

# Tracheocutaneous Fistula Closure: Outcomes and Complications in the Pediatric Population

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## Abstract

**Objective:** To review the outcomes and complications of tracheocutaneous fistula closure over a 6 year period

**Study Design:** Historical cohort study

**Methods:** Retrospective review of patient data and review of the literature.

**Results:** Over a 6 year period 19 children underwent tracheocutaneous fistula closure by 3 surgeons. 17 underwent primary excision and closure of the fistula, while 2 underwent secondary closure by excising the tract and replacing the tracheostomy temporarily. All patients' TCFs closed satisfactorily. Two complications were noted; one patient developed subcutaneous emphysema which resolved without complication or intervention, and one developed severe subcutaneous emphysema and pneumomediastinum in the postoperative care unit necessitating a reintubation. All patients had acceptable cosmetic outcomes once healed. No long term complications were noted.

**Conclusions:** While tracheocutaneous fistula remains a seemingly minor complication of long term tracheostomy placement, closure of the fistula can result in potentially catastrophic complications. Our series confirms that closure can be satisfactorily and safely performed by either primary or secondary closure techniques, but may still result in potentially life threatening complications. Careful attention should be paid to meticulous technique in primary closure to prevent acute complications

## Introduction

Persistent tracheocutaneous fistula (TCF) after tracheostomy decannulation occurs between 3% and 40% of pediatric tracheostomies. Tracheocutaneous fistulas form via squamous epithelialization of the tracheostomy stoma tract and increases in risk the longer a tracheostomy remains in place. These fistulas cause chronic drainage, skin irritation, poor cosmesis, weak cough and the continued inability of children to enjoy activities such as swimming. The persistence of a TCF can be discouraging to the patient and family after finally being able to undergo permanent tracheostomy decannulation, and is usually accompanied by a strong desire for TCF closure.

The optimal treatment modality has been debated in the literature for some time and usually varies by institution. Management usually involves surgical treatment with excision of the fistula tract, and the two most common techniques are 1) primary closure with drain placement and 2) replacement of a small tracheostomy tube with subsequent decannulation, allowing healing by secondary intention soon thereafter. Primary closure offers the benefit of improved cosmesis of the scar but has the possible complication of subcutaneous emphysema from air escaping through the fistula tract, a complication which can become serious. Secondary closure is often avoided because the patient and family are often hesitant to accept the idea of tracheostomy replacement after the patient has finally achieved decannulation, but it has been proposed to be a safer method of closure. Here we present a case series with comparison of the two techniques and discussion of ways to avoid complications.

Case	Closure Type	Drain Type	Complications
1	Primary	Penrose drain	No acute complications
2	Secondary	None	No acute complications
3	Primary	Rubber band drain	No acute complications
4	Primary	Rubber band drain	No acute complications
5	Primary	Rubber band drain	No acute complications
6	Primary	Rubber band drain	No acute complications
7	Primary	Rubber band drain	No acute complications
8	Primary	None	No acute complications
9	Primary	Rubber band drain	No acute complications
10	Primary	None	No acute complications
11	Primary	Rubber band drain	Subcutaneous emphysema in the neck, moderate pneumomediastinum right apical pneumothorax
12	Secondary	None	No acute complications
13	Primary	None	No acute complications
14	Primary	Rubber band drain	No acute complications
15	Primary	Rubber band drain	No acute complications
16	Primary	Rubber band drain	No acute complications
17	Primary	Vessel loop	No acute complications
18	Primary	Rubber band drain	Subcutaneous emphysema in the neck, right apical pneumothorax and pneumomediastinum
19	Primary	Penrose drain	No acute complications

Table 1. TCF Closure Cases. Overall 19 TCF closure cases from 2010-2016 at Memorial Hermann Hospital.

