Weaning from ventilator after cardiac operation using the Ciaglia percutaneous tracheostomy

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Abstract

Objective: To determine the predictors of weaning from mechanical ventilation after cardiac operation with the Ciaglia percutaneous dilatational tracheostomy (PDT) in our preliminary experience in the use of this technique. Methods: We prospectively analysed 33 consecutive patients (mean age 70.9 ± 12.7 years) who underwent PDT in our intensive care unit after cardiac operation. The investigation involved preoperative and postoperative clinical status, operative procedure, indication and timing for PDT. Results: PDT was performed after a mean time of 7.7 ± 5.0 consecutive days of translaryngeal intubation. Twenty-four (73%) patients were weaned from ventilator after a mean time of mechanical ventilation of 15.8 ± 9.1 days. Time point of PDT was the only predictor of ventilator weaning (P = 0.0029); there was significant association between PDT performed before the seventh consecutive day of translaryngeal intubation (early PDT) and successful weaning from ventilator (P = 0.01; odds ratio = 11.2, 95% confidence interval = 1.2–104.3). Among the patients weaned from ventilator, those who underwent early PDT had significantly shorter times of mechanical ventilation, and intensive care unit and hospital stays than patients with later PDT (P = 0.035, 0.011 and 0.0073, respectively). Nine (27%) patients died of their underlying disease while still being mechanically ventilated; another six (18%) spontaneously breathing but still intubated patients died afterward. No major PDT-related complications were observed. Two minor peristomal bleedings and one self-resolving subcutaneous emphysema were recorded. Conclusions: Early PDT was a safe and effective method to wean from mechanical ventilation the cardiosurgical patients of this series. © 2003 Elsevier B.V. All rights reserved.

Keywords: Cardiac operation; Intensive care unit; Respiratory failure; Tracheostomy; Ventilator

1. Introduction

Some patients occasionally require prolonged airway control after cardiac operations. In order to avoid complications and disadvantages of long-term translaryngeal intubation, elective tracheostomy technique, open or percutaneous, is considered the treatment of choice for this demanding kind of critically ill patients requiring prolonged mechanical ventilation [1]. However, the conventional open tracheostomy performed with the Jackson’s technique [2] is not a complications-free surgical procedure [3]. Therefore, percutaneous tracheostomy has gained increasing acceptance in intensive care units (ICUs) as an excellent alternative to the surgical tracheostomy: in experienced hands, and with proper patient selection, it is feasible at the patient’s bedside, safe, easy, quick, and cost-effective [4,5].

Out of all percutaneous tracheostomies, the Ciaglia percutaneous dilatational tracheostomy (PDT) [6] is nowadays the most widely used in ICUs [4].

So far, much has been written about superiority of percutaneous versus open tracheostomy [5,7], as well as on different types of percutaneous tracheostomy [6,8–10], but only a limited number of small studies concerning percutaneous tracheostomy in cardiosurgical patients [11–13].

The purposes of this prospective study were both to analyse our preliminary experience in the use of PDT after cardiac operations and to outline the portrait (if possible) of the cardiosurgical patient who could get greater benefit by PDT for weaning from mechanical ventilation.
2. Materials and methods

2.1. Study patients

Indications for PDT could be all clinical conditions requiring prolonged mechanical ventilation and airway protection. PDT may be also used to facilitate the weaning from ventilator and to obtain optimal pulmonary toilette. Contraindications include refused consent, age < 15 years, airway emergencies, uncontrolled coagulopathy, inability to palpate a deeply underlying trachea, infection of the neck, previous neck surgery or trauma, any other conditions causing deformity of the trachea, and need for a positive end-expiratory pressure > 15 cmH$_2$O [5]. The Ethical Committee of our Institution approves these indications and contraindications for using PDT also in the cardio-surgical patient management. Therefore, we perform immediately an elective PDT in likely long-term ICU patients, providing that a period of translaryngeal intubation and mechanical ventilation longer than 10 days can be reasonably predicted. This prediction is made according to the patient’s preexisting cardiac disease and comorbidities, postoperative complications, current clinical status, as well as the simultaneous fulfillment of two conditions: the new simplified acute physiology score II (SAPS II) [14] ≥ 30 and the Murray lung injury score (LIS) [15] ≥ 1 [16].

Between March 2000 and June 2003 (40 months), 1492 patients were admitted or readmitted (3%) to our cardio-surgical ICU. Prediction as to the length of mechanical ventilation was made daily from the second postoperative day for the patients coming out from operation, and from the first day after endotracheal reintubation for the patients taken back to ICU. Above-mentioned contraindications for PDT were never found. Finally, PDT was tried and carried out in 33 (2.2%) cardio-surgical patients, i.e. the population of this study.

