



The Egyptian Society of Chest Diseases and Tuberculosis
Egyptian Journal of Chest Diseases and Tuberculosis

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ORIGINAL ARTICLE

Endotracheal tube securements: Effectiveness of three techniques among orally intubated patients



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Received 31 July 2014; accepted 2 September 2014

Available online 12 November 2014

KEYWORDS

ETT;
Twill;
Simple bow;
Slippage;
Securements

Abstract *Background:* Invasive ventilation is a common practice in intensive care units (ICUs). Once a patient is intubated, maintenance of the endotracheal tube placement is essential. When the ETT is not secured effectively, even basic nursing management can cause tube slippage which is a major factor in causing airway trauma.

Aim of the study: This study was aimed at comparing the effectiveness of three endotracheal tube securement techniques (Twill, Adhesive and Simple bow) on endotracheal tube slippage, external jugular venous pressure measurement, oral mucosa and facial skin integrity, pain intensity and on patient satisfaction after the fixation method.

Subjects and methods: A randomized clinical trial was conducted at the intensive care units in Ain Shams University Specialized Hospital. It included a sample of 90 patients, randomly allocated to the three equal groups: Twill, Adhesive and Simple bow groups, 30 subjects for each. The tools used for data collection included demographic and clinical data sheet, the time profile of ETT fixation method sheet and scales for endotracheal tube (ETT) slippage, external jugular venous pressure (EJVP) measurement, oral assessment guide (OAG) for oral mucosa, Facial Skin Integrity, pain intensity and patient satisfaction procedure scale. The study maneuvers were applied according to the group.

Results: Both ETT slippage and EJVP were measured at 15, 30, 60 and 120 min post fixation method. At 120 min, 73% of patients in the Twill group had no slippage compared to Simple bow (50%) and (36%) in Adhesive groups. However, at 30 min post fixation method 90% of patients in the Twill group had normal EJVP measurement compared to Simple bow and Adhesive groups (70% and 57%, respectively), with a statistically significant difference between the three groups. At 60 min, only 10% of patients in the Twill group had high EJVP compared to Simple bow (37%) and Adhesive groups (47%) with a statistically significant difference among them. As well, at 120 min post fixation method, most patients in the Twill group (97%) had normal EJVP

Abbreviations: ETT, endotracheal tube; EJVP, external jugular venous pressure; OAG, oral assessment guide; PEEP, positive end expiratory pressure

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Peer review under responsibility of The Egyptian Society of Chest Diseases and Tuberculosis.

<http://dx.doi.org/10.1016/j.ejcdt.2014.09.006>

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measurement, compared to the Adhesive (60%) and Simple bow (57%) groups. Oral mucosa and facial skin integrity assessment was done for all patients in the three study groups at 2, 6, 12, and at 24 h post fixation method. For oral mucosa at 24 h post fixation method, 80% of patients in the Twill group had healthy oral mucosa compared to Simple bow and Adhesive groups (47% and 37%, respectively), with a statistically significant difference between the three groups ($P = 0.07$). For facial skin integrity, at 6 h, no one of patients in the Twill and Simple bow groups had severe facial skin reaction compared to patients in the Adhesive group (7%) and the difference was statistically significant, ($P = 0.01$). As well, a statistically significant difference was revealed among the three groups, at 12 and 24 h post fixation method, ($P = 0.04$ and 0.02 , respectively). The Twill technique had the shortest time taken for application and removal of securement method than other groups. Additionally, the Twill group had the lowest scores of pain at all three assessment times (5, 10 and 20 min), whereas those in the Adhesive group had the highest scores. All these differences were statistically significant, ($P < 0.001$). Overall, 80% of patients in the Twill group were satisfied, compared to 57% in the Simple bow group, and 37% only in the Adhesive group.

Conclusion: It is concluded that Twill technique is an ETT securement technique in ICUs for orally intubated patients.

Recommendations: It is recommended to use this method, with development of strategies to prevent slippage aiming at increasing patient safety after securement technique intervention.

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Introduction

Airway control has been described since 3600 BC, when tracheostomy was used by the Egyptians. Modern interventions include the introduction of endotracheal tubes (ETTs) for anesthesia by MacEwan in 1880 but the first clinical use of endotracheal intubation for airway control was advanced by Jackson in 1907 [1]. Invasive ventilation is a common practice in intensive care units (ICUs) for patients with serious breathing difficulties [2]. Ventilation is achieved through the insertion of an endotracheal tube into the trachea via the mouth or nose and attaching this tube to a ventilator [3].

It is vitally important that the position of the ETT remains stable for several reasons: (1) to ensure optimal ventilation and constant supply of oxygen, and (2) ETT movement within the trachea may cause local trauma, which is a significant source of discomfort for the patient [4–6] added several clinical concerns with respect to patient safety when attempting to achieve a stable ETT. These include: (1) preventing slippage of the ETT and unplanned extubation; (2) maintaining alignment of the ETT within the trachea, and (3) maintaining skin integrity of the face and neck with adequate levels of venous return from the head through the jugular veins.

The optimal position of the ETT measured fiberoptically is between 2.5 and 4 cm² above the carina [7]. Therefore, for most patients, the ETT position on chest X-ray should be checked before the ETT stabilization method is changed to ensure the ETT is in the optimal position [8]. It is also a common practice to mark this position on the ETT (depending on the stabilization method) and to document this in the patient's notes and/or flow chart [9].

Once a patient is intubated, maintenance of the ETT placement is essential and becomes the responsibility of nursing and respiratory care professionals [10]. When the ETT is not secured effectively, even basic nursing management such as changing the patient's position or suctioning can cause tube slippage which is a major factor in causing airway trauma [11]. Other complications associated with ETT stabilization

include increased external jugular venous pressure (EJVP), facial skin and mucosal breakdown which can cause patient discomfort and disfigurement [12].

Slippage is the degree of movement of the endotracheal tube within the method of stabilization. The ETT securing should be renewed if the ETT is able to migrate/move more than 1 cm² and re-intubated if move more than 2 cm² [8]. With every re-intubated attempt, there is a potential risk of causing trauma to the mouth, pharynx, vocal cords and trachea of the patient. The ETT slippage consequences to the patient's airway can include pain and discomfort to the patient, inadequate ventilation and damage of the patient's trachea [13,14].

Slippage and self-extubation of the intubated patient have been consistently cited as a potentially life-threatening event. It can precipitate critical respiratory complications, not limited to bronchospasm and airway trauma. Additional adverse sequelae associated with unplanned extubation can include respiratory and cardiac arrest, tracheal injury, malposition, cuff leak, facial and oral soft tissue injury [15,4,16].

Most of the ETT stabilization methods require the tapes or ties to go around the upper part of neck that may affect venous blood flow from head and increased external jugular venous pressure (EJVP), with a possible impact on intracranial pressure [17]. The jugular vein lies between the two heads of the sternocleidomastoid. They can be brought out by gently resisting head turning. The EJVP is most commonly elevated with a raised venous pressure due to cardiac failure, hypervolemia or with the presence of external mechanical pressure [18]. The normal EJVP is 1–3 cm² above the sternal angle and added 5 cm² to this value which is the distance estimate of sternal angle to right atrium. Therefore, when the corresponding to a right atrial pressure becomes more than 8 cm² is suggestive of raised right atrial filling pressure [19].

Various techniques have been employed by intensive care nurses to ensure ETT stabilization in order to maintain a patent airway and prevent or minimize complications. The optimal stabilization method should not only be secured but

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