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EKG Electrode as a Tactile Locator of Stoma after Decannulation: A Pilot Study

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Abstract

Objective. We aimed to evaluate the use of an electrocardiogram (EKG) electrode over decannulation dressings covering the stoma to improve speech intelligibility and volume and reduce air escape by facilitating identification of the "sweet spot" of the dressing. No objective data exist for patient outcomes with use of the EKG electrode dressing.

Methods. This prospective study included head and neck oncology patients at a tertiary hospital who received a tracheostomy. A standard tracheostomy decannulation dressing was placed followed by an EKG electrode. A speech pathologist evaluated speech volume via sound-level meter and captured speech intelligibility for random sentence-level speech. A blinded reviewer scored speech samples for intelligibility. Patients completed a 4-question satisfaction survey.

Results. Four patients completed the study. Based on the survey, the patients favored the button, with the lowest scores being 8.5 out of 10. Speech understanding was 48.5% without the button and 83% with the button. Normal speech volume was 73.75 dB without the button and 77.75 dB with the button. Loud speech volume was 80.75 dB without the button and 87 dB with the button.

Discussion. This pilot study shows objective benefits of the EKG button as well as improved patient satisfaction. Inexpensive and low maintenance, the EKG electrode provides better occlusion of stoma dressing with easier localization.

Implications for Practice. Dissemination of our results will aim to improve quality and patient outcomes following decannulation.

Keywords

tracheostomy, decannulation, head and neck cancer, dressing, voice

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A tracheostomy is a procedure performed for many reasons, including upper airway obstruction due to infections, malignancies, intrinsic pulmonary disease, or neuromuscular disease.[1-3] This was described around 360 BC in a well-known tale of Alexander the Great opening up the airway in a soldier choking on a bone.[3] Tracheostomy was initially described in the 1800s as a treatment in younger people due to infections,[1] including diphtheria causing airway obstruction due to pseudomembranes.[4] Dr Pierre-Fidèle Bretonneau was credited with performing the first ''modern'' successful tracheostomy in 1817.[4] Various techniques have been described. Based on a study by Cheung and Napolitano,[3] the incidence of tracheostomy for prolonged mechanical ventilation increased in all age groups from 8.3 to 24.2/100,000, most significantly among patients younger than 55 years. To date, in the United States, about 100,000 tracheostomies are performed per year.[3]

Following tracheostomy procedures, once the patient's airway is deemed adequate for decannulation,[3] the tracheostomy tube is removed under controlled settings. The stoma site is then temporarily covered with a small gauze dressing or left uncovered.[5] Management of the stoma site is surgeon specific, although most surgeons recommend applying pressure over the dressing. We aimed to evaluate the use of an electrocardiogram (EKG) electrode over the decannulation dressing to improve patient localization of the stoma for appropriate and effective occlusion. This method was found to be used in children but never became widely used.[6] After successful decannulation, applying pressure to

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Table 1. Patient Characteristics.

Sex/Age, y	Treatment	Flap	Hand Dominance	DM	Arthritis/Stroke/Blindness	Decannulation POD
Male, 35	Right partial glossectomy	L-RFFF	Right	Yes	No	5
Female, 41	TORS BOT resection	No	Right	Yes	No	4
Male, 64	TORS BOT resection, lateral pharyngotomy	L-RFFF	Right	No	No	7
Male, 60	Chemorads Stage IV oropharyx	No	Right	No	No	2.5 mo

Abbreviations: BOT, base of tongue; DM, diabetes mellitus; L-RFFF, left radial forearm free flap; POD, postoperative day; TORS, transoral robotic surgery.