The reason for ICU-admission of these patients was postoperative management of coronary artery bypass grafting (CABG) ($n = 11$, 33%), valve procedure ($n = 6$, 18%), combined CABG and valve procedure ($n = 10$, 30%), surgery of the thoracic aorta ($n = 4$, 12%), closure of postinfarction ventricular septal defect ($n = 1$, 3%), or pericardectomy ($n = 1$, 3%). Among the 10 (30%) patients who had been readmitted to ICU, the cause of readmission was respiratory failure ($n = 6$), low cardiac output ($n = 2$), or pneumonia ($n = 2$).

Personal data, preoperative clinical status, operative variables, indication and time point for PDT, clinical conditions at the day of PDT, and PDT-related complications were prospectively recorded and analysed. There were 15 women (45%) and 18 men, ranging in age from 24 to 82 years, with a mean of 70.9 ± 12.7 years. Preoperative symptoms were classified according to the New York Heart Association (NYHA) functional class, and the priority of each cardiac operation according to the Society of Thoracic Surgeons. Operative risk was graded according to the European System for Cardiac Operative Risk Evaluation (EuroSCORE) [17]. The severity of postoperative clinical status and the lung injury were quantified, respectively, with SAPS II [14] and LIS [15]. Preoperative right-sided heart catheterization was performed in the patients with left ventricular ejection fraction < 40%, as well as in all the other patients with surgical valve disease. Pulmonary hypertension was defined as systolic pulmonary artery pressure > 59 mmHg. We considered extracardiac comorbidities such as cerebrovascular disease, chronic obstructive pulmonary disease, and renal failure.

After PDT, ventilator weaning began only when patients had: cardiac index > 2.5 l/min per square metre (when measured) and no indirect signs of low cardiac output without important inotropic support (dopamine or dobutamine < 3.0 µg/kg per minute was allowed), urine output > 1.0 ml/kg per hour, presence of signs of recovery from any neurologic lesion, absence of signs of infection, and good nutritional status. Sequence of assisted/controlled ventilation, pressure support ventilation with or without synchronized intermittent mandatory ventilation, and continuous positive airway pressure spontaneous ventilation was always adopted for ventilator weaning. Nightly full ventilatory support was usually used in the first few days of weaning, to allow slow recovering of respiratory muscles function. A trial of spontaneous breathing through a flow-triggering ventilatory circuit with continuous positive airway pressure of 5 cmH$_2$O was performed when patients met these criteria: oxygenation index (arterial oxygen tension/fractional inspiratory oxygen) > 200 with positive end-expiratory pressure < 6 cmH$_2$O, adequate cough during suctioning, respiratory frequency/tidal volume < 106 breaths/min per litre. This trial was considered successful when patients could breath without ventilator for 2 h without being affected by any of the following conditions for more than 5 min: respiratory rate > 35 breaths/min, arterial carbon dioxide tension > 50 mmHg, arterial oxygen saturation < 90%, heart rate > 140 beats/min, systolic blood pressure > 180 or < 90 mmHg, increased anxiety, and diaphoresis. When stable spontaneous ventilation was achieved, the cannula was removed and the tracheostomy was allowed to close.

The survival patients were evaluated for tracheal stenosis with laryngotracheoscopy within the first 3 months of follow-up.

2.2. Technique of percutaneous dilatational tracheostomy

After informed consent was obtained from the patient and/or her/his relatives, a team composed of one anaesthesiologist and one cardiac surgeon performed PDT according to the Ciaglia and Graniero’s method [18], at the patient’s bedside in ICU. The Ciaglia Percutaneous Tracheostomy Introducer Set (Cook Critical Care, Bjaerverskov, Denmark) was used.
Ten minutes after the fractional inspiratory oxygen was set to 1.0, and under general intravenous anaesthesia, the patient was placed on controlled ventilation. Electrocardiogram, arterial blood pressure, and oxygen saturation were monitored continuously throughout the procedure.

