Clinical pearls in anaesthesia for electromyographic tube guided robotic thyroidectomy

Sir,

The novel gasless-technique of robot-assisted transaxillary thyroid surgery (RATS) involves introducing robotic instruments via an axillary-incision through a surgically-created tunnel to access the thyroid gland, avoiding ugly cervical-scars. RATS, with intra-operative electromyography-guided dissection has conflicting requirements. A fundamental requisite of robot-assisted surgery is avoiding catastrophic patient movement with robotic-arms docked, usually achieved by a very deep neuromuscular blockade (NMB). Contrarily, effective intraoperative vocalis-muscle electromyography for recurrent laryngeal nerve (RLN) function requires abolishing NMB, making RATS a muscle-relaxant sparing surgery. Cosmesis provided by a smaller/occult scar (hallmark of RATS) becomes meaningless if iatrogenic mouth-deviation/hoarseness of voice/respiratory distress occur.[1,2] The quest to find RLN-preservation techniques is the holy grail of

thyroid surgery. The incidence of bilateral RLN-palsy in total thyroidectomies employing intraoperative neuromuscular monitoring (IONM) is 2.43% versus 5.18% without IONM.[2] Continuous IONM, potentially facilitates changing surgical strategy before irreversible RLN-damage (loss of signal/amplitude-reduction below 100 μV at 2–3 mA stimulation).[3]

Nerve-integrity monitoring (NIM) electromyographic (EMG) endotracheal tube (Medtronic® Xomed, Inc, Jacksonville, USA)[4] is a special soft-silicone, flexometallic-tube with integrated stainless-steel bipolar contact-electrodes and audiovisual alarms, said to be useful for IONM. We report here its use in a three-patient case series.

Our modified anaesthesia-circuit comprised of two conventional circle-systems connected end-to-end to access the anaesthesia-workstation displaced to the patient's foot-end. The operation table was rotated 180° to accommodate the robot at patient's head-end [Figure 1]. Our first patient was a 27-year-old lady with a left retro-auricular approach for thyroidectomy and inter-mammary grounding-needle-electrode placement. A light NMB (maintaining two twitches out of train-of-four with atracurium infusion) was maintained throughout surgery lasting 7 h, but even this produced a 'false-low' EMG-signal. In our subsequent two patients, RATS was performed without using any additional NMB after the intubation-dose. Anaesthetic management of our second patient served as a prototype for our third patient. Both surgeries lasted 6 h.

Our second patient was a 34-year-old, 62-kg lady with papillary carcinoma necessitating total thyroidectomy. After standard-monitoring application, anaesthesia was induced using intravenous (IV) midazolam 1 mg, fentanyl 100 μg, propofol 70 mg, followed by atracurium 50 mg. C-Mac D-blade videolaryngoscope-guided endotracheal intubation with EMG-tube (7 mm internal diameter) was performed. The ribbon-strip emerging from the four sensing surface-electrodes was taped at two points to the EMG-tube shaft to prevent soiling, dislodgement and glottic-view obliteration. We etched a thick black-line, three-quarter distance up the patient-end of electrode-cuff, connecting bilateral anterior electrodes. Mid-glottic positioning of electromyographic sensors in optimal contact with vocal cords, (sans axial-rotation of EMG-tube) was videolaryngoscopically ensured by keeping this black-line in midline. After auscultatory and capnographic confirmation of EMG-tube placement and neck-extension, EMG-tube integrity

Figure 1: Electromyography (EMG) Tube, NIM Neuro-3 EMG monitor screen, patient positioning and circuit modification and intra-operative image of robot-assisted trans-axillary thyroid surgery (RATS) in progress

and supracarinal-positioning was ascertained via a fibreoptic bronchoscope. Intraoperative fibreoptic bronchoscopy ruled out EMG-tube inner wall dissection/collapse. Laryngofibrescopy affirmed glottic-contact of surface electrodes post-positioning. The position was supine (arms abducted 90°; elbows flexed). Two grounding needle-electrodes were placed over right clavicle away from the subclavicular tunnelling-track. Bispectral-index-guided (BIS 40-45) dexmedetomidine infusion, sevoflurane, nitrous oxide and fentanyl boluses maintained adequate anaesthetic-depth. Bilateral thyroid-lobes were accessed via a right-axillary incision. Four additional ports (for robotic-arms; camera) produced total 5 cm-sized incisions, all below the neckline. Bilateral vocal-cord movement was videolaryngoscopically visualised on tracheal-extubation in all three patients. Phonatory vocal-cord movement was later checked by point-of-care ultrasound.[5]

Since any type/dose of muscle relaxant hampers RLN-monitoring,[4] to variable/unpredictable extents, RATS can be performed without NMB in these special circumstances. NMB conveniently wears off, while surgeons perform painting, draping, tunnelling and robotic-docking. Consequently, vocalis-muscle activity can readily be intraoperatively tested when surgeons approach the thyroid gland. Suboptimal tube-position, NMB, lubricating jelly, salivary-pooling and loose monitor/interface-box connections produce false-negative responses.

Subcutaneous ropivacaine infiltration (along tunnelled-path), IVmorphine-based patient-controlled analgesia and IVparacetamol (1 g; 12-hourly) sufficed as multimodal postoperative analgesia.

None of our patients developed postoperative brachial plexus/vocal cord palsy/paresis.

EMG-tubes are sometimes reused after disinfection as a cost-cutting measure which can produce inner-wall dissection aggravated by nitrous oxide. Catastrophic cuff-herniation, inward-collapse of EMG-tube wall (with life-threatening airway obstruction/raised airway pressures), and lightwand-induced electrode dislodgement causing cuff-damage are reported complications.[6,7] Avoiding reuse, ribbon-strip taping and intraoperative fibreoptic bronchoscopy served as simple precautions enabling successful EMG-tube use in our RATS patients.

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Conflicts of interest
There are no conflicts of interest.

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