კლინიკური კვლევა

FEATURES OF OPEN SURGICAL TRACHEOSTOMY IN INTENSIVE CARE UNIT (ICU) PATIENTS

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Rezume

Tracheostomy is the most common procedure in the intensive care unit. Its indication is mainly prolonged intubation. Various studies have determined that 10% of intubated patients require a tracheostomy.

The article discusses the anatomical features of the neck, trachea, and thyroid gland. 70 cases of open surgical tracheostomy performed in intensive care patients over a continuous two-year period are presented, including 53 (75.7%) patients over 60 years of age.

The importance of correct positioning of the patient on the operating table and selection of a skin incision on the anterior surface of the neck is presented. Technical aspects of the operation, selection of the correct localization of the tracheal incision by the surgical team. In intensive care patients, preference is given to relatively "high" tracheostomies, mobilization of the isthmus and edges of the thyroid gland.

Open surgical tracheostomy in intensive care patients is not an easy operation to perform. The operation must be performed in an operating room with appropriate equipment, by a suitably qualified team.

Key words: Tracheostomy; Open Surgical Technique; Intensive Care Unit; Mechanical Ventilation; Thyroid Gland Anatomy.

Tracheostomy represents one of the oldest known surgical procedures, with images dating back to 3600 BC. In the early twentieth century, Chevalier Jackson established the principles of tracheostomy, which clinicians still follow today [1,2,3].

The term "tracheostomy" refers to the surgical creation of a stoma that opens the trachea onto the anterior surface of the neck.

Tracheostomy currently constitutes the most common surgical procedure in patients receiving mechanical ventilation. Various studies report that intensive care unit physicians perform tracheostomy in approximately 10% of ICU patients. The main indications for this procedure include prolonged endotracheal intubation, frequent lower airway clearance, and upper airway obstruction [1,6]. Many authors consider it appropriate to perform tracheostomy after 9–10 days of intubation [1,2,5].

Although tracheostomy is the most frequently performed surgical procedure in intensive care patients, surgeons have not yet established a single, universally accepted method [5]. We usually describe the tracheostomy as upper, middle, or lower, in relation to the thyroid isthmus. Because the anatomical relationships vary considerably, the terms "upper" and "lower" do not always correspond to "high" and "low" tracheostomy. This has been emphasized by V.S. Lyande (1957) and M.K. Perelman (1972) [6].

According to various authors, the trachea consists of 16–20 or 18–22 cartilaginous rings. In the cervical region, surgeons usually identify 4–5 rings; every 1 cm of tracheal length contains roughly two rings, each about 4 mm wide. On average, the trachea measures 10–13 cm in men and is shorter in women.

The isthmus of the thyroid gland most commonly overlies the 2nd to 4th tracheal rings [3,4,7].

The anatomical configuration of the thyroid gland also plays an important role. In 1895, C.F. Marshall noted that it is difficult to define a single "normal" anatomy of the thyroid gland. He proposed a classification based on differences in the presence and position of the pyramidal lobe and described 17 distinct forms [7].

Large-scale studies from the UK, which analyzed 70 general intensive care units, showed that performing a tracheostomy within the first 4 days of ICU care does not reduce mortality. These studies also demonstrated that intensive care physicians cannot reliably predict which patients will ultimately require tracheostomy [1,2,5,6].

In 1998–2000, M.A. Ognerubov and co-authors described 12 variants of thyroid morphology:

1. Pyramidal lobe on the right (12%)
2. Pyramidal lobe in the center (17%)
3. Pyramidal lobe on the left (31.4%)
4. Butterfly-shaped (30.6%)
5. Without a bridge (lobes separated) (21.7%)
6. Asymmetrical (11.2%)
7. Large and wide isthmus (8%)
8. Thin and narrow isthmus (8.25%)

9. Triangular shape (10.8%)
10. Crescent shape (12.8%)
11. "H" shape (11.1%)
12. Without a bridge, with lobes in close contact (3.3%)

The upper edge of the thyroid gland may extend from the lower border of the thyroid cartilage to the lower border of the cricoid cartilage. In contrast, the lower edge may reach from the cricoid cartilage to the suprasternal notch. Surgeons encounter a wide and large isthmus in about 8% of cases and observe closely apposed lobes without an isthmus in approximately 3.4% of patients [7].