The patient’s neck was hyperextended with a roll under the shoulders to anteriorly displace the trachea. Before preparation of the operative area, endotracheal tube was withdrawn under direct vision using the laryngoscope to place the cuff just below the vocal cords: the endotracheal tube was fixed at this place to prevent unintentional extubation and also avoid the risk of puncturing the endotracheal tube or cuff, allowing adequate ventilation during procedure. The intercartilaginous area between the first and second or the second and third tracheal rings was chosen as the site for the tracheostomy: the subcricoid puncture was avoided to prevent late subglottic stenosis, and the area below the third tracheal ring was avoided to minimize the potential trauma to thyroid isthmus and prevent accidental lesion of the brachiocephalic artery. To reduce the risk of bleeding, the skin near the selected site was infiltrated with a solution of 1% lidocaine (Astra Farmaceutici, Milan, Italy) and 0.001% epinephrine (SALF, Bergamo, Italy). Seventeen 7.0 mm and 16 8.0 mm tracheostomy tubes (Portex SIMS, Hythe, Kent, UK) were used.

The puncture of the trachea, the dilatational procedure, and the insertion of the tracheal cannula were performed without bronchoscopic monitoring, although bronchoscope was available in case of procedural complications.

2.3. Statistical analysis

The variables examined included age, sex, NYHA functional class, left ventricular ejection fraction, systolic pulmonary artery pressure, cerebrovascular disease, chronic obstructive pulmonary disease, renal failure, surgical priority, reoperation, EuroSCORE, operative procedures, aortic cross-clamping and cardiopulmonary bypass times, readmission to ICU, SAPS II and LIS of the day of PDT, and indications and timing for PDT. Values of variables were expressed as mean ± SD or as percentage.

Methods of univariate analysis included the Mann–Whitney test for continuous variables and the Fisher’s exact test for categorical variables. A binary logistic regression was then performed to confirm whether significant associations exist between significant variables from the univariate analysis and weaning from mechanical ventilation. Kaplan–Meier estimates and survival curves comparison (Log-Rank test) of the times of mechanical ventilation, and ICU and hospital stays were made. Statistical significance was assumed for a P value <0.05.

Statistical analysis was performed with MINITAB release 13 statistical software (MINITAB Inc., State College, PA).

3. Results

PDT was performed after a mean time of translaryngeal intubation of 7.7 ± 5.0 consecutive days (range 2–19 days): 7.9 ± 4.6 days (median 9) for the patients coming out from operative room to ICU, and 7.2 ± 6.0 days (median 4.5) for the patients coming back from ward to ICU. For the latter patients, ventilation early after cardiac operation, during the first ICU stay, was not considered in this calculus.

Indications for PDT were respiratory failure (n = 11, 33%), low cardiac output (cardiac index <2.0 l/min per square metre) (n = 8, 24%), pneumonia (n = 7, 21%), multiorgan failure (n = 3, 9%), stroke (n = 2, 6%), and sepsis (n = 2, 6%).

All the 33 PDT procedures lasted less than 15 min. No major complications were observed either during or after procedure. There were two (6%) patients who experienced minor peristomal bleeding managed with local pressure and with lidocaine and epinephrine injection into the soft tissue at four corners of the stomal area. One (3%) patient had self-resolving subcutaneous emphysema.

Twenty-four (73%) patients were weaned from ventilator after a mean time of mechanical ventilation of 15.8 ± 9.1 days, with a median of 12.5 (range 5–36 days). Time point of PDT was the only predictor of ventilator weaning (Table 1): there was significant association between PDT performed before the seventh consecutive day of translaryngeal intubation (early PDT) and successful weaning from ventilator (P = 0.01; odds ratio = 11.2, 95% confidence interval = 1.2–104.3). Among the patients weaned from ventilator, those who underwent early PDT had significantly shorter times of mechanical ventilation, and ICU and hospital stays than patients with later PDT (Table 2). There was no statistically significant difference in time of mechanical ventilation comparing the patients who underwent PDT for treatment of their postoperative respiratory failure with the patients who had different indication for PDT (16.0 ± 7.6 versus 13.7 ± 9.2 days, P = 0.24).

Overall mortality was 45% (15 patients). Nine (27%) patients died of their underlying disease while still being mechanically ventilated; another six (18%) spontaneously breathing but still cannulated patients died afterwards. No deaths could be attributed to PDT. No sternal wound infections were observed.

Within 3 months after discharge, neither stridor nor tracheal stenosis developed after decannulation in any of the 18 survivors.

