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Percutaneous dilational and surgical tracheostomy in burn patients: Incidence of complications and dysphagia

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ABSTRACT

The aim of this study is to evaluate the incidence of complications and dysphagia in relation to the timing of tracheostomy and tracheostomy technique in 49 consecutive adult burn patients. We analysed prospectively collected data. Bronchoscopy was used to diagnose tracheal stenosis and a modified Evans blue dye test was used to diagnose dysphagia. Eighteen patients received a percutaneous dilatational tracheostomy (PDT) and thirty-one patients received an open surgical tracheostomy (OST). Eight patients developed significant complications (16%) following tracheostomy, there is no difference in the incidence of complications; post op infection, stoma infection or tracheal stenosis between PDT and OST groups. Patients with full thickness neck burn who developed complications had a tracheostomy significantly earlier following autografting ($p = 0.05$). Failed extubation is associated with dysphagia ($p = 0.02$) whereas prolonged intubation and ventilation prior to tracheostomy independently predicts dysphagia ($p = 0.03$).

We conclude that there is no difference in the complication rates for PDT and OST in our burn patients. We recommend early closure of neck burns and tracheostomy through fully adherent autograft or at least 10 days after grafting to reduce stomal infections. For patients with no neck burn, we support early tracheostomy to reduce the likelihood of dysphagia.

1. Introduction

Tracheostomy is frequently required for patients with extensive burns and those with co-morbidities to facilitate ventilation weaning, reduce the need for sedation thereby enabling earlier active rehabilitation, improve tracheobronchial toilet, ease airway management during wound care procedures and improve patient comfort. Traditionally, the only tracheostomy technique available to clinicians was the open surgical tracheostomy (OST) which was performed in an operating theatre by a surgeon. However, tracheostomy techniques have evolved over the last 5 decades and particularly so since 1985 when Ciaglia et al. introduced and described the percutaneous dilatational tracheostomy (PDT) procedure [1]. Over the last 20 years many clinical trials have compared OST and PDT with respect to rate of complications, cost and time taken for the procedures. There have been conflicting findings from these reports. Massick et al. [2] and Bowen et al. [3] reported increased post op complications in PDT group whereas Grover

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et al. [4] found that OST at the bedside was more cost effective than PDT. More recently meta-analyses of clinical trials and studies have identified that short and longer term outcomes of PDT are similar to, or better than, OST [5–8]. There have been no prospective clinical trials to evaluate PDT versus OST in burn patients. To the best of our knowledge the first study of PDT in burn patients was reported by Caruso et al. who favoured PDT over OST in terms of cost [9]. Later Gravvanis et al. performed 37 PDT and compared these with 22 OST in a cohort of burn patients with smoke inhalation injury [10]. They found that PDT was superior to OST with respect to a lower complication rate and less costs.

The optimal timing of tracheostomy placement in burn patients has not been reported. Recently three large, randomised, controlled trials failed to demonstrate a benefit of "early" tracheostomy on infection rates, ICU length of stay, hospital length of stay and mortality in general intensive care and cardiac surgery patients [11–13].

At our Burn Centre tracheostomy technique is dependent on patient and burn characteristics. The neck is a priority for autografting and wound closure in this patient group. For an OST, a Bjork Flap [14] is performed by a burns surgeon in the operating theatre. An OST is usually, but not exclusively, performed at the same time as other burn surgical procedures and therefore often does not require an extra trip to theatre. A PDT is performed at the bedside in the intensive care unit using a single dilator and bronchoscopic guidance by an anaesthetist.

This study has 2 aims; firstly to evaluate the incidence of complications and dysphagia in relation to tracheostomy procedure (PDT versus OST) and timing, and, secondly to identify variables that predict the onset of dysphagia in our cohort of burn patients.

