Editorial Commentary

Needle electrodes inserted in the thyroid cartilage may provide better neuromonitoring signals during thyroidectomy

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In this interesting paper, authors used an animal model (Meishan piglets) to evaluate the utility of using needle electrodes inserted in the thyroid cartilage (TC), compared with endotracheal tube (ET) electrodes, for neuromonitoring during thyroid surgery with evaluation of electromyographic profile of the vagus and recurrent laryngeal nerves. First, various needle insertion depths and orientations were evaluated in nine areas of the TC to determine best potential locations for needles placement. Then, electromyographic profiles (amplitude and latency features) were recorded using TC and ET electrodes and were compared during intermittent and continuous monitoring. Interestingly, a previously published nerve traction injury model was also used to detect and compare electromyographic profiles obtained by the TC needle versus ET electrodes.

Overall, this study provides new data in showing that: (I) electromyographic profiles recorded by TC electrodes were optimal in locations corresponding to inferior and posterior aspects of the TC (areas 4–6). No significant impact of depth and/or orientation of needle insertion was observed; (II) manipulations of the trachea affected electromyographic amplitudes recorded by ET electrodes whereas amplitudes were more stable when using TC needle electrodes; (III) In the nerve traction injury model, TC electrodes were more sensitive and recorded the decreased amplitude profile by about 1 and 5 sec earlier than did ET surface electrodes when testing for decrease of 50% of the baseline value and for complete loss of signal, respectively.

However, some limitations have to be acknowledged. One of the weaknesses is that data have been generated from pigs. It is questionable whether anatomical landmarks reported in the study may be easily applicable in humans. Optimal areas as well as depth and/or orientation of needle insertions are likely not totally similar in humans. Similarly, this study showed that perichondral insertion into the avascular area of the TC was safe. We should recognize that this conclusion comes from a very limited number of animals (n=6) and consequently may be questionable. There was however no other alternative when designing the study and performing this study in humans would have been unethical and not possible.

On the other hand, this study's data is also very interesting because the placement of electrodes into the TC is not only a brand new approach providing a surgeon-controlled method of IONM but this alternative can also overcome some factors affecting ET based neural monitoring accuracy during thyroid surgery. For example, about 1–5% of patients need ET repositioning because initial placement provided V1 values below 100 microvolts precluding any possibility for continuous neuromonitoring (without use of curarization). When using ET based electrodes, the surgical team relies on the anesthesia team to optimally place the tube with surface electrodes positioned at the level of the vocal cords during intubation. The use of TC electrodes directly in the operative field and at well-defined specific locations may eliminate those biases due to variations observed among different anesthesia teams. Furthermore, ET can rotate or migrate from its initial optimal placement due to multiple factors during the course of surgery, leading to an intraoperative decrease or loss of electromyographic signal. Many surgeons have experienced those frequent amplitude variations during thyroid dissection. Several studies have reported that ET displacement may lead to a false positive loss of signal in about 3.8% to 23% of monitored surgeries (1). We believe that the use of TC electrodes will avoid these intraoperative signal variations (in patients with a big goiter for example) that are potentially misleading and overall improve intraoperative signal stability and reliability. Consequently, the use of TC electrodes will provide robust electromyography (EMG) data with higher amplitudes for the vagus and recurrent laryngeal nerve (RLN), as well as more accurate detection of true loss of signal in comparison to ET electrodes.

Another very interesting point is that changes in signal amplitudes in response to nerve traction injury were observed earlier when using TC electrodes than ET electrodes, with higher and more stable amplitudes. Although these findings should be confirmed in humans and the underlying mechanisms be elucidated in further studies, this data is clinically relevant because it may help surgeons to decrease type 2 loss of signals incidence during thyroidectomy. Other future directions for research could be to compare the cost effectiveness of TC versus ET electrodes, and to compare the use of needle electrodes placed into the TC versus electrodes applied on the TC.

We would like to thank and congratulate these authors for their excellent work in pushing the envelope. Even though this dataset is small and comes from animals, we believe this is an important contribution to the fields of continuous neuromonitoring during thyroid surgery.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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