4. Discussion

The technique of percutaneous puncture of the trachea by a needle and subsequent progressive dilatation with blunted dilators over a flexible guiding catheter (PDT) was introduced by Ciaglia in 1985 [6] and improved by Ciaglia.
and Graniero in 1992 [18]. PDT, using the Ciaglia (Cook Critical Care, Bjaeverskov, Denmark) or the Griggs (Portex SIMS, Hythe, Kent, UK) Percutaneous Tracheostomy Introducer Set, overcame the technical problems of the earlier percutaneous technique and led to the general acceptance of percutaneous tracheostomy as a bedside procedure in the critically ill patients [4,5]. Out of all percutaneous tracheostomy techniques [6,8–10], we have chosen the Ciaglia PDT because it is the most commonly performed procedure and the most evaluated in the literature [4,5].

Factors predisposing to prolonged ventilator support include advanced age, congestive heart failure, chronic obstructive pulmonary disease, impaired renal function, urgent or emergency procedure, and reoperation [1,5]. Despite the fact that there are no data to support this opinion, most experts agree that patients requiring translaryngeal intubation over a period of 10 days should have

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients weaned from ventilator (n = 24, 73%)</th>
<th>Patients unweaned from ventilator (n = 9, 27%)</th>
<th>P value (n = 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>73.2 ± 10.7</td>
<td>69.3 ± 17.7</td>
<td>0.85</td>
</tr>
<tr>
<td>Female sex (%)</td>
<td>12 (50)</td>
<td>3 (33)</td>
<td>0.22</td>
</tr>
<tr>
<td>Preoperative clinical status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NYHA functional class</td>
<td>2.9 ± 0.7</td>
<td>3.2 ± 0.8</td>
<td>0.29</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>46.7 ± 11.5</td>
<td>44.9 ± 16.4</td>
<td>0.81</td>
</tr>
<tr>
<td>sPAP (mmHg)</td>
<td>52.4 ± 13.2 (18)</td>
<td>62.3 ± 11.1</td>
<td>0.066</td>
</tr>
<tr>
<td>Cerebrovascular diseaseb (%)</td>
<td>3 (12.5)</td>
<td>2 (22)</td>
<td>0.31</td>
</tr>
<tr>
<td>COPD (FEV1 &lt; 40%) (%)</td>
<td>13 (54)</td>
<td>5 (56)</td>
<td>0.3</td>
</tr>
<tr>
<td>Renal failure (serum creatinine concentration &gt;200 μmol/l) (%)</td>
<td>12 (50)</td>
<td>5 (56)</td>
<td>0.29</td>
</tr>
<tr>
<td>Urgent or emergency surgical priorityc (%)</td>
<td>5 (21)</td>
<td>5 (56)</td>
<td>0.058</td>
</tr>
<tr>
<td>Reoperation (%)</td>
<td>4 (17)</td>
<td>3 (33)</td>
<td>0.21</td>
</tr>
<tr>
<td>EuroSCOREd</td>
<td>9.5 ± 3.6</td>
<td>11.7 ± 5.3</td>
<td>0.21</td>
</tr>
<tr>
<td>Operative procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABG (%)</td>
<td>9 (37.5)</td>
<td>2 (22)</td>
<td>0.24</td>
</tr>
<tr>
<td>Valve procedure (%)</td>
<td>4 (17)</td>
<td>2 (22)</td>
<td>0.34</td>
</tr>
<tr>
<td>CABG + valve procedure (%)</td>
<td>8 (33)</td>
<td>2 (22)</td>
<td>0.29</td>
</tr>
<tr>
<td>Surgery of the thoracic aorta (%)</td>
<td>2 (8)</td>
<td>2 (22)</td>
<td>0.24</td>
</tr>
<tr>
<td>Other procedure (%)</td>
<td>1 (4)</td>
<td>1 (11)</td>
<td>0.41</td>
</tr>
<tr>
<td>Aortic cross-clamping time (min)</td>
<td>69.8 ± 27.6 (22)</td>
<td>59.1 ± 9.6</td>
<td>0.43</td>
</tr>
<tr>
<td>CPB time (min)</td>
<td>115.5 ± 37.1 (22)</td>
<td>108.2 ± 27.2</td>
<td>0.65</td>
</tr>
<tr>
<td>Readmission to ICU (%)</td>
<td>9 (37.5)</td>
<td>1 (11)</td>
<td>0.13</td>
</tr>
<tr>
<td>SAPS II of the day of PDTf</td>
<td>43.8 ± 10.0</td>
<td>49.0 ± 9.2</td>
<td>0.06</td>
</tr>
<tr>
<td>LIS of the day of PDT</td>
<td>1.6 ± 0.5</td>
<td>1.4 ± 0.5</td>
<td>0.34</td>
</tr>
<tr>
<td>Time point of PDT (days)g</td>
<td>6.3 ± 5.1 (5)</td>
<td>11.2 ± 2.3 (12)</td>
<td>0.0029</td>
</tr>
<tr>
<td>Indication for PDT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory failure (%)</td>
<td>10 (46)</td>
<td>1 (11)</td>
<td>0.091</td>
</tr>
<tr>
<td>LCO (%)</td>
<td>4 (17)</td>
<td>4 (44)</td>
<td>0.096</td>
</tr>
<tr>
<td>Pneumonia (%)</td>
<td>6 (25)</td>
<td>1 (11)</td>
<td>0.28</td>
</tr>
<tr>
<td>MOF (%)</td>
<td>2 (8)</td>
<td>1 (11)</td>
<td>0.45</td>
</tr>
<tr>
<td>Stroke (%)</td>
<td>2 (8)</td>
<td>0</td>
<td>0.52</td>
</tr>
<tr>
<td>Sepsis (%)</td>
<td>0</td>
<td>2 (22)</td>
<td>0.068</td>
</tr>
</tbody>
</table>