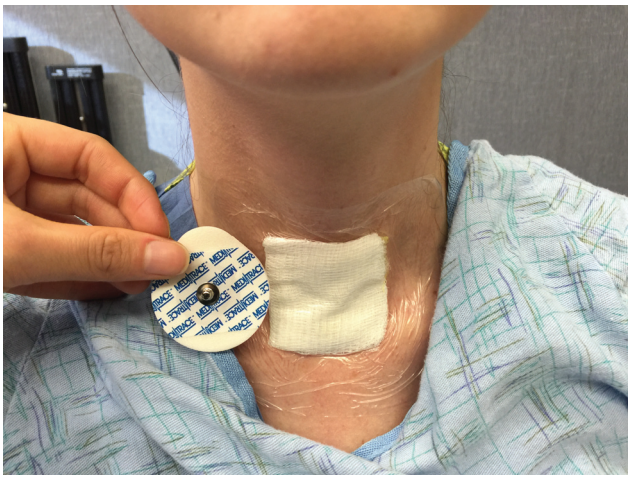

Figure 1. Placement of occlusive dressing including 2 × 2-inch gauze followed by Tegaderm (3M, St. Paul, Minnesota).

Figure 2. Pressing of the electrocardiogram button for phonation.

the stoma improves occlusion and communication; however, some patients struggle with identifying the location of the stoma.

Methods

This prospective pilot study performed at our tertiary referral hospital included head and neck oncology patients who received a tracheostomy as part of their oncologic surgery or treatment. Basic demographic information was obtained, including age/sex; oncologic treatment (surgery or chemoradiation); flap usage; history of diabetes, stroke, and blindness; and decannulation day (**Table 1**). Exclusion criteria included intrinsic laryngeal pathology or prior laryngeal surgeries.

A tracheostomy was performed per our institution's standard protocol. A tracheostomy decannulation dressing (2 × 2-inch Vaseline gauze, 2 × 2-inch dry gauze, and clear occlusive tape) was placed over the stoma followed by the EKG electrode (M530 Foam Series Diaphoretic ECG Electrode; Covidien, Minneapolis, Minnesota) (**Figures 1** and **2**). This study was approved by Henry Ford Hospital's institutional review board (IRB 9800).

Pre-decannulaton criteria included but not limited to resolution of surgical or postprocedure oral/oropharyngeal edema or tumor, flexible laryngoscopy, and stable pulmonary status. The hospital tracheostomy capping protocol was followed as implemented by respiratory therapy. On the day of decannulation, subjective measurements and objective measurements were obtained. For objective measurements, the same speech-language pathologist (SLP) performed the exercises with the patient, both with and without use of the EKG button. Measurements obtained were maximum sustained phonation time (seconds) and volume of speech in a normal voice and loud voice via sound-level meter (decibels) (cat. 33-2055; RadioShack, Fort Worth, Texas). Speech intelligibility was measured using random sentence-level speech (percentage correct) from the Assessment of Intelligibility of Dysarthric Speech-Sentence Intelligibility Task.[7] The SLP recorded the speech output on an iPhone 6 (Apple, Cupertino, California) at an approximate distance of 1 to 2 feet from the patient for use by the blinded reviewer. For the subjective measure, because no validated surveys were found regarding patient satisfaction of the tracheostomy EKG electrode, we developed a 4-question patient survey using a Likert scale of 1 to 10. The questions were as follows: (1) Is it easier to identify the dressing covering your trach site with the button in place? (2) Do you feel your voice is louder when you press the button? (3) Do you feel your speech is easier to understand when you press the button? (4) How likely is it that you would you recommend this button to other patients?

Discussion

Although only 4 tracheostomy patients completed the study (**Table 1**), this pilot offers the first objective and subjective outcomes on use of an EKG button after decannulation. The patient satisfaction survey was completed in less than 5 minutes per patient. As expected, the EKG button was favored by the patients. On a Likert scale of 1 to 10, with 10 being favorable, each of the 4 questions had a score of $\geq$8.5. For the objective measures, maximum sustained phonation time was greater while wearing the EKG button (19.6 vs 17.8 seconds). Phonation volume with use of the EKG button was louder (normal volume 73.75 dB vs EKG button 77.75 dB; loud volume 80.75 dB vs EKG button 87 dB). Speech intelligibility was much improved (48.5% without vs 83% with the EKG button).

