

## นิพนธ์ต้นฉบับ

# เปรียบเทียบผลลัพธ์รูปแบบการลงแผลผ่าตัดเจาะคอช่วยหายใจแบบแนวตั้งและแนวนอนด้วยการทดลองแบบสุ่มและมีกลุ่มควบคุม

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กองโสต คอ นาสิกกรรม โรงพยาบาลพระมงกุฎเกล้า

## บทคัดย่อ

**ความสำคัญและที่มางานวิจัย** การผ่าตัดเจาะคอช่วยหายใจใช้ในการช่วยเหลือผู้ป่วยที่ต้องใช้เครื่องช่วยหายใจเป็นเวลานาน มีปัญหาทางเดินหายใจอุดตันและซับซ้อนหลังไม่ได้ โดยปัจจุบันโสต คอ นาสิกแพทย์นิยมลงแผลผ่าตัด 2 แบบคือแนวตั้ง (Vertical incision) และ แนวนอน (Horizontal incision) เนื่องจากการศึกษาและเปรียบเทียบผลลัพธ์ของการลงแผลผ่าตัดเจาะคอช่วยหายใจในประเทศไทยนั้นยังให้ผลที่ไม่ชัดเจน คณะผู้วิจัยจึงทำวิจัยเพื่อช่วยในการตัดสินใจเลือกรูปแบบการลงแผลผ่าตัดเจาะคอที่เหมาะสมกับผู้ป่วย **วัตถุประสงค์** เพื่อศึกษาและเปรียบเทียบผลลัพธ์ของการลงแผลผ่าตัดเจาะคอช่วยหายใจแบบแนวตั้งและแนวนอนและเพื่อศึกษาปัจจัยที่มีผลต่อความสำเร็จของการเจาะคอ **รูปแบบงานวิจัย** การทดลองแบบสุ่มและมีกลุ่มควบคุม (Randomized controlled trial) **วิธีดำเนินงานวิจัย** งานวิจัยนี้แบ่งอาสาสมัครจำนวน 51 คน เป็น 2 กลุ่ม ด้วยวิธีการสุ่มกลุ่มแรกลงแผลผ่าตัดแบบแนวตั้งและกลุ่มที่ 2 ลงแผลผ่าตัดแนวนอนแล้วเก็บข้อมูลทั่วไป ข้อมูลระหว่างการผ่าตัดและติดตามอาการที่ 7 วัน กับ 3-6 เดือน **ผลการวิจัย** ผลการติดตามอาการหลังผ่าตัดอาสาสมัครจำนวน 51 ราย ที่เข้ารับการผ่าตัดเจาะคอช่วยหายใจด้วยวิธีลงแผลผ่าตัดแนวตั้ง 26 รายและลงแผลผ่าตัดแนวนอน 25 ราย พบว่าภายใน 7 วันกลุ่มที่ลงแผลผ่าตัดแนวตั้งตรวจพบเลือดออกจากแผลระดับ 2 (2.5-10 ml) 1 ราย (3.8%) และเลือดออกจากแผลระดับ 3 (10-100 ml) 1 ราย (3.8%) ซึ่งไม่พบเลือดออกจากแผลในกลุ่มที่ลงแผลแนวนอน และไม่มี ความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ( $p=0.368$ ). ตรวจพบการติดเชื้อบริเวณแผลผ่าตัดในกลุ่มที่ลงแผลผ่าตัดแนวนอน 1 ราย (4%) และไม่พบการติดเชื้อที่แผลผ่าตัดในกลุ่มที่ลงแผลแนวตั้ง ( $p=0.303$ ) ทั้ง 2 กลุ่มตรวจพบการหายของบาดแผลผ่าตัดสมบูรณ์ 100% ส่วนผลการติดตามที่ระยะ 3-6 เดือน มีอาสาสมัครที่มาติดตามจำนวน 18 ราย ตรวจพบแผลผ่าตัดติดเชื้อ 1 ราย ในกลุ่มที่ลงแผลผ่าตัดแนวตั้ง (14.3%) ( $p=0.197$ ) จากการศึกษาตัวแปรที่ส่งผลกระทบต่อความสำเร็จของการผ่าตัดเจาะคอช่วยหายใจพบว่า การจัดทำแขนคอช่วยลดระยะเวลาการผ่าตัดได้อย่างมีนัยสำคัญทางสถิติ โดยค่าสัมประสิทธิ์ (coefficient) เท่ากับ  $-0.3026$  ( $p=0.0309$ ) แผลผ่าตัดที่มีขนาดใหญ่จะเพิ่มระยะเวลาการผ่าตัดโดยค่าสัมประสิทธิ์ (coefficient) เท่ากับ  $0.3755$  ( $p=0.0066$ ) นอกจากนี้ยังพบว่าระยะเวลาการนอนโรงพยาบาลลดลงเมื่อได้รับการผ่าตัดเจาะคอเร็วขึ้นทั้ง 2 กลุ่ม **สรุปผลการวิจัย** จากการศึกษาพบว่าตัวแปรที่มีความสัมพันธ์กับผลลัพธ์ของการผ่าตัดช่วยหายใจทั้ง 2 วิธี อย่างมีนัยสำคัญทางสถิติได้แก่ การจัดทำแขนคอซึ่งช่วยลดระยะเวลาการผ่าตัด การลงแผลผ่าตัดใหญ่ขึ้นทำให้ระยะเวลาการผ่าตัดนานขึ้น และระยะเวลาการนอนโรงพยาบาลจะลดลงเมื่อผู้ป่วยได้รับการผ่าตัดเจาะคอเร็วขึ้น