CABG, coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease; CPB, cardiopulmonary bypass; EuroSCORE, European system for cardiac operative risk evaluation; FEV1, forced expiratory volume in one second; ICU, intensive care unit; LCO, low cardiac output; LIS, the Murray lung injury score; LVEF, left ventricular ejection fraction; MOF, multorgan failure; NYHA, New York Heart Association; PDT, the Ciaglia percutaneous dilatational tracheostomy; SAPS II, the new simplified acute physiology score II; sPAP, systolic pulmonary artery pressure.

* The patients who had preoperative right-sided heart catheterization.

b Symptomatic carotid stenosis greater than 50%, non-symptomatic carotid stenosis greater than 70%, vertebral atherosclerotic disease, previous transient, reversible, or permanent ischemic neurological deficit, or previous carotid endarterectomy.

c According to the Society of Thoracic Surgeons.

d EuroSCORE 6 or higher equals high-risk patients (95% confidence interval for predicted mortality = 10.9–11.5%) [17].

e The patients undergoing CPB.

f Mean SAPS II of the study patients was 45.2 ± 9.9 (95% confidence interval for predicted mortality = 10.6–75.3%) [14].

g The number of consecutive days of translaryngeal intubation early before PDT.

b Median.
a tracheostomy performed [19]. However, the timing of tracheostomy, open [2] or percutaneous [6,8–10], is still controversial [20–22]. Much of this controversy originates from the difficulty of accurately predicting both the length of time that patients will likely require mechanical ventilation, and the kind of patients that will gain one or more of the benefits ascribed to tracheostomy versus the probability they will suffer from any reported procedural complications. Although some authors prefer early tracheostomy [13,20], there is no adequate comparative study as to the advantages of this approach [24].

Decreased airway resistance, more effective airway suctioning and mouth care, enhanced patient mobility and comfort with free nose and pharynx, ability to speak and eat orally, more secure airway control, quicker and safer tube replacement, and more secure fixation are the recognized advantages of tracheostomy versus prolonged translaryngeal intubation. These benefits facilitate and accelerate weaning from mechanical ventilation, reduce ventilator-associated and aspiration pneumonias, improve patient comfort, and make possible the transfer of ventilator-dependent patients from the ICU [1]. Although all that is very important in every critically ill patient, it is more and more important in patients taken into ICU after cardiac operations. In fact, the typical cardiosurgical patient is elderly, has restricted cardiac work reserve and unstable haemodynamics, and suffers from frequent extracardiac comorbidities such as cerebrovascular disease, chronic obstructive pulmonary disease, and renal failure. In addition to this, while off-pump cardiac surgery is becoming widespread, most cardiac operations are still performed on cardiopulmonary bypass that has long been recognized as one of the main causes of a complex systemic inflammatory response contributing to postoperative complications and organ dysfunction. Out of the accepted advantages of percutaneous versus open tracheostomy [5,7], ease of performance at the patient’s bedside in ICU, rapidity of execution, lesser reduction of the oxygenation index early after procedure [12], lower risk of cross-contamination of the sternal wound with microbes from the trachea [13], and generally lower complications rates are the most important to cardiosurgical patients.

The rate of PDT after cardiac operations recorded in the present study is in agreement with the data in the literature: postoperative complications requiring prolonged mechanical ventilation in cardiac surgery occur in about 2% of primary CABG and valve surgery patients and in up to 4% of reoperation patients [12].

