

# Perioperative Management of Percutaneous Dilated Tracheostomy for Patient during Intensive Care after Ventriculoperitoneal (VP) Shunt Installation

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## ABSTRACT

**Background:** Tracheostomy is a technique used to treat patients with inadequate ventilation and upper airway obstruction by making air passage through the neck directly into the trachea. Percutaneous dilated tracheostomy is usually performed in patients requiring long-term use of a ventilator in an intensive care unit. Basic knowledge of perioperative management of percutaneous dilated tracheostomy is fundamental and must be mastered by anesthesiologists.

**Case:** A woman, 45 years old is treated at dr. Moewardi hospital with decreased consciousness E2V2M3, non-communicant hydrocephalus, and intraventricular hemorrhage. The patient underwent ventriculoperitoneal shunt surgery and was admitted to the intensive care unit. Patients require long-term use of a ventilator and thus require percutaneous dilated tracheostomy. The percutaneous dilated tracheostomy procedure was successfully performed and there were no complications after the procedure.

**Conclusion:** Percutaneous dilated tracheostomy is a minimally invasive tracheostomy technique as an alternative to conventional techniques, with lower complications and shorter time..

**Keywords:** Percutaneous dilated tracheostomy, intensive care, perioperative management

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## INTRODUCTION

Tracheostomy is a technique used to treat patients with inadequate ventilation and upper airway obstruction by creating an airway through the neck directly into the trachea. One of the tracheostomy techniques is percutaneous dilated tracheostomy, which is a minimally invasive tracheostomy technique performed by placing a tracheostomy cannula with the help of a series of dilators with endoscopy. The percutaneous dilatation tracheostomy technique was first introduced by Cigila in 1985.<sup>1</sup> The percutaneous dilated tracheostomy technique has various advantages over the open tracheostomy technique, such as an easier tracheostomy procedure and minimal postoperative complications.<sup>2</sup>

Tracheostomy is usually performed in patients who require long-term use of a ventilator in the intensive care unit. In the implementation of percutaneous dilated tracheostomy, preparations are needed such as screening and preparation of the patient's condition, preparation of equipment, preparation of the implementing team, and emergency preparation.

Basic knowledge of tracheostomy perioperative management is fundamental and must be mastered by anesthesiologists. In this case report, we will discuss the perioperative management of percutaneous dilated tracheostomy in patients in the intensive care unit.

## CASE

On November 7, 2020, a female patient came to the emergency installation (IGD) of the Regional General Hospital (RSUD) dr. Moewardi, Mrs. YK, 45 years old with loss of consciousness. The patient was referred from RSUD Bagas Waras with intracranial hemorrhage (ICH) and obstructive hydrocephalus. From alloanamnesis, obtained a history of seizures and weakness of the right limb one day before admission to the hospital. In addition, the patient had a history of falling in the kitchen with headaches accompanied by not being able to speak since three weeks before being admitted to the hospital. The patient was treated for 2 weeks at the Klaten Regional Mental Hospital (RSJD) by a neurologist with subarachnoid hemorrhage (SAH) and hemorrhagic stroke.

In the emergency room of RSUD dr. Moewardi, the patient was treated by a neurosurgeon with a diagnosis of E2V2M3 loss of consciousness, non-communicating hydrocephalus, and intraventricular hemorrhage (IVH). The patient is planned to install a ventriculoperitoneal (VP) shunt on November 8, 2020. After the operation, the patient is treated in the intensive care unit (ICU) and receives multi-specialty therapy by anesthesiologists, neurosurgeons, neurologists, and cardiologists. On the third day of treatment in the ICU (11 November 2020), the patient was planned for percutaneous dilated tracheostomy as indicated by the need for long-term ventilator use.



**Figure 1.** Tools preparation of the percutaneous dilated tracheostomy.

Before the procedure of percutaneous dilated tracheostomy begins, the anesthesiologist performs a comprehensive perioperative examination of the patient, which includes preparation of the implementing team, patient preparation, equipment preparation, and drug preparation. The implementation team consists of one operator who performs the tracheostomy procedure, one assistant who is above the patient's head to manage the airway and breathing (pulling the endotracheal tube, monitoring breathing patterns, helping with bronchoscopy), and one person to assist the tracheostomy process (managing bleeding, keeping the guidewires from the stoma during the procedure).

Anesthesiologists also perform patient preparation including history taking, physical examination, supporting examinations, diagnosis, and provision of pre-operative therapy. From the history and physical examination, there was a decrease in consciousness, GCS E2VxM1, endotracheal tube (ETT) installed no 7.0 lvl 20 cm Synchronous intermittent mandatory ventilation (SIMV) mode, Ps 8, PEEP 6.0, FiO<sub>2</sub> 40%, SpO<sub>2</sub> 97%. Other vital signs within limits normal. On pulmo dextra installed water seal drainage, undulation (+) bubble (+). Investigations in the form of blood laboratory showed anemia with hemoglobin 12.4 g/dl, decreased hematocrit with a hematocrit value of 26%, hypoalbumin 2.8 g/dl, hypernatremia 150 mmol/L, hypocalcemia 1.10 mmol/L, coagulation factors within normal limits. On chest X-ray examination, he found unilateral right-sided pneumonia, a chest tube was attached from the right side with a tip projecting at the level of the right posterior rib 3, an ET tube was attached with a tip projecting as high as the VTh 4 body, CvC was attached from the left side with a tip projecting as high as the VTh 6 body on the right attached gastric tube with tip projecting on the stomach, attached VP shunt from the cranial direction with tip kinking projected at the level of the right posterior 11<sup>th</sup> rib. Based on all these examinations, the patient was fasted for 2 hours before