**คำสำคัญ** ● tracheostomy incision ● tracheostomy complication

● Horizontal versus vertical incision ● stomal granulation grading ● stomal ulcer

**เวชสารแพทย์ทหารบก 2568;78(1):13-24.**

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## Original article

# Comparison of Outcomes between Vertical and Horizontal Tracheostomy Incisions: A Randomized Controlled Trial

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## Abstract

**Background** Tracheostomy is a procedure for patients requiring prolonged mechanical ventilation, those with airway obstructions, or individuals unable to clear secretions effectively. Otolaryngologists typically perform tracheostomies using two incisions: vertical and horizontal. However, outcome data comparing these techniques in Thailand remain inconclusive. **Objectives** This study aims to determine and compare the results of vertical and horizontal tracheostomy incisions and to identify factors affecting the success of tracheostomy. **Study design** A Randomized Controlled Trial **Material and methods** Fifty-one participants were randomly assigned to vertical incision (n=26) and horizontal incision (n=25). Data collection included demographic information, intraoperative details, and follow-up at 7 days and 3–6 months post-surgery. **Results** Among the 51 patients, 26 underwent vertical and 25 horizontal incisions. At 7 days post-surgery, postoperative bleeding complications occurred in the vertical incision group: one case (3.8%) of grade 2 bleeding (2.5–10 ml) and one case (3.8%) of grade 3 bleeding (10–100 ml). No bleeding was observed in the horizontal group, though differences were not statistically significant ( $p=0.368$ ). Stomal infection was seen in one case (4%) in the horizontal group and none in the vertical group, without statistical significance ( $p=0.303$ ). Both groups exhibited 100% wound healing by day 7. At the 3 to 6-month follow-up, one case of stomal infection (14.3%) was reported in the vertical group and none in the horizontal group ( $p=0.197$ ). Positioning the patient in a hyperextended neck significantly reduced procedure time with a coefficient =  $-0.3026$  ( $p=0.0309$ ). Additionally, a larger incision size was associated with increased procedure time with a coefficient =  $0.3755$  ( $p=0.0066$ ). Furthermore, early tracheostomy could reduce hospitalization. **Conclusion** This study determined significantly different variables, including hyperextended neck positioning, which reduced operative time, and larger surgical incisions, which increased operative time. Moreover, early tracheotomy minimized hospitalization.

**Keyword :** ● tracheostomy incision ● tracheostomy complication

● Horizontal versus vertical incision ● stomal granulation grading ● stomal ulcer

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## Introduction

Tracheostomy is a surgical procedure that involves creating an opening in the anterior wall of the trachea. This procedure is commonly performed in patients who require prolonged ventilator support. Tracheostomy offers several benefits, including reducing the risk of lung infections and preventing ventilator dependence. Bypassing the upper airway facilitates the drainage of secretions and aids in ventilation, improving respiratory management. Furthermore, tracheostomy is also beneficial for patients experiencing upper airway obstructions, as it allows for easier airway access and breathing support. These advantages make tracheostomy a valuable intervention in critical care settings for patients who face respiratory challenges due to various underlying conditions.<sup>(1-3)</sup>

There is no consensus regarding the optimal timing and technique for performing a tracheostomy. While otolaryngologists commonly perform surgical tracheostomies, pulmonologists typically perform percutaneous dilatation tracheostomy (PDT).<sup>(1, 2, 4-6)</sup> The choice between these two methods depends on various factors, including the patient's condition, available expertise, and institutional protocols.