Anatomical variants of the thyroid and trachea strongly depend on typical features of the neck, particularly on absolute measurements of neck length and width [7].

Many authors recommend that surgeons perform open surgical tracheostomy, with rare exceptions, in a fully equipped operating room, with adequate lighting and instrumentation, and under the supervision of a team of experienced surgeons and anesthesiologists [2,3,4].

The patient lies in the supine position, and the surgeon fully extends the neck by placing a pillow or bolster under the shoulders and tilting the head backward. The neck must remain in the midline. Before starting the incision, the surgeon identifies and marks key landmarks from the cricoid cartilage down to the suprasternal notch [2,3,4].

Investigators classify tracheostomy complications as intraoperative, early postoperative (up to 7 days), and late (after 7 days). Engels P.T. et al. [5,6] report that the most frequent complication of open surgical tracheostomy is paratracheal placement of the tracheostomy tube (up to 10%), which can lead to subcutaneous emphysema and pneumomediastinum. In the early postoperative period, the most common complications include bleeding (up to 80%), wound infection (up to 63%), and unintended decannulation (up to 15%). Among late complications, tracheal stenosis occurs in up to 63% of cases, and patients may also develop a rigid tracheostomy tract after decannulation [5,6].

Most authors prefer a transverse skin incision, placed midway between the cricoid cartilage and the jugular fossa [1,2,3]. Some Russian authors recommend a longitudinal midline incision from the cricoid cartilage to the jugular fossa in critically ill patients, due to both the severity of their condition and the technical challenges of the operation [5].

After incising the skin and superficial cervical fascia and retracting the prethyroid muscles, the surgeon usually divides the thyroid isthmus to expose the operative segment of the trachea [3]. The surgeon then performs transverse tracheal dissection between rings 2–3 or 3–4. If necessary, the surgeon can pull the trachea upward and forward using a tracheal hook, which facilitates fixation of the skin to the edges of the tracheal opening [1,2,3,5].

In this article, we present 70 cases of open surgical tracheostomy performed in intensive care unit patients over a continuous 2-year period. During the same period, we also performed three emergency tracheostomies in patients outside the intensive care unit. In extremely severe, practically hopeless patients with a very short, wide neck, we created six tracheostomies between the first and second tracheal rings and three between the cricoid cartilage and the first tracheal ring. We also performed one conicotomy between the thyroid and cricoid cartilages in an extremely critically ill ICU patient.

We usually performed tracheostomy on days 9–10 of mechanical ventilation. In six patients, we operated on the first or second day for other indications, not for prolonged ventilation.

Patient age ranged from 17 to 92 years. Fifty-three patients (75.7%) were older than 60 years; the cohort included 36 females and 34 males.

We carried out almost all operations under general anesthesia in the operating room. Only in two extremely critically ill patients did we perform the procedure directly in the intensive care unit. Correct patient positioning proved crucial: we placed a pillow under the shoulders and carefully aligned the neck in both the sagittal and frontal planes.

Most intensive care patients in our series were elderly and showed some degree of cervical spine ankylosis, which was further aggravated by prolonged immobilization during mechanical ventilation. Consequently, we often could not achieve sufficient head extension for optimal surgical exposure. In relatively young patients with a normal neck length, full extension increases the distance between the cricoid cartilage and the suprasternal notch to about 6 cm. In elderly, short-necked patients, this distance may decrease to about 3 cm. In five patients, we observed a rotated neck; even after repositioning the head, we could not fully center the trachea in the operative field. All these factors significantly complicated the surgery.

In all cases, we used a Kocher-type transverse arcuate skin incision measuring 5–6 cm and locally excised excess subcutaneous fat down to the third cervical fascia. After additional fascial mobilization, we extended the incision longitudinally from the lower edge of the thyroid cartilage to the suprasternal notch. Once we opened the second fascia longitudinally, we exposed the thyroid gland and the anterior tracheal wall.

In intensive care patients, we prefer to create a relatively "high" tracheostomy. In most cases, this approach requires resecting the isthmus and performing limited mobilization or resection of the adjacent thyroid lobes.