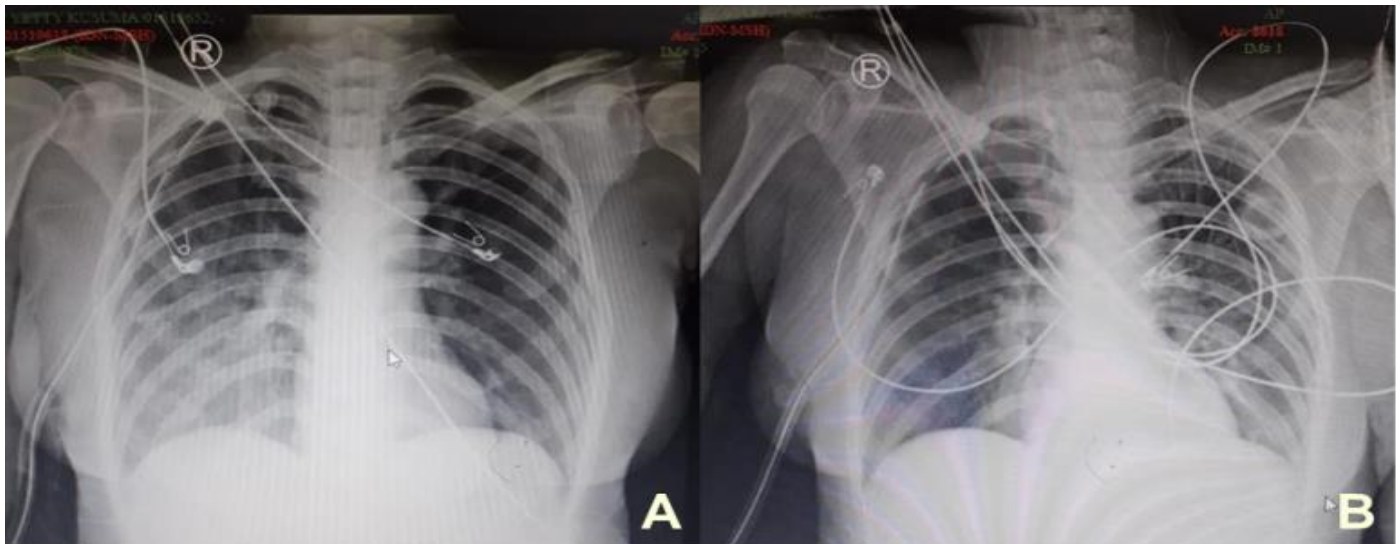
**Figure 2.** Operative procedure for percutaneous dilated tracheostomy



**Figure 3.** Clinical photos after installation of percutaneous dilated tracheostomy

the insertion of a percutaneous dilated tracheostomy and transfused with 2 kolf packed red cell. The anesthesiologist also asks for approval and provides information to the family about the action to be taken and the complications that may arise.

After obtaining approval for medical action from the family, then the preparation of tools and preparation of drugs is carried out. The tools prepared (Figure 1) include surgical gowns, sterile medical gloves, dilators, and sterilized percutaneous dilated tracheostomy wires, sterile gauze, masks, headgear, large hole drapes, large drapes, bent, com, needles, threads, syringes. 5 ml/10 ml/20 ml, suction catheter, gel, abboath no 14, and shoulder support pillow. Drug preparations include providing analgesic Fentanyl 100 mcg, sedation Midazolam 1 ampoule, muscle relaxant Atracurium 1



**Figure 4.** Comparison of (A) Pre-operative and (B) Post-operative Thorax X-rays

ampoule, anti-bleeding Tranexamic Acid 2 ampoules, emergency medicine Ephedrine, and Lidocain 2% 2 ampoules, Tramadol 1 ampoule, antiseptic liquid alcohol, and betadine.

After all the preparations were done, the percutaneous dilated tracheostomy procedure was carried out on November 11, 2020, at 13.00 WIB. The patient lies supine, the shoulders supported with pads (Figure 2)(Figure 3). The anterior colli region was cleaned according to aseptic and antiseptic principles and covered with a sterile cloth. Local anesthetic with 2% lidocaine 4 ml in the tracheal lumen is injected in the middle of the cricoid with the suprasternal fossa infiltrating. Then a 2-3 cm long skin incision is made, 2 cm below the cricoid cartilage. A pair of mosquito forceps were used for blunt dissection to the fascia pretracheal. The needle with the catheter is inserted, between the tracheal rings 1 and 2 median line up into the trachea until the bubble test is positive, this action is monitored using a bronchoscope that has been connected to a camera. The needle is then withdrawn, the guidewire (J-Wire) is then inserted and the catheter is withdrawn completely and maintaining the guidewire in the tracheal lumen. The Ciaglia dilator is then inserted through the guidewire up to 38F. The tracheostomy cannula is then attached to the same size as the dilator via a guidewire, and the guidewire is then removed. After that, ronchial toilet, wound care, suture fixation, and cuff development were performed. To see the presence or absence of complications of pneumothorax and pneumomediastinum, a post-tracheostomy chest X-ray was performed.