Two main incision techniques are commonly used in surgical tracheostomy: a vertical incision, which facilitates the procedure and provides better visualization of underlying structures, and a horizontal incision, which follows the skinfold to potentially reduce scarring (Figure 1). However, there is ongoing debate regarding which technique is superior in minimizing complications and promoting optimal postoperatively wound healing. Evidence comparing the effectiveness of these two approaches still needs to be conclusive.<sup>(6-8)</sup>

Since the comparative outcomes of tracheostomy incisions in Thailand remain inconclusive, the authors conducted this study to compare the results of vertical and horizontal incisions. The findings will assist otolaryngologists in determining the most suitable incision technique for individual patients.

### **Surgical tracheostomy technique<sup>(1, 9)</sup>**

Patients are positioned supine with the neck hyperextended. Anesthesia and intubation are performed to ensure oxygenation and continuous monitoring of heart rate, blood pressure, and oxygen levels throughout the procedure. The surgery takes place in the operating room, where local anesthesia is injected into the patient's neck after they are sedated. The incision is made approximately 1 inch below the cricoid cartilage or 2 inches above the sternal notch. Either a vertical or horizontal incision technique may be used.

The strap muscles are then divided and retracted laterally. The thyroid gland is displaced or partially cut (isthmus) to expose the trachea. Additionally, the patient's neck is fully extended by placing a shoulder roll underneath the upper back area, and the head is stabilized on a head ring.<sup>(9)</sup> Once the trachea is identified, a stay suture is placed at the anterior tracheal wall. A U-shaped (n) incision is made in the trachea while the tracheostomy tube is prepared. Afterward, the endotracheal tube is removed, and the tracheostomy tube is inserted once the tracheal stoma is adequately visualized.

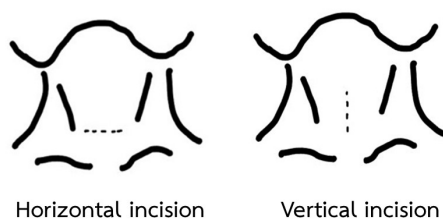


Figure 1: Surgical Incision Type

This study hypothesizes that there may be differences in outcomes, such as cosmetic appearance, infection rates, and surgical difficulty, between horizontal and vertical tracheostomy incisions. Horizontal incisions offer better cosmetic outcomes with less visible scarring and a lower infection rate, but they are more challenging to perform, requiring careful alignment and positioning. In contrast, vertical incisions are more accessible due to better identification of anatomical structures during surgery. However, they result in more visible and prominent scarring and tend to have higher infection rates.

## Objectives

### Primary objective

To determine and compare the results of vertical and horizontal tracheostomy incisions

### Secondary objective

To identify factors affecting the success of tracheostomy and the correlation between the timing of tracheostomy and hospitalization

## Materials and Methods

The authors conducted a randomized controlled trial at Phramongkutklo Hospital, approved by the Institutional Review Board of the Royal Thai Army Medical Department on 21 May 2021 (Approval No. R069h/64) and registered with the Thai Clinical Trials Registry on 18 July 2021 (No. TCTR20210718001). The consort diagram displayed the allocation of participants (Figure 2). The participants were allocated to the vertical and horizontal incision groups using a block of four randomization.