As well as open tracheostomy, percutaneous tracheostomy is associated with various periprocedural, postprocedural, and late complications. In a meta-analysis comparing percutaneous versus open tracheostomy, it was found that the first is associated with a higher prevalence of perioperative complications but lower rates of postoperative complications [23]. Another meta-analysis reported the lower incidence of peristomal bleeding and postoperative infection as potential advantages of PDT relative to open tracheostomy [24]. In the present study, only two minor complications were recorded in three patients: bleeding and self-resolving subcutaneous emphysema. Bleeding is the most common perioperative complication after tracheostomy. Bleeding rate in PDT is low due to minimal amount of procedural, and late complications. In a meta-analysis comparing percutaneous versus open tracheostomy, it was found that the first is associated with a higher prevalence of perioperative complications but lower rates of postoperative complications [23]. Another meta-analysis reported the lower incidence of peristomal bleeding and postoperative infection as potential advantages of PDT relative to open tracheostomy [24]. In the present study, only two minor complications were recorded in three patients: bleeding and self-resolving subcutaneous emphysema. Bleeding is the most common perioperative complication after tracheostomy. Bleeding rate in PDT is low due to minimal amount of procedural, and late complications. In a meta-analysis comparing percutaneous versus open tracheostomy, it was found that the first is associated with a higher prevalence of perioperative complications but lower rates of postoperative complications [23]. Another meta-analysis reported the lower incidence of peristomal bleeding and postoperative infection as potential advantages of PDT relative to open tracheostomy [24].
complications are rare and most of them can be avoided by thorough examination of the proposed PDT site. The guiding catheter sliding in the dilator in PDT may cause posterior tracheal wall damage with subcutaneous emphysema, pneumomediastinum, and pneumothorax. Too much tight stoma may cause air leak from PDT into the paratracheal tissue in the form of subcutaneous emphysema [3,5]. Bronchoscopy in PDT is frequently advocated [5]. However, it is not always practiced [25]. As our low complications rate was obtained without bronchoscopic guidance, this study confirms the safety of PDT if simple precautions, such as ensuring free aspiration of air on needle insertion into trachea, bubbling of fluid placed over the hub of the cannula during ventilation, and free mobility of guide wire at each step of the procedure, are observed to secure the right positioning of the tracheostomy tube. According to our experience, cross-contamination with microbes from the trachea of the sternal wound after PDT is not a problem. Also the risk of tracheal stenosis after decannulation is low, though follow-up has been brief.

Even if we agree that decisions on the time point of tracheostomy should be made on an individual basis and should depend on prognostic evaluations and not on calendar watching [22], we prefer to perform early PDT in our cardiosurgical patients because of its low complications rate and its recognized benefits. Moreover, according to our analysis, early PDT was predictor of successful weaning from ventilator; it apparently spared days of mechanical ventilation, and ICU and hospital stays in the weaned patients of this study.

In this experience, postoperative respiratory failure was the most frequent indication for PDT, including one-third of the patients of this study. Respiratory failure is an occasional postoperative complication of the cardiosurgical patient. Although its pathogenesis is complex, in many cases it is related to reversible modifications of lungs due to cardiopulmonary bypass. However, despite a prognosis sometimes more favourable, successful weaning from ventilator in the patients with postoperative respiratory failure as indication for PDT was not faster than in the patients with the other indications, the same method of weaning being used in these two groups.

The main limitations of this paper concern the study design and method of prediction of length of mechanical ventilation we adopted. As regards the study design, a randomized controlled study design seemed most appropriate. We are well aware that our clinical judgment may have unintentionally selected ‘better’ patients for early PDT, so introducing a selection bias. However, because we confide in above-mentioned advantages of PDT for critical cardiosurgical patients, we think it is ethically incorrect to randomize such frail patients. Our method of prediction of the length of mechanical ventilation is certainly subjective and arbitrary, but it is both functional and empirical: the two scoring systems we have chosen are easy, quick, and diffusely used. Moreover, according to the Troché and Moine’s observational study, LIS is an independent predictor of duration of endotracheal intubation ≥ 15 days ($P = 0.004$; odds ratio $= 3.7$) [16]. Up to now, on the other hand, there have been no reliable scoring systems that would predict the length of ventilation. The intensivist’s experience and insight are essential.

Although we cannot draw any final conclusions from this non-randomized and non-controlled prospective analysis of a restricted series of patients, early PDT could be a safe and good method to wean from ventilator the patients requiring prolonged mechanical ventilation after cardiac operations.

References


