EDUCATIONAL INNOVATION



Dream one, do one, teach one: a mental practice script for bougie assisted cricothyrotomy

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Abstract

Mental practice is an effective method for skill acquisition in medicine. We describe the integration of interview-derived sensory cues with a list of procedural steps into a cohesive script to facilitate mental practice for a High Acuity, Low-Occurrence procedure, the bougie-assisted cricothyrotomy. Data collection occurred through interviews with emergency physicians. Interview transcripts were analyzed on a coding framework based on a previously published list of procedural steps. These cues were integrated with procedural steps to create a narrative script. Eight interview transcripts were analyzed. A total of 328 cues were identified. On average, each participant identified 13.7 cues per procedure. This represents the first attempt to combine cues identified by practitioners along with procedural steps with the aim of supporting rich mental representations of a procedure. We expect that this script will be useful to physicians seeking to improve their skills in this rare procedure.

Keywords Mental practice · Simulation · Emergency medicine procedures

Résumé

La pratique mentale est une méthode efficace d'acquisition de compétences en médecine. Nous décrivons l'intégration d'indices sensoriels dérivés de l'entrevue avec une liste d'étapes procédurales dans un scénario cohésif pour faciliter la pratique mentale pour une procédure de haute acuité, de faible occurrence, la cricothyrotomie assistée par bougie. La collecte de données s'est faite au moyen d'entrevues avec des médecins urgentistes. Les transcriptions des entrevues ont été analysées selon un cadre de codage fondé sur une liste d'étapes procédurales déjà publiée. Ces indices ont été intégrés aux étapes procédurales pour créer un scénario narratif. Huit transcriptions d'entrevues ont été analysées. Au total, 328 indices ont été identifiés. En moyenne, chaque participant a identifié 13,7 indices par procédure. Il s'agit de la première tentative de combiner des indices identifiés par les praticiens avec des étapes procédurales dans le but de soutenir des représentations mentales riches d'une procédure. Nous nous attendons à ce que ce texte soit utile aux médecins qui cherchent à améliorer leurs compétences dans cette procédure rare.

Introduction

Emergency physicians must be competent in a variety of procedures. These procedures include front-of-neck airway techniques that represent the final step in cannot-ventilate, cannot-intubate airway management guidelines [1]. Frontof-neck airway techniques are often performed in high-stress clinical environments with little margin for error.

Simulation modalities may be used to develop surgical airway skills, including animal-based models, low and high-fidelity bench-top simulators, virtual reality devices, and insitu simulation [2–4]. Although these techniques differ, all rely on repeated physical practice of the skill. For emergency medicine physicians, time and lack of resources mean that simulation opportunities for rare procedures may not be sufficient to achieve and maintain confidence in performing these skills [4].

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Mental practice, defined as the cognitive rehearsal of a skill without gross physical movement [5], is an effective method of learning and maintaining complex physical skills in medicine [6]. Mental practice generates mental representations of the skill being practiced, which has been shown to be as effective as additional physical practice for selected surgical skills [7]. A common method of mental practice implementation is the use of scripts, which aim to strengthen the mental imagery representation of the task in question [8]. These scripts consist of detailed instructions on how to complete the skill, and will also contain cues from different sensory modalities to enhance the mental representation of the skill being developed. This typically includes visual, kinesthetic, and cognitive cues to facilitate the generation of rich mental representations of the procedure.

Numerous scripts have been developed for both surgical skills [8] and non-technical skills such as team-based trauma resuscitation [9]. The methods used in developing these scripts vary, and include interviewing experts [8] and investigator-developed scripts [9]. However, the process used to develop the scripts used in mental practice studies are not well described. We are only aware of one detailed description of the development of a mental practice script in medicine by Arora et al. [8] who developed a script for laparoscopic cholecystectomy. We are not aware of any systematic attempt to create a script that would allow learners to create a realistic mental representation of performing a bougie-assisted cricothyrotomy.

Purpose

The primary objective of this study is to develop a mental practice script for the bougie-assisted cricothyrotomy by combining a previously established list of procedural steps with newly identified visual, cognitive and kinesthetic experiences that are common when performing the procedure.