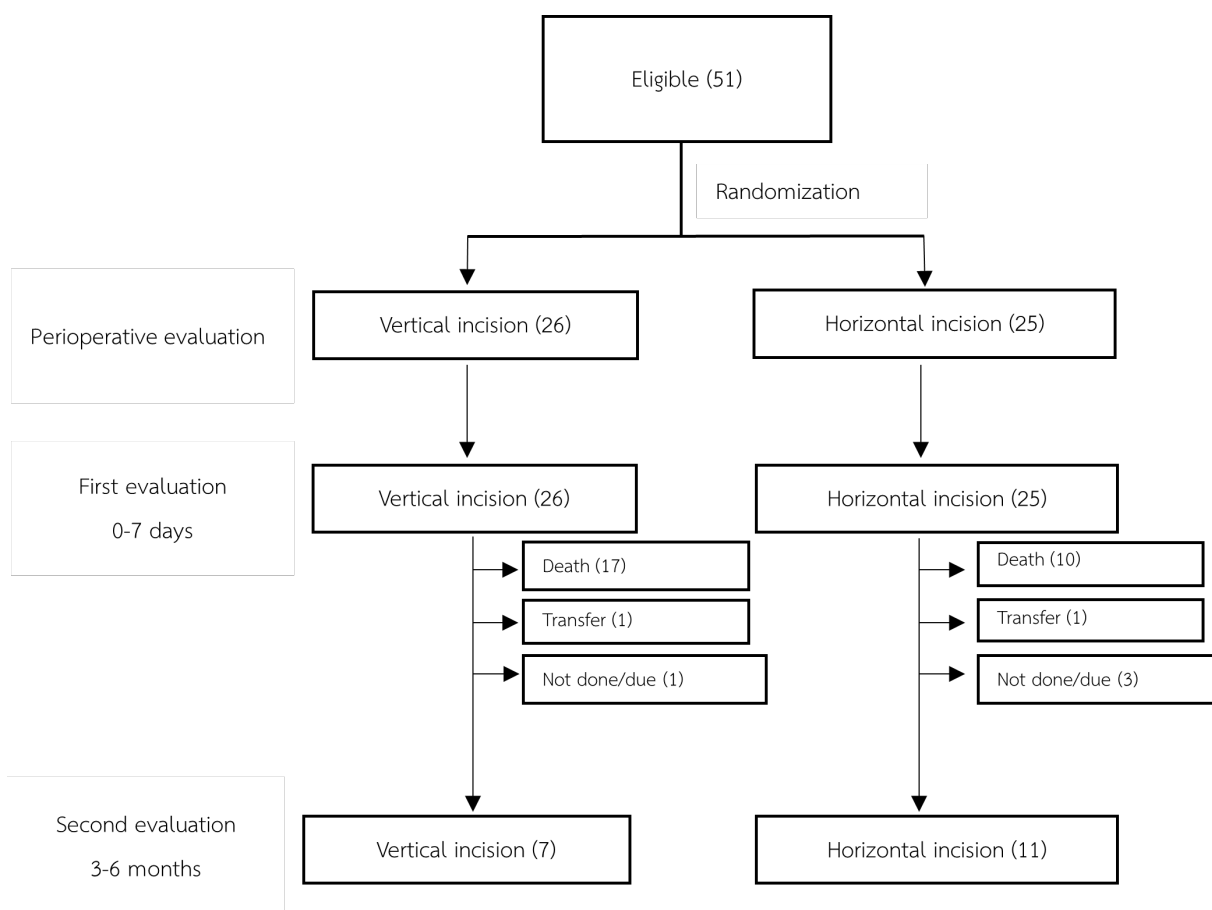
### Inclusion criteria

The study, conducted from 21 March to 22 October 2021, enrolled patients aged 20 years or older who underwent tracheostomy based on indications such as prolonged intubation due to respiratory or neuromuscular diseases, respiratory toilet needs, or ventilator dependence. Exclusion criteria included patients with unresolved coagulopathy, those requiring emergency tracheostomy, and those who refused participation. Additionally, the withdrawal criteria consisted of (1) Loss to follow-up and (2) Transfer to another hospital.

The study collected general data (age, sex, weight, height, underlying diseases, Hematocrit (Hct), WBC, Platelets, INR, tracheostomy indications, and endotracheal tube duration), perioperative data (incision type, incision size, procedure time, thyroid manipulation, neck hyperextension, tube

decannulation, bleeding, suture method, and surgeon), and follow-up data at 7 days and 3–6 months post-surgery. At 7 days, the data focused on complications such as bleeding, stomal infection, stomal pressure ulcers, subcutaneous emphysema, pneumothorax, accidental decannulation, tube obstruction, wound healing, and suture status. Furthermore, at 3–6 months, complications such as granulation tissue, stomal narrowing, tracheomalacia, stomal infection, delayed stoma closure, and hospital stay length were recorded. The tracheostomy will be performed in the operative room by a staff or a resident of the Department of Otolaryngology, Phramongkutklao Hospital.

