The Utility of Chest Radiographs Following Percutaneous Dilatational Tracheostomy*

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**Objective:** To determine the usefulness of performing routine postprocedure chest radiographs (CXRs) following percutaneous dilatational tracheostomy (PDT) under bronchoscopic visualization.

**Design:** Retrospective, chart review.

**Setting:** Medical-surgical ICU of a teaching hospital.

**Methods:** Sixty patients who underwent PDT under bronchoscopic visualization, for persistent ventilator dependence, in our medical-surgical ICU were studied. We noted the occurrence of any perioperative complications, physician anticipation of postoperative complications, and postprocedure CXR findings. We compared postprocedure CXRs with the last preprocedure CXR. *Immediate postoperative complication* was defined as a clinical worsening, hemodynamic instability, or a new radiographic finding such as atelectasis, paratracheal placement, pneumothorax, and pneumomediastinum. We determined whether the postprocedure CXRs led to any change in patient management.

**Observation:** Two patients (3.3%) had postoperative complications detected on their CXRs, one with a pneumomediastinum and the other with a tension pneumothorax. Both procedures were noted to be difficult, with a high physician anticipation of complication. In the remaining 58 patients (96.7%), no postoperative complications were detected on the postprocedure CXRs that necessitated any change in patient management.

**Conclusion:** We concluded that routine CXR following PDT that had been performed under bronchoscopic visualization is unnecessary in the absence of clinical deterioration or the anticipation of postoperative complications. (CHEST 2003; 123:1603–1606)

**Key words:** chest radiograph; complications; percutaneous dilatational tracheostomy

**Abbreviations:** CXR = chest radiograph; PDT = percutaneous dilatational tracheostomy

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Percutaneous dilatational tracheostomy (PDT) has become a commonly performed procedure in the ICU. It has largely replaced conventional tracheostomy in intubated patients who experience respiratory failure and failure to wean. Studies have demonstrated a lower incidence of complications with PDT compared to conventional tracheostomy. Perioperative complications with PDT, including hemorrhage, pneumothorax, and paratracheal placement, have ranged in various series from 3 to 18%.

Several authorities have shown that bronchoscopic guidance during PDT provides a higher degree of safety and decreases the incidence and severity of complications. Whether postprocedure chest radiographs (CXRs) are of any value in detecting perioperative complications has not been studied.

Routine CXR following tracheostomy is a common practice. Limited data exist on the value of postprocedure CXRs following tracheostomy, whether conventional or percutaneous. One retrospective study by Tarnoff et al of cases of conventional tracheostomy found that abnormalities detected by posttracheostomy CXR did not alter patient management.

We have noted in our institution that obtaining a CXR following PDT is a routine practice. Whether
this practice results in any benefit and whether obtaining post-PDT CXRs results in significant changes in the management of patients is not known. The objective of this study was to determine the utility of obtaining CXRs following PDT and to
determine whether these studies detected complications that resulted in any significant changes in management.

**Materials and Methods**

The medical records of 60 patients with ventilator dependence and failure to wean, who had undergone PDT in our institution between 1997 and 2000, were retrospectively reviewed. All patients had undergone PDT under bronchoscopic guidance. PDT was performed at the bedside by either of two surgical intensivists using the standard surgical technique, as popularized by Ciaglia et al.12 The same system was used in performing the PDTs.

The data obtained from charts included age, sex, indication for PDT, comorbid conditions, and complications, if any, during the procedure and up to 48 h after the procedure. The perioperative complications studied included bleeding, subcutaneous emphysema, hypotension, arrhythmia, and pneumothorax. Immediate postoperative complication was defined as ventilatory or hemodynamic instability or a new radiographic finding such as atelectasis, pneumothorax, or pneumomediastinum that had not been present in the last preprocedure CXR or evidence of tracheal tube malpositioning. Whether the procedure was technically difficult and whether there was physician anticipation of postoperative complication was determined from the procedure notes. The immediate preprocedure CXR and the postprocedure CXR were reviewed and compared. Whether the findings on the CXR obtained postprocedure resulted in any changes in patient management such as chest tube insertion, bronchoscopy, chest physiotherapy, and tracheal tube repositioning was determined from progress notes.

**Results**

The medical records of 60 patients who had undergone PDT in our institution between 1997 and 2000 were analyzed. All 60 patients had undergone PDT for respiratory failure with ventilator dependence and failure to wean. Of the 60 patients, 34 (56.7%) were men and 26 (43.3%) were women. The

**Discussion**

Our study found a low rate of complications for PDT performed under bronchoscopic monitoring. Complications due to PDT have ranged from 0 to 18%.2-5 The perioperative complications that have been reported to occur with PDT include hemorrhage, pneumothorax, paratracheal placement, tracheal perforation, subcutaneous emphysema, cardiac dysrhythmia, the inability to complete the procedure, and, rarely, death. The complication rate was 0% in the series reported by Moore et al.4 8.2% in the series reported by Ciaglia and Graniero6 9.8% in the series reported by Marelli et al,5 10% in the series reported by Bodenham et al,3 and 18% in the series reported by Winkler et al.7 The complications reported by Ciaglia and Graniero6 were all minor. In the series of Marelli et al,5 all complications were minor except for one fatality due to arrhythmia. Marelli et al5 confirmed the satisfactory placement of dilators during the procedure by bronchoscopic visualization.

