomy (ST) placement are important means of securing an artificial airway in patients with acute or chronic respiratory failure.
- Use of CRIC or ST is effective in acute/emergency upper airway obstruction, allowing establishment of an airway in cannot intubate/cannot oxygenate scenarios.
- PDT and ST are safe and cost-effective procedures performed on patients requiring prolonged mechanical ventilation, typically in the intensive care setting.
- A growing body of literature has demonstrated that PDT is not only equivalent in outcomes, but may in fact be a superior modality.

## INTRODUCTION

The establishment of an artificial airway by means of surgical incision is a procedure dating to the 36th century BC Egypt.<sup>1</sup> A more famous example from antiquity is its

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performance by Alexander the Great (356–323 BC), who was reported to have performed a tracheostomy on a choking soldier in his army, "...opened the trachea of a choking soldier with the point of his sword."

Over the ensuing 2500 years, the practice was variously reported and refined, yet seemed to fall out of favor until the 16th century, when Italian surgeon Antonia Brasavola performed the procedure on a patient dying from asphyxiation from an upper airway obstruction and is quoted as saying, "...when there is no other possibility, in angina, of admitting air to the heart, we must incise the larynx below the abscess."<sup>2</sup>

It was not until the early 20th century that placement of artificial airways regained popularity after standardization of the open surgical technique by Chevalier Jackson. Jackson's standardization of the surgical tracheostomy (ST) technique is credited with reducing the operative mortality associated with tracheotomy at that time from 25% to 1%. He recognized and emphasized the importance of adequate oxygenation during the procedure, as well as maintaining control of the airway. He also further advanced all surgical techniques by recognizing the importance of postoperative care. In the 1930s, tracheostomy was advocated as an effective way to provide adequate bronchopulmonary toilet in patients with polio. Because of the continued modern track record of safety associated with ST along with the widespread use of positive pressure ventilation in the 1950s, there was considerable effort focused on the development of tracheostomy tubes as a means of providing long-term ventilatory support.<sup>2</sup> Following this era, cricothyrotomy (CRIC) and percutaneous dilational tracheostomy (PDT) were introduced as alternative techniques. Although these techniques have not replaced ST, they have been shown to be safe and effective. This has led to a growing body of literature attempting to parse out which patients would benefit most from each individual technique. This article discusses each technique, its indications, contraindications, complications, and the comparative data.

## **CRICOTHYROTOMY**

### ***History of Cricothyrotomy***

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First described in 1805, then successfully performed in 1852, CRIC was introduced long after the first tracheostomy was performed. Initially championed by Chevalier Jackson, who in 1909 described the surgical technique and considerations to successfully perform the procedure, he later abandoned the technique after publishing a case series of 200 patients with post-CRIC tracheal stenosis.<sup>3</sup> In 1976, Brantigan published a case series of 655 patients in which the overall complication rate was 6.1%, with only 8 patients developing tracheal stenosis, 5 of whom required resection of the lesions.<sup>4</sup> This publication combined with subsequent case series reporting low rates of postsurgical complication again popularized the procedure as a method of emergency airway management.

## **CURRENT TECHNIQUES FOR CRICOTHYROTOMY**

### ***Surgical Cricothyrotomy***

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Surgical CRIC (SCRIC) is performed by identifying the cricothyroid membrane and immobilizing the larynx. Once done, a vertical incision is made first cutaneously, then horizontally through the cricothyroid membrane. A tracheal hook is then inserted superiorly and is used to lift the thyroid cartilage. The incision is dilated using forceps, and a small endotracheal or tracheostomy tube is inserted into the distal airway and fixed in place. A modified 4-step technique involves incision of both the skin and cricothyroid membrane in a single horizontal motion followed by insertion of the tracheal hook inferiorly stabilizing the trachea. The endotracheal or tracheostomy tube is then placed and secured.

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