**Figure 2 CONSORT FLOW**



### Statistical analysis

This study measured the outcomes of vertical and horizontal tracheostomy incisions by comparing results and monitoring postoperative complications. Data were recorded and analyzed using STATA/MP 12 software. Descriptive statistics displayed general patient information, including number, percentage, mean, standard deviation, median, minimum, and maximum values. The chi-square test was applied to compare categorical data between groups, while paired t-tests were used for continuous data. Additionally, Pearson's product-moment correlation coefficient assessed factors correlated with the success of the incisions. A p-value of < 0.05 was considered statistically significant.

## Study endpoint

The study endpoints include several preoperative, intraoperative, and postoperative measures. Preoperatively and intraoperatively, the endpoints involve the duration of endotracheal tube (ETT) use (days), incision size (cm), procedure time (minutes), the use of hyperextended neck positioning, and bleeding (ml). On postoperative Day 7, the endpoints include ETT duration, incision size, procedure time, hyperextended neck positioning, and bleeding. At the 3 to 6-month postoperative follow-up, the study assesses the presence of granulation tissue, tracheomalacia, stomal narrowing, tracheoesophageal and tracheoarterial fistulas, stoma infection, and the duration of hospital admission (days). These endpoints are intended to evaluate the immediate and long-term outcomes of different tracheostomy incision techniques.

## Results

This study included 51 patients who underwent tracheostomy at Phramongkutklao Hospital between March 2021 and October 2022. Of these, 25 patients underwent horizontal incisions, and 26 underwent vertical incisions. The average age of the horizontal incision group was  $76.52 \pm 14.55$  years, with 60% females, while the vertical incision group had an average age of  $77.73 \pm 17.19$  years, with 50% females. The average height and weight were 161.36 cm and 61.96 kg for the horizontal group and 161.18 cm and 60.90 kg for the vertical group. The two groups had no significant differences in patient characteristics such as HCT, WBC, PLT, and INR. The comparison of clinical outcomes, including ETT duration, incision size, procedure time, thyroid manipulation, neck hyperextension, hemostatic device use, hemorrhage, perioperative suturing, and the type of surgeon (resident or staff), showed no significant differences between the two groups. Hospitalization duration was similar, with an average of  $104.22 \pm 51.45$  days for the horizontal group and  $116.71 \pm 50.02$  days for the vertical group (Table 1). Postoperative complications, including bleeding and infection, were also assessed. The vertical incision group experienced one case (3.8%) of grade 2 bleeding (2.5–10 ml) and one case (3.8%) of grade 3 bleeding (10–100 ml), while no bleeding occurred in the horizontal group. However, the difference was not statistically significant ( $p=0.368$ ). Stomal infection occurred in one case (4%) in the horizontal group and none in the vertical group, which was also not statistically significant ( $p=0.303$ ). Both groups showed 100% wound healing by day 7. After a 7-day follow-up, no significant differences were found between the groups in terms of postoperative bleeding, stomal infection, stomal pressure ulcer, emphysema, pneumothorax, tube dislodgement, tube obstruction, wound healing, or days until stitches were removed (Table 1). At the 3 to 6-month follow-up, one case of stomal infection (14.3%) was reported in the vertical group, while none was observed in the horizontal group ( $p=0.197$ ). There were no significant differences between the two groups regarding complications such as granulation tissue, tracheomalacia, stomal narrowing, tracheoesophageal fistula, trachea-arterial fistula, stoma infection, delayed stoma closure, or stomal pressure ulcers (Table 1). Factors affecting the success of tracheostomy were displayed in Table 2; positioning the patient in a hyperextended neck position significantly reduced procedure

time, coefficient ( $r$ ) = -0.3026, ( $p$ =0.0309), and larger incision sizes were associated with increased procedure time, coefficient ( $r$ ) = 0.3755, ( $p$ =0.0066). In the horizontal incision group, incision size, thyroid manipulation, neck hyperextension, and surgeon type were not associated with procedure time. However, neck hyperextension significantly reduced procedure time in the vertical incision group ( $p$ =0.0015).