## Methods and Materials

A retrospective review was undertaken for all tracheocutaneous fistula closures at a tertiary care Children's Hospital between July 2010 and June 2016. Cases were identified using procedure CPT codes. Primary closure cases were performed by excision of the fistula tract, three layered closure and drain placement based on surgeon's preference. The drain types used were either rubber band drains or penrose drain. In these cases the drain was usually removed on POD 1-2. Some cases were closed primarily without drain placement. Secondary closure entailed excision of the fistula tract and replacement of a small tracheostomy tube. Patients were then decannulated either in PACU or on POD 1 and the stoma was allowed to close by secondary intention. All patients were extubated in the OR and transported to PACU.

## Results

In total, 19 cases of tracheocutaneous fistula closure were identified. Of these, there were 2 cases that had complications. Both cases involved primary closure of the TCF with rubber band drain placement. In the first case, the child had postoperative nausea and vomiting with significant retching in PACU. The patient was noted to have subcutaneous emphysema so chest X-ray was ordered which showed subcutaneous emphysema in the neck and mild pneumomediastinum. He was followed with daily chest x-rays until he had resolution of pneumomediastinum on POD 5 and was then discharged that day. In the second case, the patient had moderate to severe agitation with screaming and crying in PACU. The child then developed mild to moderate respiratory distress and subcutaneous emphysema was noted. The neck incision was immediately reopened at the bedside and the patient was urgently reintubated. Chest x-ray demonstrated pneumomediastinum and subcutaneous emphysema. The patient was taken back to the OR where a small tracheostomy tube was replaced without complications. The patient was then decannulated in the ICU on POD 2. The stoma healed well without complications.

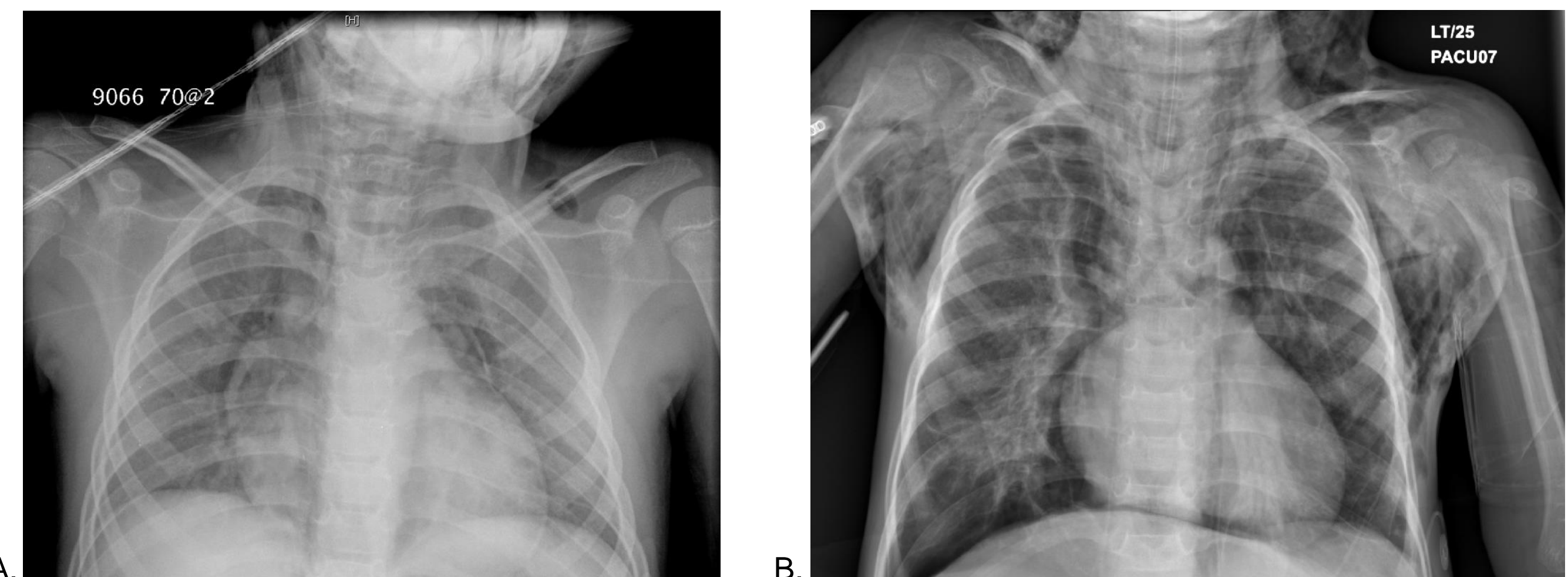


Figure 1. Complications of TCF closure. A. First complication with subcutaneous emphysema of neck, moderate pneumomediastinum. B. Second complication with subcutaneous emphysema, pneumomediastinum and right pneumothorax.

