POST-TRACHEOSTOMY HEMORRHAGE

SUMMARY

Post-tracheostomy hemorrhage may be classified into two broad categories: early and late. In the first few hours after tracheostomy, inadequate surgical hemostasis and/or coagulopathy are the most common causes of hemorrhage from the tracheostomy wound. The most feared cause is late hemorrhage due to tracheo-innominate artery fistula (TIF), the hallmark of which is massive arterial bleeding either via or around the tracheostomy. Prompt surgical attention is the key to managing this often fatal process.

RECOMMENDATIONS

- **Level 1**
  - **None**
- **Level 2**
  - **Percutaneous dilational tracheostomy (PDT) is not contraindicated in patients with severe liver disease or refractory coagulopathy**
- **Level 3**
  - **Hemorrhage in the first 24 hours post-tracheostomy is often due to inadequate surgical hemostasis or preexisting coagulopathy**
  - **Prophylactic subcutaneous heparin does not increase the risk of peri-procedure hemorrhage**
  - **Full anticoagulation with heparin does not predispose patients to bleeding**
  - **Consideration for tracheo-innominate artery fistula (TIF) should be given if arterial bleeding is noted from or around a tracheostomy site several days to months following tracheostomy**
  - **Suspected TIF should receive immediate surgical attention**
    - **Bronchoscopy (rigid/flexible) is the diagnostic tool of choice. This should be performed in the operating room with appropriate sub-specialty support (thoracic surgery).**

INTRODUCTION

Post-operative hemorrhage is a potential complication associated with any surgical procedure. In the first few hours to days post-tracheostomy, peri-stomal bleeding can usually be attributed to surgical site oozing, but hemorrhage from larger arteries and veins, as well as the thyroid gland, should always be considered based upon the technical difficulty associated with the procedure. Late hemorrhage also has multiple causes including infection, granulation tissue formation, coagulopathy, tumor invasion, pulmonary artery rupture and most notably TIF. Over 75% of TIF's occur in the first three weeks after tracheostomy

EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

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and are often heralded by a self-limited so-called “sentinel bleed” from either the tracheostomy tube itself or around the tracheostomy site in the hours to day prior to the exsanguinating hemorrhage.

Prompt surgical attention, performed in the operating room, is the key to patient survival from TIF. Personnel with skills in urgent airway management and the ability to correct the fistula are fundamental. Simple maneuvers can maintain the airway and control bleeding until definitive diagnosis / repair is complete.

LITERATURE REVIEW

Beiderlinden et al. evaluated the effect of pre-operative coagulation status on the incidence of acute and chronic bleeding in 415 consecutive patients undergoing percutaneous dilational tracheostomy (PDT) (1). The incidence of acute bleeding was independent of the coagulation variables tested. The risk of chronic bleeding was higher with an activated partial thromboplastin time above 50, a platelet count below 50,000, and in the presence of two or more abnormal coagulation variables. Low-dose heparin treatment did not significantly increase the risk of chronic bleeding.

Pasin et al. demonstrated a low incidence of severe bleeding complications related to PDT despite anticoagulant therapies (2). This is one of the largest studies ever published on bleeding complications associated with PDT in critically ill-patients receiving anticoagulant or antiplatelet therapies. Thirty-six patients (2.7% of the overall ICU population) underwent PDT during a one-year period. Twenty-six patients were on anticoagulation therapy, one patient was on antiplatelet therapy and two patients received prophylactic doses of low molecular weight heparin. Only four patients had a normal coagulation profile and were not receiving anticoagulant or antiplatelet therapies. Overall, bleeding of any severity complicated 19% of PDTs. No procedure-related deaths occurred.

Fatal complications of PDT are rare and intraoperative fatal complications even more so. Giblet et al. did an extensive review of all previously reported fatal complications of PDT (3). Almost all fatal complications of PDT resulted from vascular injury. It is recommended that each patient have an extensive evaluation of their history and a thorough physical examination prior to attempting PDT. Any vascular pulsation palpated over the tracheostomy site should mandate preoperative ultrasound or conversion to open surgical tracheostomy. Those with previous neck surgery, radiotherapy or unclear surgical anatomy should be approached with caution.