In Table 3, the correlation between the timing of the tracheostomy and hospitalization was significantly related to hospitalization in both horizontal and vertical incision groups ( $p$ -value = 0.0016 and 0.0018, respectively). As shown in Figure 3, the length of the hospital stay was shorter when the tracheostomy was performed faster in both the horizontal and vertical incision groups.

**Table 1: Patient demographic data by incision classification.**

| Characteristics          |                 | Horizontal group (n=25) | Vertical group (n=26) | p-value |
|--------------------------|-----------------|-------------------------|-----------------------|---------|
| Age                      |                 | 76.52±14.55             | 77.73±17.19           | 0.7875  |
| Sex                      | female          | 15(60.0%)               | 13(50.0%)             | 0.4730  |
|                          | male            | 10(40.0%)               | 13(50.0%)             |         |
| Height (cm)              |                 | 161.36±9.49             | 161.81±7.44           | 0.8517  |
| Weight (Kg)              |                 | 61.96±15.48             | 60.90±13.49           | 0.7959  |
| HCT (Vol.%)              |                 | 27.36±5.12              | 28.71±3.85            | 0.2891  |
| WBC (Cells/uL)           |                 | 11,612±4,690.81         | 10,488.87±5,424.34    | 0.4336  |
| PLT (/uL)                |                 | 257,868.00±124,285.70   | 242,040.30±117,045.40 | 0.6416  |
| INR (ratio)              |                 | 1.19±0.18               | 1.19±0.23             | 0.9200  |
| Covid                    |                 | 25(100.0%)              | 26(100.0%)            | -       |
| Indication               | prolonged       | 25(100.0%)              | 26(100.0%)            | -       |
|                          | intubation      |                         |                       |         |
| ETT duration (days)      |                 | 36.48±23.06             | 35.77±49.27           | 0.9480  |
| Size of incision (cm)    |                 | 3.02±0.70               | 2.77±0.71             | 0.2101  |
| Procedure time (minutes) |                 | 43.6±20.39              | 39.38±20.71           | 0.4675  |
| Thyroid manipulation     | yes             | 16(64.0%)               | 14(53.8%)             | 0.4610  |
|                          | no              | 9(36.0%)                | 12(46.2%)             |         |
| Hyperextend neck         | yes             | 18(72.0%)               | 21(80.8%)             | 0.4600  |
|                          | no              | 7(28.0%)                | 5(19.2%)              |         |
| Packing                  | absorbable      | 0(0.00%)                | 2(7.7%)               | 0.286   |
|                          | none            | 5(20.0%)                | 3(11.5%)              |         |
|                          | none -          | 20(80.0%)               | 21(80.8%)             |         |
|                          | absorbable pack |                         |                       |         |
| False passage            | 0               | 24(96.0%)               | 26(100.0%)            | 0.3030  |
|                          | 1               | 1(4.0%)                 | 0(0.0%)               |         |
| Hemorrhage (ml)          |                 | 22.60±13.24             | 26.35±11.88           | 0.2923  |
| Perioperative suture     |                 | 0.76±1.09               | 0.69±1.01             | 0.8191  |

| First evaluate<br>(1 week)      |               | Horizontal group (n=11) | Vertical group (n=7) |        |
|---------------------------------|---------------|-------------------------|----------------------|--------|
| Delayed Bleeding                | Gr1=<2.5m     | 25(100.0%)              | 24(92.4%)            | 0.3680 |
|                                 | Gr 2=2.5-10ml | 0(0.0%)                 | 1(3.8%)              |        |
|                                 | Gr 3          | 0(0.0%)                 | 1(3.8%)              |        |
| Stomal infection                | no            | 24(96.0%)               | 26(100.0%)           | 0.3030 |
|                                 | yes           | 1(4.0%)                 | 0(0.0%)              |        |
| Stomal pressure ulcer           | no            | 25(100.0%)              | 26(100.0%)           | -      |
| Emphysema                       | no            | 25(100.0%)              | 26(100.0%)           | -      |
| Pneumothorax                    | no            | 25(100.0%)              | 26(100.0%)           | -      |
| Tube decannulation accidentally | Replaceable   | 25(100.0%)              | 26(100.0%)           | -      |
| Tube obstruction                | no            | 25(100.0%)              | 25(96.2%)            | 0.3220 |
|                                 | yes           | 0(0.0%)                 | 1(3.8%)              |        |
| Good wound healing              | yes           | 25(100.0%)              | 26(100.0%)           | -      |
| Day of stitches off             |               | 7.00±0.00               | 7.00±0.00            | -      |
| Re suture                       |               | 0.00 (0.00)             | 0.00 (0.00)          | -      |
| Status                          | Death         | 11(44.0%)               | 17(65.4%)            | 0.4240 |
|                                 | Transfer      | 1(4.0%)                 | 1(3.8%)              |        |
|                                 | Follow up     | 10(40.0%)               | 7(26.9%)             |        |
|                                 | not done/     | 3(12.0%)                | 1(3.8%)              |        |
|                                 | not due       |                         |                      |        |