## Discussion

Persistent tracheocutaneous fistula is a complication of prolonged tracheostomy which is caused by epithelialization of the tracheostomy tract, inhibiting healing and closure after decannulation. Surgical closure is often the only definitive method of treatment. The two main methods of surgical repair are primary closure with drain placement or fistula excision with trach replacement and closure by secondary intention. Despite a lengthy debate over optimal closure method, recent systematic reviews have shown no difference in complication rates between closure types. Most complications are caused by air escaping into the neck via the remnant fistula tract which is exacerbated by increased intrathoracic and airway pressures. Increased airway pressure can be caused by screaming, Valsalva, retching or coughing.

Here we present a case series of 19 cases of tracheocutaneous fistula closure. In two cases there were major complications predominated by subcutaneous emphysema and pneumomediastinum. In one case, postoperative nausea and vomiting with significant retching appeared to be the cause and in the other case, the patient had significant agitation in PACU resulting in air trapping. Both of these cases highlight the importance of smooth emergence, rigorous nausea control and minimization of postoperative agitation. The anesthesia team and postoperative nursing team are vital to the delivery of this care. It is important to discuss these aspects of the postoperative plan with these teams in order to ensure minimal complications after tracheocutaneous fistula closure. Similarly, patients with known behavioral problems who are likely to emerge from anesthesia with significant agitation may be better suited for closure by secondary intention.

Tracheocutaneous fistula closure should not be dismissed as a minor procedure. Parents should be appropriately counseled regarding potential complications as well as be taught how to recognize potential complications. As most data on these procedures has revolved around single institution retrospective case reviews, prospective randomized controlled trials may be beneficial to determine the optimum method of management for future cases.

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## References

1. Wine TM, Simons JP, Mehta DK. Comparison of 2 techniques of tracheocutaneous fistula closure analysis of outcomes and health care use. *JAMA Otolaryngol Head Neck Surg.* 2014; 140(3): 237-242.
2. Tasca RA, Clarke RW. Tracheocutaneous fistula following paediatric tracheostomy – A 14-year experience at Alder Hey Children's Hospital. *International Journal of Pediatric Otorhinolaryngology.* 2010; 74: 711-712.
3. Al-Samri M, Mitchell I, Drummond DS, Bjornson C. Tracheostomy in children: A population-based experience over 17 years. *Pediatric Pulmonology.* 2010; 45: 487-493.
4. Corbett HJ, Mann KS, Mitra I, Jesudason EC, Losty PD, Clarke RW. Tracheostomy – A 10-year experience from a UK pediatric surgical center. *Journal of Pediatric Surgery.* 2007; 42: 1251-1254.
5. Colman KL, Mandell DL, Simons JP. Impact of stoma maturation on pediatric tracheostomy-related complications. *Arch Otolaryngol Head Neck Surg.* 2010; 136(5): 471-474.
6. Osborn AJ, de Alarcon A, Hart CK, Cotton RT, Rutter MJ. Tracheocutaneous fistula closure in the pediatric population: Should secondary closure be the standard of care? *Otolaryngology-Head and Neck Surgery.* 2013; 149(5): 766-771.
7. Cheng J, Setabutr D. Tracheocutaneous fistula closure in children. *International Journal of Pediatric Otorhinolaryngology.* 2016; 89: 107-111.
8. Lewis S, Arjomandi H, Rosenfeld R. Systematic review of surgery for persistent pediatric tracheocutaneous fistula. *Laryngoscope.* 2017; 127: 241-246.
9. Schroeder JW, Greene RM, Holinger LD. Primary closure of persistent tracheocutaneous fistula in pediatric patients. 2008; 43: 1786-1790.