Auzinger et al. performed a prospective cohort study of 60 consecutive patients in a single institution (4). Evaluated patients had refractory coagulopathy (platelet count less than or equal to 50×10^9 cells/L or international normalized ratio (INR) greater than 1.5 on the day of PDT and for the 72 hours afterward). Of the twenty-five patients who fulfilled the definition criteria of refractory coagulopathy, there was no significant difference in number of bleeding incidents between groups. The rate of clinically relevant early complications was not higher than expected (n=7, 12%). Resource utilization was higher for patients with coagulopathy, receiving significantly more platelet transfusions over the three-day period (80 versus 49 units; p=0.009) and increased fresh frozen plasma requirements (p=0.059). The number of patients requiring platelet transfusion was higher in the coagulopathy group (21/25 versus 20/35; p=0.029). Hospital survival did not differ between groups.

The overall incidence of TIF has been reported to be 0.3-0.7%. Jones et al., in 1976, reported a case series of ten patients over 12 years at a large teaching hospital (5). They also reviewed the literature available at that time, for a total of 137 patients. Factors thought to contribute to TIF were: high-pressure tracheostomy cuffs (as opposed to current low-pressure cuffs), distally placed tracheostomy (4^{th} tracheal ring or below), abnormally high innominate artery, and excessive head movements. In their review, nearly 50% of patients that had bleeding greater than 48 hours after tracheostomy had a TIF.

Allan & Wright also reviewed the emergency management of TIF (6,7). Besides over inflation of the tracheostomy tube cuff (successful in over 80% of cases, Figure 1), they also suggested that reintubation orally with manual compression of the innominate artery against the sternum may aid in controlling hemorrhage until definitive care can be achieved. This is accomplished by either bluntly dissecting in the pre-

tracheal space to compress the artery, or placing a finger in the trachea adjacent to the endotracheal tube in an effort to tamponade the hemorrhage (Figure 2).

Once the patient is in the operating room with the appropriate personnel, a fiberoptic bronchoscope should be used to inspect the distal airways to rule out other causes for the bleeding (i.e., infection, granulation tissue, tumor invasion, necrotizing pneumonias, pulmonary artery rupture, etc.). The next step is to slowly remove the tracheostomy tube while inspecting the anterior trachea for signs of blood clot or active bleeding. Alternatively, a rigid bronchoscope may be used to achieve the same goal. In either case, the operating room is the best place to perform these procedures (8) (Figure 3).

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Primary Author: Anthony Gielow, DO
Editor: Michael L. Cheatham, MD
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Please direct any questions or concerns to: webmaster@surgicalcriticalcare.net

