Tracheostomy in critically ill patients: new insights

PAOLO PELOSI, MD, FERS
Department of Surgical Sciences and Integrated Diagnostics (DISC)
IRCCS AOU San Martino IST
University of Genoa, Italy

ppelosi@hotmail.com

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Conflicts of interest

I declare NO conflicts of interest
Percutaneous Tracheostomy in Critically Ill Patients

Giuseppe Servillo
Paolo Pelosi
Editors

Springer
Agenda

- Surgical or percutaneous tracheostomy
- Intra-post op/early-late Complications
- Early or Late Tracheostomy
- Mechanical ventilation during tracheostomy
- Mortality of tracheostomized patients
- Functional abnormalities
- Quality of Life
- Conclusions
Surgical vs Percutaneous Tracheostomies


PT vs ST:

- **Intraoperative**
  - Less total bleeding
  - More technical difficulties

- **Post-operative**
  - Less major bleeding
  - Less stoma infection and inflammation

Blue Rhino vs Griggs

- Griggs with higher risk of intraop major bleeding
- Griggs higher risk of PNX
- Griggs lower risk of tube dislocation during the procedure
Tracheostomy procedures in the intensive care unit: an international survey

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The most frequent early and late complication was "bleeding controlled by compression"
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Paolo Pelosi. 10-й Британсько-Український Симпозіум. Київ, 2018
## Tracheostomy procedures in the intensive care unit: an international survey


<table>
<thead>
<tr>
<th>Most frequent indication</th>
<th>Total</th>
<th>Europe</th>
<th>Outside Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Prolonged mechanical ventilation</td>
<td>151/281 (53.7 %)</td>
<td>107/208 (51.4 %)</td>
<td>44/73 (60.3 %)</td>
</tr>
<tr>
<td>- Difficult/prolonged weaning</td>
<td>68/281 (24.2 %)</td>
<td>55/208 (26.4 %)</td>
<td>13/73 (17.8 %)</td>
</tr>
<tr>
<td>- Neurocritical disease (medical, disease, surgical or trauma involving the neurologic system)</td>
<td>41/281 (14.6 %)</td>
<td>32/208 (15.4 %)</td>
<td>9/73 (12.3 %)</td>
</tr>
<tr>
<td>- Inability to perform airway protection</td>
<td>12/281 (4.3 %)</td>
<td>8/208 (3.8 %)</td>
<td>4/73 (5.5 %)</td>
</tr>
<tr>
<td>- Inability to cough and swallow</td>
<td>5/281 (1.8 %)</td>
<td>4/208 (1.9 %)</td>
<td>1/73 (1.4 %)</td>
</tr>
<tr>
<td>- Improvement of patient respiratory mechanics</td>
<td>3/281 (1.1 %)</td>
<td>1/208 (0.5 %)</td>
<td>2/73 (2.7 %)</td>
</tr>
<tr>
<td>- Copious secretions</td>
<td>1/281 (0.4 %)</td>
<td>1/208 (0.5 %)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most frequent timing</th>
<th>Total</th>
<th>Europe</th>
<th>Outside Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>- &lt;7 days</td>
<td>55/281 (19.6 %)</td>
<td>47/208 (22.1 %)</td>
<td>9/73 (12.3 %)</td>
</tr>
<tr>
<td>- 7–15 days</td>
<td>153/281 (54.4 %)</td>
<td>108/208 (51.9 %)</td>
<td>45/73 (61.6 %)</td>
</tr>
<tr>
<td>- 15–21 days</td>
<td>58/281 (20.6 %)</td>
<td>43/208 (20.7 %)</td>
<td>15/73 (20.5 %)</td>
</tr>
<tr>
<td>- 21–30 days</td>
<td>11/281 (3.9 %)</td>
<td>7/208 (3.4 %)</td>
<td>4/73 (5.5 %)</td>
</tr>
<tr>
<td>- &gt;30 days</td>
<td>4/281 (1.4 %)</td>
<td>4/208 (1.9 %)</td>
<td>0</td>
</tr>
</tbody>
</table>