| First evaluate<br>(1 week)      |               | Horizontal group (n=11) | Vertical group (n=7) |        |
|---------------------------------|---------------|-------------------------|----------------------|--------|
| Delayed Bleeding                | Gr1=<2.5m     | 25(100.0%)              | 24(92.4%)            | 0.3680 |
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| Stomal infection                | no            | 24(96.0%)               | 26(100.0%)           | 0.3030 |
|                                 | yes           | 1(4.0%)                 | 0(0.0%)              |        |
| Stomal pressure ulcer           | no            | 25(100.0%)              | 26(100.0%)           | -      |
| Emphysema                       | no            | 25(100.0%)              | 26(100.0%)           | -      |
| Pneumothorax                    | no            | 25(100.0%)              | 26(100.0%)           | -      |
| Tube decannulation accidentally | Replaceable   | 25(100.0%)              | 26(100.0%)           | -      |
| Tube obstruction                | no            | 25(100.0%)              | 25(96.2%)            | 0.3220 |
|                                 | yes           | 0(0.0%)                 | 1(3.8%)              |        |
| Good wound healing              | yes           | 25(100.0%)              | 26(100.0%)           | -      |
| Day of stitches off             |               | 7.00±0.00               | 7.00±0.00            | -      |
| Re suture                       |               | 0.00 (0.00)             | 0.00 (0.00)          | -      |
| Status                          | Death         | 11(44.0%)               | 17(65.4%)            | 0.4240 |
|                                 | Transfer      | 1(4.0%)                 | 1(3.8%)              |        |
|                                 | Follow up     | 10(40.0%)               | 7(26.9%)             |        |
|                                 | not done/     | 3(12.0%)                | 1(3.8%)              |        |
|                                 | not due       |                         |                      |        |

Table 2: Factors Affecting the Success of Tracheostomy

| Variables                      |                         | Horizontal group<br>(n=21) |         | Vertical group<br>(n=21) |          | All<br>(n=42) |          |
|--------------------------------|-------------------------|----------------------------|---------|--------------------------|----------|---------------|----------|
|                                |                         | r                          | p-value | r                        | p-value  | r             | p-value  |
| Procedure<br>time<br>(minutes) | Size of incision        | 0.3162                     | 0.1236  | 0.4100                   | 0.0375   | 0.3755        | 0.0066** |
|                                | Thyroid<br>manipulation | 0.3437                     | 0.0925  | 0.1923                   | 0.3467   | 0.2723        | 0.0532   |
|                                | Hyperextend neck        | -0.0214                    | 0.9191  | -0.5914                  | 0.0015** | -0.3026       | 0.0309** |
|                                | Surgeon                 | -0.3518                    | 0.0846  | 0.0443                   | 0.8299   | -0.1614       | 0.2580   |