The patient's condition after percutaneous dilated tracheostomy was found to be hemodynamically stable. From the history and physical examination, the patient is still experiencing decreased consciousness, GCS E3VXM2, tracheostomy attached, ETT no 7.0 lml 20 cm spontaneous mode FiO2 35%, WSD right undulation (+). The results of the chest X-ray examination after the installation of a percutaneous dilated tracheostomy (Figure 4B) did not reveal complications such as pneumothorax and pneumomediastinum. Furthermore, the patient is planned to receive regular monitoring for signs of bleeding, blocked tracheostomy tube, and clearance of secretions.

## DISCUSSION

Percutaneous dilated tracheostomy is a common procedure performed for critically ill patients in the ICU. There are several indications that underlie the need for percutaneous dilated tracheostomy, such as respiratory failure and the need

for long-term ventilators. Prior to performing a tracheostomy, an examination must be carried out to find absolute and relative contraindications. Absolute contraindications include the presence or absence of infection in the neck wall and unstable hemodynamic conditions. Relative contraindications include obesity, limited neck mobilization (in patients with neck trauma), and the presence of anatomical abnormalities of the neck. The patient in this case report was examined and found no contraindication to tracheostomy.<sup>3,4</sup>

There are several things that need to be prepared including the operator, the bronchoscopy technician, the person to pull and hold the endotracheal tube, and a nurse to administer medication and monitor the patient's vital signs<sup>5</sup>. This tracheostomy procedure requires adequate analgesia and sedation. Anterior neck area analgesia can use a combination of lidocaine and epinephrine to achieve vasoconstriction along with local anesthesia. Commonly used drugs include fentanyl, midazolam, propofol, and morphine.<sup>6</sup> In this case, we chose to use 2% lidocaine alone without epinephrine in view of the effects of local administration of epinephrine on the patient's condition. Our patient was given an analgesic in the form of fentanyl 100 mcg.

The patient is placed in a supine position and provided with a shoulder pad. Padding in the shoulder area aims to make the trachea easily palpable and the cricoid cartilage to be pulled superiorly. It increases the distance between the sternal notch and the cricoid cartilage, thereby facilitating access to the trachea. The skin and neck are then cleaned according to an antiseptic aseptic process, and covered with a sterile cloth. After that, a local anesthetic was injected in the middle of the cricoid with infiltrating suprasternal fossa. The next process is the identification of landmarks (sternal notch, tracheal ring, and cricoid cartilage). Once the landmark was identified, the anterior neck area should be cleaned and the surface covered with a sterile cloth. In this patient, the landmark identification process can be done clearly considering that the patient is not obese. If the cricoid cartilage or tracheal ring cannot be palpated, we recommend avoiding percutaneous insertion techniques.<sup>3,4</sup>

The operator can perform the incision after confirming the identification of landmarks according to the patient's clinical anatomy. The incision can be either a horizontal incision or a vertical incision, in this case, we used a vertical incision with consideration to reduce the risk of excessive bleeding. After the incision is complete, the operator places a finger to palpate and ensure that the tube is positioned just above the tracheal



puncture site, and ensures that the needle is positioned to allow the puncture to be performed at 12 o'clock. The needle with the catheter is inserted, ideally between the second and third tracheal rings. Then the needle is withdrawn, the guidewire (J-Wire) is inserted and the catheter is fully withdrawn and maintains the guidewire within the tracheal lumen. Then, dilator Ciaglia is inserted through the guidewire up to 38F. Then, the tracheostomy cannula is placed with the same size as the dilator via guidewire, and then the guidewire is removed. After that, tracheostomy cannula fixed and cuff developed.

After the percutaneous dilated tracheostomy procedure is successful, post-procedure monitoring is mandatory to evaluate for post-operative complications. The main complication of concern is bleeding. If there is active bleeding, especially if the bleeding occurs around the tracheostomy tube, it is necessary to explore the stoma to look

for ruptured blood vessels and perform cauterization and re-suture. Other complications that can occur are pneumothorax and pneumomediastinum. Therefore, the patient underwent a post-operative examination to see these complications. In this case, no significant complications were found in the patient. Stoma treatment is carried out every 8 hours, if there is a crust then medication will be done using a saline solution.

## CONCLUSION

Tracheostomy is a surgical procedure that aims to create an airway in the cervical trachea. Percutaneous dilated tracheostomy is a minimally invasive tracheostomy technique as an alternative to conventional techniques, with lower complications and shorter time.

## ACKNOWLEDGMENT

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## CONFLICT OF INTEREST

None

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