Description of innovation

To understand the visual, cognitive, and kinesthetic cues associated with the procedure, we conducted in-depth semi-structured qualitative interviews with emergency physicians at a single tertiary care centre, similar to the method used in previous studies [3]. This study was approved by the St. Michael's Hospital Research Ethics Board (REB #17-300). Interviews began with a hypothetical clinical scenario leading to a bougie-assisted cricothyrotomy. Participants were asked to describe in detail their experiences completing the procedure. Participants were allowed to describe the procedure to completion without interruption. Using notes made during the first description



of the procedure, the interviewer then prompted participants to expand on their experiences at each step of the procedure. Interviews were audio recorded and transcribed verbatim. Transcripts were coded using qualitative content analysis on a coding framework based on a previously published list of procedural steps [10]. At each procedural step, cognitive, visual and kinesthetic cues that could enhance mental practice were extracted and counted. Two investigators identified common cues at each step. These common cues were then integrated with procedural steps in an iterative fashion to create a coherent narrative script. An example of this workflow is shown in Table 1.

A total of eight interviews were completed and transcripts were analyzed, at which point it was felt that saturation had been reached with no new cues being identified. All interviewees were emergency physicians with experience completing the procedure in clinical practice. Participants were able to describe sensory cues at each step, including cues not present in traditional descriptions of the procedure. A total of 328 cues were identified. On average, each participant identified 13.7 cues for each procedure. All identified visual, kinesthetic and cognitive cues at key procedural steps. The final script was written in first-person perspective and incorporated a colour coding scheme to highlight important cues. The design and layout of the script were refined to produce a visually interesting format to facilitate readability and hold users attention.

Discussion

To our knowledge, this work represents the first attempt to combine cues identified by experienced practitioners along with procedural steps into a narrative script to support rich mental representations of a high-acuity low-occurrence procedure. We expect that this script will be useful to physicians seeking to improve their skills in this rare procedure. The script is meant to serve as the basis for structured mental practice by deliberately taking participants through each procedural step with relevant cues to enhance the realism of the mental picture. At first, reading the script and imagining oneself performing each step may be sufficient. As experience with mental practice increases, reading the script may no longer be necessary as sufficiently detailed mental representations of the procedure are generated from memory. Script-based mental practice may also be useful to supplement more traditional physical deliberate practice.

The methodology presented here may also be useful to those seeking to develop scripts for other skills. The script is available as Appendix 1. We have disseminated this work via online, open-access platforms, as well as through presentations at relevant clinical and academic forums. Future work

	Interview transcript	Common cues identified	Script text
Cognitive	vertical incision, three to four centimeters long right in the midline of your mark—where I've marked the neck (230), I don't want to be moving too laterally so that I injure vessels (line 364), or going too inferiorly to injure thyroid tissue (line 368), at the same time, this patient is going to die if I don't do this, so, I'm going to do a generous incision to optimize my changes of having a successful tube placed (line 372) (Participant #5) make sure I am staying midline (line 159), I'm going to make a two-centimeter vertical incision over the cricothyroid membrane (line 165), that (the amount of bleeding) was surprising to me at the time (line 187) (Participant #6)	Incision along the midline, being aware that I may extend- ing all the way to the sternal notch if the anatomy is difficult. Reassure myself that bleeding is normal, and do not try to control it	With a scalpel in my right hand, I make a generous longi- tudinal midline incision with equal length on each side of the CTM. I'm aware that I may need to extend it all the way to the sternal notch if the anatomy is difficult. I reasure myself that bleeding is normal, and do not try to control it I feel through the incision with my left index finger, feeling for the soft, smooth CTM. I know that there will be lots of blood to obscure my ability to see structures through the incision and so I do not try to see the CTM
Kinesthetic	I'm going to have the scalpel in my right hand, and I'm going to make a vertical incision over where I feel to be the cricoid cartilage inferiorly (line 445) (Participant #2) anticipate I'm sort of feeling something, uh, more rigid as I'm making the cut through the—the middle (line 184) (Participant #4)	With a scalpel in my dominant I made generous midline incisions with equal length on each side of the cricothy- roid membrane	
Visual	when I did that, uh, I was surprised by how much it bled (line 170), there's no bleeding in sim, and there's— and so in sim you can see it (line 178), "What did the field look like?"—Blood (line 305) (Participant #6) think I'm very aware of that I wasn't aware of before I did it, how bloody it is (line 207) (Participant #8)	Expect lots of blood to obscure my ability to see struc- tures through the incision	

Table 1 Representation of data analysis workflow for procedural step #7: "With scalpel in dominant hand, make a vertical incision from thyroid cartilage to bottom of cricoid cartilage. If no pal-



will evaluate the validity of the script as well as the effects of the script on physician confidence and competence with this procedure.