Figure 1: Overinflation of balloon

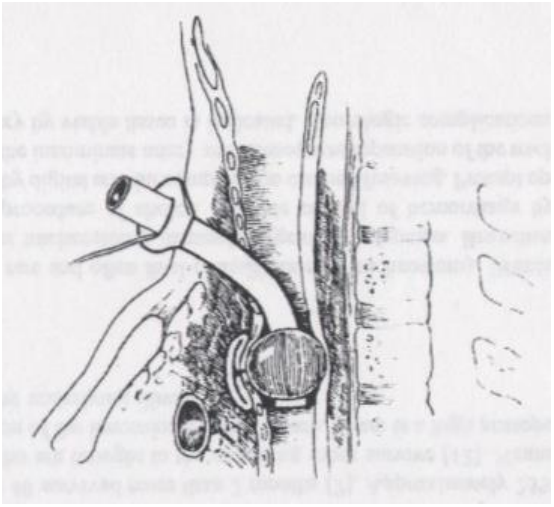


Figure 2: Manual compression of fistula

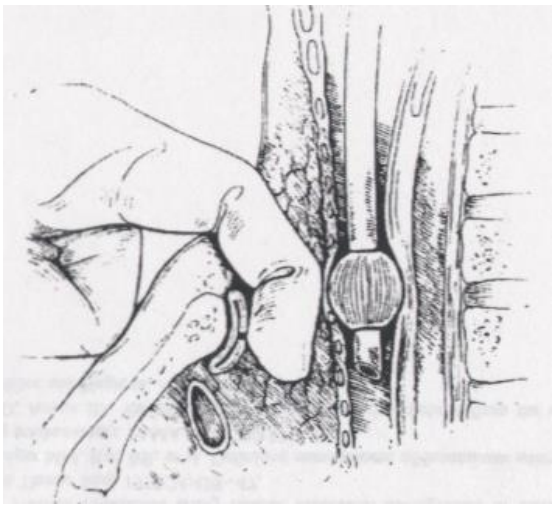
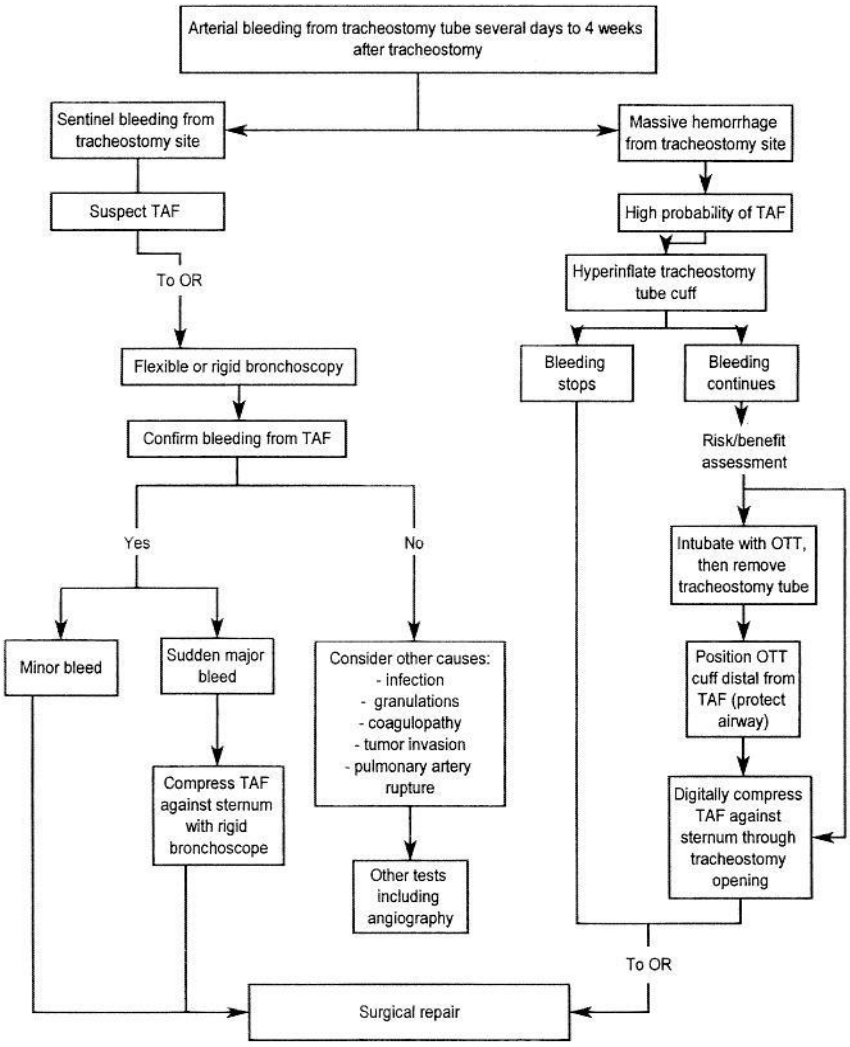


Figure 3: TIF Algorithm



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