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Effect of early tracheostomy (< 10 days) on resource utilization and clinical outcomes in critically ill patients: meta-analysis of RCTs


No effect on Mortality

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Early tracheostomy Events</th>
<th>Total Events</th>
<th>Prolonged intubation Events</th>
<th>Total Events</th>
<th>Risk ratio M-H, Fixed, 95% CI Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>El-Naggar 1976</td>
<td>21</td>
<td>26</td>
<td>21</td>
<td>26</td>
<td>1.00 (0.77, 1.30) 1976</td>
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<tr>
<td>Sugerman 1997</td>
<td>13</td>
<td>53</td>
<td>19</td>
<td>95</td>
<td>1.23 (0.66, 2.28) 1997</td>
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<tr>
<td>Rumbak et al 2004</td>
<td>11</td>
<td>60</td>
<td>18</td>
<td>60</td>
<td>0.61 (0.32, 1.18) 2000</td>
</tr>
<tr>
<td>Saffle et al 2002</td>
<td>4</td>
<td>21</td>
<td>6</td>
<td>23</td>
<td>0.73 (0.24, 2.23) 2001</td>
</tr>
<tr>
<td>Bouderka et al 2004</td>
<td>12</td>
<td>31</td>
<td>7</td>
<td>31</td>
<td>1.71 (0.78, 3.77) 2002</td>
</tr>
<tr>
<td>Blot et al 2008</td>
<td>12</td>
<td>61</td>
<td>15</td>
<td>62</td>
<td>0.81 (0.42, 1.59) 2004</td>
</tr>
<tr>
<td>Barquist 2006</td>
<td>2</td>
<td>29</td>
<td>5</td>
<td>31</td>
<td>0.43 (0.09, 2.03) 2004</td>
</tr>
<tr>
<td>Terragni et al 2010</td>
<td>65</td>
<td>209</td>
<td>62</td>
<td>210</td>
<td>1.60 (0.79, 3.31) 2008</td>
</tr>
<tr>
<td>Saboori, 2009</td>
<td>2</td>
<td>20</td>
<td>2</td>
<td>20</td>
<td>0.50 (0.16, 1.49) 2009</td>
</tr>
<tr>
<td>Young et al 2013</td>
<td>168</td>
<td>451</td>
<td>180</td>
<td>448</td>
<td>0.93 (0.79, 1.09) 2008</td>
</tr>
<tr>
<td>Trouillet 2011</td>
<td>30</td>
<td>109</td>
<td>28</td>
<td>107</td>
<td>1.05 (0.68, 1.63) 2009</td>
</tr>
<tr>
<td>Bylappa 2011</td>
<td>0</td>
<td>22</td>
<td>0</td>
<td>22</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Zheng et al 2012</td>
<td>13</td>
<td>58</td>
<td>14</td>
<td>61</td>
<td>0.98 (0.50, 1.90) 2011</td>
</tr>
<tr>
<td>Bosel 2012</td>
<td>3</td>
<td>30</td>
<td>14</td>
<td>30</td>
<td>0.21 (0.07, 0.67) 2011</td>
</tr>
</tbody>
</table>

Total (95% CI) 1180 1226 100.0% 0.93 (0.83, 1.05)

Total events 356 391

Heterogeneity. Chi^2 = 13.57, df = 12 (P = 0.39); I^2 = 12%
Test for overall effect: Z = 1.17 (P = 0.24)

No effect on LOS, VAP, Duration of MV

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Effect of early tracheostomy (< 10 days) on resource utilization and clinical outcomes in critically ill patients: meta-analysis of RCTs


Tracheostomy procedures performed

- Increased!
Agenda

- Surgical or percutaneous tracheostomy
- Intra -post op/early-late Complications
- Early or Late Tracheostomy
- Mechanical ventilation during tracheostomy
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- Conclusions
Percutaneous tracheostomy: it's time for a shared approach!