2. Methods

We retrospectively analysed prospectively collected data for all adult burn patients (≥18 years) admitted to our Burn Intensive Care Unit and who had received a tracheostomy between 2005 and 2010. This review of our practice did not require Research Ethics Committee approval and was registered at the Hospital Research and Development department. The data were collected on a centralised, secure spreadsheet.

We recorded patient age, Total body surface area (% TBSA) burn size, presence of full thickness neck burn, past medical history, incidence of smoke inhalation injury, admission bronchoscopy findings, body mass index (BMI), endotracheal tube size, the technique and timing of tracheostomy, number of days from autografting of full thickness neck burns to tracheostomy placement, duration of ventilatory support, days with tracheostomy, patient outcome, symptomatic evidence of complications and dysphagia. We also collected data with respect to the patient's ventilation and oxygenation status prior to tracheostomy insertion; mean airway pressure, fraction of inspired oxygen (FiO_2) and ratio of arterial oxygen partial pressure to fraction of inspired oxygen (PaO_2:FiO_2). Data regarding the incidence of pre- op pneumonia for up to 7 days prior to tracheostomy were collected to ascertain if there is a relationship with the emergence of a bloodstream infection within 72 h after tracheostomy. Patients were counted as positive for post op infection which is likely to be related to the tracheostomy procedure if they satisfied the criteria for sepsis [15] within 3 days after tracheostomy and identical isolates were found in the bloodstream that were previously only grown from tracheal aspirates within a 7 day period before tracheostomy.

We recorded the following post-op complications; Minor and major bleeding, false passage, tracheo-oesophageal fistula, stoma infection (mild – local erythema/inflammation, severe – necrosis or breakdown), post op infection, tracheal stenosis and death. Bleeding was considered to be major if surgical intervention or blood transfusion was required. Minor bleeding did not require surgery or blood transfusion and the number of dressing changes needed were noted. The diagnosis of tracheal stenosis was made by bronchoscopy for symptomatic patients.

PDT was performed by 2 anaesthetists (1 consultant and 1 senior trainee level), 1 to undertake the tracheostomy and 1 to manage the airway. PDT was performed using the Ciaglia Percutaneous Blue Rhino kit (Cook Critical Care) and with bronchoscopic guidance. All OST were performed by Consultant Plastic Surgeons. In this series of patients anterior neck wounds were excised and autografted at the first operation, usually within 24 h of admission. The excisional technique was dependent on the depth of injury. Early wound closure was achieved using sheet or unexpanded narrowly meshed autograft secured with staples. For other burned sites, in the event of inadequate donor site availability to achieve total wound closure at one sitting, cadaveric allograft was used as a temporary biological dressing. Following the tracheostomy a Lyofoam Max T dressing (Molnlycke Healthcare) was applied and changed during stoma cleaning procedures routinely twice per day or when soiled.

All patients received the usual care according to burn unit procedures. Initial resuscitation was performed with the Parkland Formula and tailored to maintain a urine output of ≥0.5 mL/kg/h. Patients received Bilevel positive pressure ventilation or pressure support ventilation and positive end expiratory pressure with target tidal volumes of 6–7 mL/kg body weight. All patients with a suspected smoke inhalation injury underwent a bronchoscopy and a pulmonary lavage/culture on admission. Patients with documented smoke inhalation injury, based on bronchoscopic findings, received a triple regime of nebulisers for 5–7 days. These consisted of heparin (5000 i.u. diluted in 3 mL Nsaline, 4 hourly), acetylcysteine (20% diluted in 3 mL Nsaline, 4 hourly) and salbutamol (2.5–5 mg, 4 hourly). Thorough pulmonary toilet was performed 30 min following acetylcysteine, at least every 4 h and all patients received regular chest physiotherapy. Sputum cultures were sent on admission, three times per week and as clinically indicated when there was suspicion of pneumonia (change in sputum colour or tenacity/new radiological infiltrate) for microbiological surveillance. Paired blood cultures were sent for analysis before and after every intravenous cannula change and on clinical suspicion of sepsis.