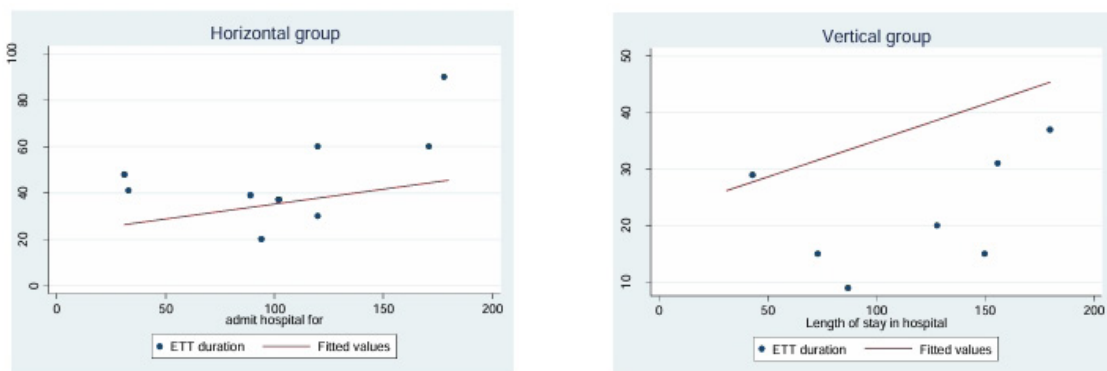
\*Correlation Coefficient

Table 3: The correlation between the timing of tracheostomy and hospitalization.

| Group                |                                      | $\bar{X}$ | SD    | t       | p-value  |
|----------------------|--------------------------------------|-----------|-------|---------|----------|
| Horizontal<br>(n=10) | ETT duration                         | 46.20     | 19.72 |         |          |
|                      | Length of stay in<br>hospital (days) | 104.00    | 48.51 | -4.4571 | 0.0016** |
| Vertical<br>(n=7)    | ETT duration                         | 22.29     | 10.21 |         |          |
|                      | Length of stay in<br>hospital (days) | 116.71    | 50.02 | -5.3286 | 0.0018** |

\*Independent t-test

Figure 3: The correlation between the timing of tracheostomy and hospitalization.



## Discussion

In this study, we compared the outcomes of vertical and horizontal tracheostomy incisions in patients at Phramongkutklao Hospital.

Our results showed no significant differences in surgery procedure time or postoperative complications between the two groups. This contrasts with studies by Sung Yoon Lim<sup>(7)</sup> and Rajiv Ranganath Sanji<sup>(6)</sup>, which found that horizontal incisions were associated with reduced bleeding complications and fewer infectious surgical wounds. However, our study had a relatively small sample size and a low rate of complications, which may explain the lack of significant differences in these outcomes. Our findings are consistent with those of Johnson-Obaseki S, Bradley PJ, and Hemmati H<sup>(8, 10, 11)</sup>, who reported similar results. These results suggest that both incision types can be performed safely with minimal complications.

Regarding the surgical procedure, we found that the incision size affected the operative time. Larger incisions typically required more stitches, likely contributing to increased procedure time. Additionally, we observed that hyperextending the neck during surgery helped reduce the procedure time by providing better exposure to the surgical site. This aligns with previous studies<sup>(9)</sup> emphasizing the importance of optimal patient positioning to enhance surgical efficiency. Due to unpredictable changes in neck anatomy, such as soft tissue swelling or the insertion of intravenous fluid through a central line, our team may utilize ultrasonography of the anterior neck region to estimate the incision size. Early tracheostomy was found to reduce the length of hospitalization, which is consistent with the clinical review by Cheung HN.<sup>(2)</sup> However, due to the small number of participants, determining the precise timing of tracheostomy was challenging. According to data from Table 1, the second evaluation demonstrated that the number of follow-up patients was lower than that of the first evaluation, resulting from death by underlying diseases. Our data was compatible with the recent study conducted by Lei H-H et al.<sup>(12)</sup> Patients. Our results are compatible with Engels PT<sup>(13)</sup>, which indicated that early tracheostomy significantly reduced hospital stay duration. Finally, our study demonstrates comparable outcomes between the vertical and horizontal tracheostomy incisions. Therefore, our findings provided valuable insights into the role of incision size and patient positioning in influencing surgical outcomes. Further research with larger sample sizes and extended follow-up periods is needed to confirm these results and define the optimal timing for tracheostomy procedures.

## Conclusion

This study found no significant differences in procedure time or complications between vertical and horizontal tracheostomy incisions. Both techniques were safe, with minimal complications. Incision size and patient positioning, particularly neck hyperextension, influenced surgery duration. However, further research with a larger sample size is needed to confirm these findings and optimize tracheostomy timing and technique. Moreover, early tracheostomy could minimize hospitalization.

## Limitations

1. Due to the Covid-19 pandemic, there were fewer participants than expected.
2. The small sample size caused the inability to analyze the differences in data between groups.

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