After incising the trachea, we can pull it upward and, if necessary, construct a relatively "low" tracheostomy between the third and fourth rings. However, in short-necked patients, this configuration may lead to problems in the postoperative period. When the head remains relatively elevated, the traction can cause skin fixation sutures to cut through the skin near the trachea. We observed this complication in 2 of our patients.

During the operation, the anesthesiologist advances the endotracheal tube as far as possible toward the tracheal bifurcation. This maneuver provides crucial information about the trachea's orientation and reduces the risk of

cuff injury. After we obtain this information, we decide on the exact site of the tracheal incision.

In all cases, we closed the mobilized edges of the thyroid gland with Z-sutures to ensure reliable hemostasis. We performed tracheostomy without manipulating the thyroid gland in only 11 of 70 patients (15.7%).

In most cases, we transected the trachea transversely between rings 1–2 or 2–3. We fixed the upper and lower skin flaps to the edges of the tracheal opening with two sutures each and then placed additional skin sutures laterally. We inserted an adjustable-length tracheostomy tube, which allowed us to adjust the tube position in patients with a short neck and a short trachea. At the end of the procedure, we placed a dressing under the tracheostomy site and secured the tube around the neck with straps that provided moderate compression.

We did not observe any major postoperative complications. The only issues involved two cases in which the skin fixation sutures cut into the skin.

CONCLUSION:

Open surgical tracheostomy in critically ill, elderly, mechanically ventilated patients is not a simple procedure. Surgeons should, whenever possible, perform this operation in a fully equipped operating room, working together with experienced anesthesiology and surgical teams. The surgeon must determine the precise level of the tracheostomy intraoperatively, taking into account the individual anatomy of the neck, trachea, and thyroid gland. In patients who require prolonged mechanical ventilation, we recommend relatively "high" tracheostomies, which generally demand appropriate intervention on the thyroid gland.

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ღია ქირურგიული ტრაქეოსტომიის თავისებურებები რეანიმაციული განყოფილების პაციენტებში

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რეზიუმე

ტრაქეოსტომია ინტენსიური თერაპიის განყოფილებაში ყველაზე გავრცელებული ქირურგიული პროცედურაა. მისი ჩვენება ძირითადად არის ხანგრძლივი ინტუბაცია. სხვადასხვა კვლევით დადგენილია, რომ ინტუბირებული პაციენტების 10%-ს ესაჭიროება ტრაქეოსტომია.

სტატიაში განხილულია კისრის, ტრაქეის და ფარისებრი ჯირკვლის ანატომიური თავისებურებები. წარმოდგენილია უწყვეტ ორწლიან პერიოდში რეანიმაციულ პაციენტებში ჩატარებული ღია ქირურგიული ტრაქეოსტომის 70 შემთხვევა, მათ შორის, 60 წელს ზემოთ 53 (75,7%).

წარმოდგენილია საოპერაციო მაგიდაზე პაციენტის სწორი პოზიციონირების და კისრის წინა ზედაპირზე კანის განაკვეთის შერჩევის მნიშვნელობა. ოპერაციის მსვლელობის ტექნიკური ასპექტები, ტრაქეის კვეთის სწორი ლოკალიზაციის შერჩევა ქირურგიული ბრიგადის მიერ. რეანიმაციულ პაციენტებში უპირატესობა ენიჭება შედარებით „მაღალ“ ტრაქეოსტომიებს, ფარისებრი ჯირკვლის ისთმუსის და კიდეების მობილიზაციას. რეანიმაციულ პაციენტებში ღია ქირურგიული ტრაქეოსტომია არ წარმოადგენს მარტივად შესასრულებელ ოპერაციას და ის უნდა ჩატარდეს სათანადო აღჭურვილობის მქონე საოპერაციოში, სათანადო კვალიფიკაციის მქონე ბრიგადის მიერ.

საკვანძო სიტყვები: ტრაქეოსტომია; ღია ქირურგიული ტექნიკა; ინტენსიური თერაპიის განყოფილება; მექანიკური ვენტილაცია; ფარისებრი ჯირკვლის ანატომია.