In our institution, the same system had been used in performing the PDTs during the period studied. Two skilled surgical intensivists had performed all PDTs. Based on the above information, as well as on the fact that the incidence of complications over the period studied was low, we cannot comment on a learning curve effect of the change in technique or technology on the occurrence of complications.

Overall, fatalities due to PDT itself are rare. Moe et al,11 in a meta-analysis of >1,500 cases, found that the mortality rate in most individual series ranged from 0 to 14%. Of 1,146 cases that were analyzed from major studies in the literature, there were four deaths reported (mortality rate, 0.4%).13 Deaths were due to paratracheal placement, cardiac arrhythmia, and accidental decannulation. The incidence of pneumothorax in various series has ranged from 0 to 3%, while that of paratracheal placement has ranged from 0 to 6%.13 The complications that would be detected with CXR following PDT would be tracheal tube malpositioning, paratracheal placement, pneumothorax, and pneumomediastinum. However, tracheal tube malpositioning and paratracheal placement could be detected if bronchoscopic monitoring had been carried out during the procedure. Due to concern about the possible misplacement of the tracheal tube, some authors routinely perform bronchoscopy to confirm
positioning. Hence, bronchoscopy during PDT works as an important safety measure and may preclude the need for a CXR following procedure. The role of CXRs in the detection of perioperative complications following PDT is undefined presently, with limited data existing in literature.

Several authors7–10 have shown that bronchoscopic guidance during PDT provides a high degree of safety. The midline puncture of the tracheal anterior wall and consequently a reduction in potential complications can only be achieved by bronchoscopic monitoring.8 Winkler et al7 performed PDT with bronchoscopy in 71 patients and found that the initial puncture was incorrect in 13 (18%). Hence, most authorities stipulate the need for the endoscopic monitoring of tracheal cannulation and dilation with bronchoscopy. However, some authors2 have found no significant difference in the occurrence of complications in PDT performed with bronchoscopic monitoring and that performed without bronchoscopic monitoring.

Studies14 have shown that life-threatening complications often are detected clinically prior to a CXR being performed. This was also evident in our study in which both patients with complications were clinically suspected to have developed the complications prior to it being confirmed on CXR.

In a retrospective study of 268 patients by Tarnoff et al,11 postprocedure CXRs following open tracheostomy detected complications in a small number of cases. One patient (0.3%) had a pneumothorax, and eight patients (2.4%) had postoperative subsegmental atelectasis. No significant changes in patient management occurred as a result of these radiographic studies. Similar studies following PDT are lacking at present.

The present study sought to evaluate the utility of performing CXRs routinely following PDT that was performed under bronchoscopic monitoring. Although limited by the fact that this was a retrospective study, the study demonstrated the following: (1) the incidence of complications with PDT is low under bronchoscopic guidance; and (2) complications can be recognized clinically and anticipated in difficult cases. Because complications, when they occur, either are clinically evident or are suspected to have occurred, CXRs after the performance of PDT should be reserved for those patients who have clinical evidence of a complication or in whom it is suspected that a complication might have occurred.

Eliminating the need for routine postprocedure CXRs in every patient who undergoes PDT would result in a significant decrease in medical costs. The study by Tarnoff et al11 on patients undergoing open tracheostomy estimated a reduction in costs of $52.39 per patient by not performing a routine posttracheostomy CXR in every patient.

In the 96.7% of the patients studied, in whom no complications were detected on CXR, no change in patient management occurred as a result of the CXRs. Hence, in patients who have undergone an uncomplicated surgery with the correct placement of the tracheal tube confirmed bronchoscopically and a low clinical suspicion of complications occurring, postprocedure CXRs are of no benefit and do not result in any alteration in patient management. Hence, in these patients post-PDT CXRs need not be performed.

Following PDT, the obtaining of a CXR should be reserved for the following cases: difficult procedures; clinical deterioration postprocedure; postprocedure hemodynamic instability, such as hypotension and arrhythmia; ventilatory difficulties with worsening oxygenation and high peak airway pressures; subcutaneous emphysema; and clinical findings of pneumothorax, such as diminished breath sounds.

Conclusions

CXRs following PDT do not reveal new abnormalities in the majority of cases. In the few patients in whom post-PDT CXRs reveal complications, usually it has been clinically suspected or evident. The routine performance of CXRs post-PDT is of no benefit and should be restricted to patients with a difficult operative course or a suspected or evident complication. A prospective, randomized study should be performed to further define the role of CXRs following percutaneous dilatational tracheostomy.

References


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