These encouraging results of our pilot study on the use of the EKG electrode as a tactile stimulator have changed the scope of decannulation dressing practice within our otolaryngology department. The premise of our study started from seeing multiple patients struggle with finding the pressure point over the stoma. The patients who struggled the most often had a multitude of intravenous (IV) lines; had forearm surgery, including radial forearm free flaps; or had conditions in which proprioception was affected. It was imperative to find a quick and inexpensive solution for the ''perfect'' decannulation dressing. With trial and error, including using a plastic top from an IV line and then covering it with clear tape to be used as a locator and folding a 2 $\times$ 2-inch gauze multiple times, which was not successful because it kept rolling or flattening, respectively, we then saw a patient with a leftover cardiac EKG button and the idea was placed into action. Since the pilot study, multiple patients have benefited from the use of the EKG button at an inexpensive price of 20 cents per button.

A review of the literature showed that Vats et al[6] had placed a lone EKG button over the stoma without a dressing; however, the idea did not become common practice, possibly because the findings were published as a commentary without subjective or objective data.[8] In a recent study from the United Kingdom in which 69% of patients undergoing free flap reconstruction of the head and neck received a tracheostomy, at least 60% of the patients associated negative feelings toward the tracheostomy as part of their treatment and would avoid it at all costs in the future.[9,10] Considering the findings from Vats et al[6] along with ours, the EKG button concept is a much-needed addition to tracheostomy decannulation.

Our pilot patients first completed decannulation criteria including but not limited to flexible laryngoscopy to assess for airway edema resolution, good pulmonary status, and completion of the tracheostomy capping trial.[3,11,12] At our institution, the tracheostomy capping trial is conducted by the respiratory therapy department upon our request. Tracheostomy teams have been implemented elsewhere, but no improvement has been noted in decannulation times or time for SLP evaluation.[12] Such protocols differ from institution to institution.

As other researchers have commented, it is imperative that post-decannulation dressings remain in place; since it is easy for dressings to peel off with neck movement or lack of application of pressure.[6] Gudka et al[8] advocated for application of pressure to ensure rapid and spontaneous closure of the stoma. Often the dressings become saturated with secretions or detached after coughing, speaking, or sneezing. Patients are reminded to apply pressure to avoid these issues.

Limitations of this pilot study include the small group size. Reasons for the small sample were excluding those with decannulation over the weekends or in the outpatient setting or when there was a lack of access to the SLP performing the objective measurements. However, the small sample was expected since this was a preliminary inquiry, and we aimed to keep the conditions well controlled. Based on our pilot study's findings, the consensus within our department was that the EKG button could also be used safely on our other patients with tracheostomy. It is a favored adjunct and easily reproducible for placement by the patients.

Implications for Practice

Because of the beneficial findings of our pilot study in terms of louder voice, improved speech intelligibility, and increased patient satisfaction, the EKG button as an adjunct to the standard dressing after decannulation is being used in our department with nearly 100% compliance. EKG buttons are currently stored in the otolaryngology clinic for outpatient decannulation. Patients favor this augmented dressing as it facilitates localizing the stoma. This, in turn, keeps the dressing on longer as it is less likely to detach with sneezing, coughing, or speaking.

Author Contributions

Laura Garcia-Rodriguez, acquisition of the data and data analysis, drafting, final approval, accountability for the work; **Tayaba Miah**, acquisition of the data and data analysis, drafting, final approval, accountability for the work; **Jamie Lindholm**, acquisition of the data, drafting, final approval, accountability for the work; **Steven Chang**, data analysis, drafting, final approval, accountability for the work; **Tamer Ghanem**, interpretation of data, drafting, final approval, accountability for the work.

Disclosures

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