Shared clinical practice for percutaneous tracheostomy from an analysis of seven national surveys in Europe

<table>
<thead>
<tr>
<th>Findings</th>
<th>Most common practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indications</td>
<td>Long-term mechanical ventilation, weaning failure, and upper airway obstruction</td>
</tr>
<tr>
<td>Techniques</td>
<td>Ciaglia single dilator and guide-wire dilating forceps</td>
</tr>
<tr>
<td>Timing</td>
<td>7 to 15 days after intensive care unit admission</td>
</tr>
<tr>
<td>Involved physicians in percutaneous tracheostomy</td>
<td>Intensivists; ear, nose, throat specialist; and general surgeon</td>
</tr>
<tr>
<td>Neck ultrasound evaluation</td>
<td>Screening before the procedure to assess at-risk structure</td>
</tr>
<tr>
<td>Ventilation protocol</td>
<td>Largely used with volume-controlled ventilation</td>
</tr>
<tr>
<td>Sedation protocol</td>
<td>Largely used in association with local anesthesia, analgesia, and neuromuscular blocking</td>
</tr>
<tr>
<td>Airway management</td>
<td>Endotracheal tube in place</td>
</tr>
<tr>
<td>Fiberoptic bronchoscopy</td>
<td>Largely used</td>
</tr>
<tr>
<td>Diameter of fiberoptic bronchoscope</td>
<td>3 to 5 mm</td>
</tr>
<tr>
<td>Procedural complications</td>
<td>Minor bleeding</td>
</tr>
</tbody>
</table>
Fiberoptic Guidance during PCT

Ultrasound-Guided Percutaneous Dilational Tracheostomy versus Bronchoscopy-Guided Percutaneous Dilational Tracheostomy in Critically Ill Patients (TRACHUS): A RCT


- 118 Critically ill patients
- Primary Outcome: procedure failure
  - conversion to a surgical trach
  - unplanned associated use of bronchoscopy or ultrasound during PDT
  - the occurrence of a major complication

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Pressure Regulated Volume Control (PRVC)
Adaptive Pressure Ventilation (APV)
Autoflow (Volume Assured Pressure Control)

- The inspiratory pressure level is regulated until the preset volumes are delivered.
- P increments: max 3 cmH₂O (PRVC), max 1 cmH₂O (APV), max 3 cmH₂O (Autoflow).
- Max P: 5 cmH₂O (PRVC), 10 cmH₂O (APV and Autoflow) below the set upper limit and alarm.

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DLT- Endotracheal Tube Resistance with and without Fibroscope

Vargas M et al. Respir Care. 2014 Nov;59(11):1652-9
Double Lumen Endotracheal Tube For Percutaneous Tracheostomy

Vargas M et al. Respir Care. 2014 Nov;59(11):1652-9
Percutaneous tracheostomy in ICU with a double lumen endotracheal tube: In-vivo evaluation

Percutaneous tracheostomy in ICU with a double lumen endotracheal tube: In-vivo evaluation

Different available kits with double-lumen endotracheal tube (DLET)


Ciaglia single-step tracheostomy

Griggs guide wire dilating forceps tracheostomy

Tracheostomy tube for DLET
Percutaneous tracheostomy in ICU with a double lumen endotracheal tube: In-vivo evaluation


Gas-exchange before and after PDT

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Mechanical Ventilation during Tracheostomy: How Can We Do Better?

- Sedation, Analgesia and Neuromuscular Blocking Protocol
- Minimize the procedural time ("Best Team" available) in high risk pts
- Use the smallest FOB
- Pressure Regulated Volume Guaranteed (\(V_T\) 7 ml/Kg) with low RR (10 breaths/minute) and I:E=1:2
- FiO\(_2\) 100% --- or less?
- New devices available to improve safety and ventilation
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Long-term survival of critically ill patients treated with prolonged mechanical ventilation: a systematic review and meta-analysis


Pts successfully liberated from the ventilator in the hospital

Event rate (95% CI)

ICUs in acute care hospitals

0.50 (0.46-0.56)

Weaning units in acute care hospitals

0.57 (0.45-0.68)