Summary

Mental practice is a useful modality for physicians to build and maintain skills in rare procedures. We have developed a mental practice script based on cues derived from interviews with expert practitioners. This script may be useful to those who must be competent performing a bougie-assisted cricothyrotomy, while our methodology could be applied to create similar scripts for other procedures.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s43678-023-00630-y.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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Appendix 1. A mental practice script for bougie assisted cricothyrotomy.

Mental Practice Script: Bougie Assisted Cricothyrotomy

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Use this script to enhance your mental practice. Cues will prompt you about what you should expect to "think", "feel", and "see" at each procedural step.

Declare to the team that this is a can't intubate can't oxygenate scenario, and that it is time to proceed with a surgical airway. I ask for a bougie, scalpel, and endotracheal tube to be brought to the bedside. I direct the person at the head of the bed to continue their efforts to oxygenate by inserting a supraglottic airway. Turning to my colleague, I ask them to take over as resuscitation team leader, and make it clear that I am 'eyes off' the patient.

I move to the right side of the patient, and straighten and extend the neck. I adjust the stretcher height and lighting to be comfortable.

My goal is to identify midline neck structures: the cricothyroid cartilage and thyroid cartilage. Looking down at the patient I use the nose, mouth, and middle of face to line up with the sternal notch to identify the midline. I palpate down from the jaw in the midline to feel a prominence superiorly, feeling just inferior to that for a soft, flat divot, which is the cricothyroid membrane (CTM). I can also palpate up from sternal notch, feeling along tracheal rings until you reach the same soft divot with the prominence of the thyroid cartilage above. I use a marker to mark the position of the CTM.

If time permits, I now prep a generous area of the neck with antiseptic solution.

Using landmarks previously identified, my left hand stabilizes the CTM between the thumb and middle finger. With my left index finger I palpate again in the midline for the CTM.

With a scalpel in my right hand, I make a generous longitudinal midline incision with equal length on each side of the CTM. I'm aware that I may need to extend it all the way to the sternal notch if the anatomy is difficult. I reassure myself that bleeding is normal, and do not try to control it.

I feel through the incision with my left index finger, feeling for the soft, smooth CTM. I know that there will be lots of blood to obscure my ability to see structures through the incision and so I do not try to see the CTM.

I position the same scalpel over the area where I have felt the CTM. I make a single push through the CTM with the blade facing towards my body. I notice there is an immediate loss of resistance and look for bubbling or gush of air as I enter the airway. With the scalpel still in the incision I turn the blade 180 degrees in my hand to extend the incision away from my body.

After carefully removing the scalpel from the incision, I place my left index finger through the incision alongside. I hook my finger towards the patient's feet and feel the tracheal rings with the pad of my finger. I may continue to see bubbling blood.

I grab the bougie with my right hand. Watching to ensure the coude tip is facing up, I feel the bougie slide behind my finger into the trachea towards the patient's feet. As the tip moves past my finger I can feel the tip clicking on the tracheal rings, advancing easily until I get hold up. Holding the bougie with my right hand, I slide my left index finger out of the incision.

I ask an assistant to thread the tube onto the bougie, and remind myself that the tube may require some gentle pressure to advance, but that I will not force it. Holding the bougie in my left hand, I can now railroad the tube over the bougie. When I feel some resistance to pass the tube through the incision, I use gentle pressure and rotation to pass it successfully without forcing. I continue to advance the tube just until the cuff disappears beyond the CTM.

Keeping a firm grasp of the tube with my left hand, I remove the bougie with my right hand with a steady pull.

Now that the tube is in the airway, I inflate the cuff with air until resistance is felt.

Keeping a firm grip on the tube with my left hand, I attach my end-tidal monitor and BVM, and observe for colour change or end-tidal tracing. Watch for symmetrical chest rise.

Keeping in mind that the tube may still be dislodged, I am diligent to secure the tube with tape or a tube holder. In order to create a good seal I may need to stitch or pack the wound with gauze.

Once secure, I inform the team that the airway is secure, reassess the patient's status and continue with the resuscitation.