Post-acute care hospitals

0.49 (0.44-0.53)
Long-term survival of critically ill patients treated with prolonged mechanical ventilation: a systematic review and meta-analysis


Proportion of patients discharged to home from the hospital

Acute care hospitals

Post-acute care hospitals

Event rate (95% CI)

0.13 (0.08-0.21)

0.21 (0.17-0.27)
Long-term survival of critically ill patients treated with prolonged mechanical ventilation: a systematic review and meta-analysis


Mortality at timepoints beyond 1 year

ICUs in acute care hospitals

Weaning units in acute care hospitals

Post-acute care hospitals

Event rate (95% CI)

0.69 (0.63-0.74)

0.56 (0.45-0.66)

0.64 (0.61-0.70)
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Functional abnormalities after Percutaneous Tracheostomy


- Speech difficulties: 51%
- Coughing: 30%
- Shortness of breath: 30%
- Swallowing difficulties: 18%
- Sore Throat: 14%
- Wheezing: 13%
- Scar problems: 10% (40%)
- Painful: 6%
Tracheostomy does not improve the outcome of patients requiring prolonged mechanical ventilation: A propensity analysis


Odds ratios for post-intensive care unit mortality associated with tracheostomy in patients matched on propensity scores

<table>
<thead>
<tr>
<th>Model</th>
<th>OR</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>2.57</td>
<td>1.20–5.48</td>
<td>.01</td>
</tr>
<tr>
<td>Patients decannulated before discharge</td>
<td>1.43</td>
<td>0.42–4.90</td>
<td>.56</td>
</tr>
<tr>
<td>Patients not decannulated before discharge</td>
<td>3.73</td>
<td>1.41–9.83</td>
<td>.008</td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>2.12</td>
<td>1.003–4.40</td>
<td>.049</td>
</tr>
<tr>
<td>Patients decannulated before discharge</td>
<td>0.86</td>
<td>0.26–2.86</td>
<td>.80</td>
</tr>
<tr>
<td>Patients not decannulated before discharge</td>
<td>4.63</td>
<td>1.68–12.72</td>
<td>.003</td>
</tr>
</tbody>
</table>

Tracheostomy may represent an additional risk of death after intensive care unit discharge

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- Quality of Life

Conclusions

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Mortality and QoL after percutaneous tracheostomy in ICU: An observational study

Varghese M et al. Minerva Anestesiologica 2018 Jan 16

Mortality 1 yr
- Neuro: 88%
- ARF: 78%
- Other: 92%

Quality of Life
- QoL = 11: mild disability
- QoL = 12-15: moderate disability
- QoL >15: severe disability
One-Year Outcomes in Caregivers of Critically Ill Patients


- Center for Epidemiologic Studies Depression (CES-D)
- Positive Affect Scale of the Positive and Negative Affective Schedule (PANAS)
- Mental Component Summary (MCS)
- Physical Component Summary (PCS)
Conclusions

- Percutaneous tracheostomy is first choice
- Indications: Prolonged MV, difficult weaning, neuro-muscular diseases
- Intra–post op/early–late Complications
- Late (after 10 days)
- General bundles to optimize tracheostomy procedure, including ECHO and MV setting
- QoL is poor and Mortality is high

Ethical issues

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Conclusions

- Percutaneous tracheostomy is first choice
- Indications: Prolonged MV, neuro-muscular diseases
- Intra –post op/early -late Complications
- Late (of days) complications
- General bundle to optimize tracheostomy including ECHO and MV setting
- Quality of Life is poor and Mortality is high - Follow-up
- Ethical issues

TRACHEOSTOMY: ONLY WHEN ABSOLUTELY NEEDED!

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Let’s make things simple
LESS IS MORE

REDUCE THE NUMBER
OF TRACHEOSTOMIES

Tracheostomy in intensive care:
patients and families will never walk alone!

Pelosi P, Ball L, Brunetti I, Vargas M, Patroniti N.
Anaesth Crit Care Pain Med. 2018 Mar 17

Paolo Pelosi. 10-й Британско-Український Симпозіум. Київ, 2018