Case Report

Anaesthesia for robotic thyroidectomy for thyroid cancer and review of literature

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ABSTRACT

Robotic thyroidectomy (RT) is a new gasless, scarless technique which utilises the da Vinci™ surgical robot to excise thyroid tumours. Anaesthetic management must be modified according to the patient position and robotic surgery equipment. Anaesthesiologists need to be geared up to face the new challenges posed by advancements in surgical techniques in order to maintain patient safety. Another vital aspect of this surgery is documenting possible recurrent laryngeal nerve palsy, for which a C-Mac D-Blade™ video laryngoscope serves as a valuable tool. Post-operative pain management in RT also merits special attention.

Key words: da Vinci robot, robotic thyroidectomy, thyroid cancer, video laryngoscope

INTRODUCTION

Robotic thyroidectomy (RT) is a new gasless, transaxillary technique which utilises the da Vinci robot[1] (da Vinci Surgical System™, Intuitive Surgical, Inc., Sunnyvale, CA, USA) to avoid the transcervical incision and scar.[2,3] Papillary thyroid carcinoma, the most common type of thyroid cancer for which thyroidectomy is routinely performed, is 3 times more common in women and presents in the 20–55 years age group. RT provides immense cosmetic benefits to this patient population. Pioneered in South Korea by WY Chung, to our knowledge, our institution has the unique distinction of being one of the first in India to successfully perform RT. Our initial experience, itself has necessitated a number of issues to be addressed.

CASE REPORT

A 25-year-old, 167 cm, 64 kg female patient, diagnosed with a papillary thyroid carcinoma presented for a robot-assisted endoscopic total thyroidectomy. In computed tomography, the right thyroid lobe showed an 8 mm sized nodule. Her medical history was unremarkable. Her mouth opening was restricted to two fingers due to trismus owing to an erupting wisdom tooth. The pre-operative electrocardiogram (ECG), chest and neck radiographs, laboratory investigations and indirect laryngoscopic findings were normal. In the operation theatre, routine monitors (ECG, pulse oximeter, capnograph and non-invasive blood pressure) were applied. After pre-oxygenation, anaesthesia was induced with intravenous midazolam 1.5 mg, fentanyl 80 μg, propofol 70 mg and atracurium 50 mg. On direct laryngoscopy (prior to giving the neuromuscular blocking agent), Cormack and Lehane Grading was 2B and both the vocal cords were mobile. The trachea was intubated with an ID 7 mm cuffed reinforced Lo-Contour™ flexometallic endotracheal tube (ETT) (Covidien, Mallinckrodt Medical Ltd., Athlone, Ireland) using the C-Mac D-Blade™ video laryngoscope. The tracheal cuff was inflated, and a circle system with inspiratory and expiratory tubings twice the standard length (improvised in advance) was connected. After capnographic confirmation of proper placement, the tube was fixed on the left side of the mouth at the 19 cm mark. A bispectral index-guided

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intravenous propofol infusion along with desflurane in 66% air-oxygen mixture was utilised for the maintenance of anaesthesia. Continuous atracurium infusion was given under peripheral nerve stimulator monitoring of neuromuscular blockade. Ventilatory parameters were adjusted to maintain an end-tidal CO_2 between 35 and 40 mmHg.

The patient was placed in supine position with head extended, neck flexed, right arm abducted and the left arm adducted. The robotic arms were inserted via the right axillary approach after utilising a Chung's retractor to facilitate exposure [Figure 1]. At the end of surgery, after reversing the neuromuscular blockade, on insertion of the video laryngoscope, we found the right true vocal cord to be immobile. Patient-controlled analgesia (PCA) pump with morphine infusion, intraoperative subcutaneous ropivacaine infiltration and 1 g intravenous paracetamol infusion were utilised for post-operative pain relief.

DISCUSSION

The anaesthesiologist is displaced away from the patient's airway, to the foot-end along with the anaesthesia workstation, intravenous drip set and syringe pumps.[2,3] Two conventional closed circuit tubings are connected end-to-end to obtain this extra length. De-docking the robot from the patient requires several steps consuming 1–2 min, and the position of the operating table cannot be altered without de-docking. Hence, all monitors must be applied prior to docking.[4] In RT, in anticipation of airway complications such as tracheal resection and ETT cuff rupture, a pre-operative arrangement of the robot away from the patient's head (by 20–30° rotation of operation table towards the robot) to obtain easy access to the patient is essential. Mandatory saline instillation before the completion of surgery can detect leaks.

Figure 1: Utilising a Chung's retractor to facilitate gasless exposure of thyroid gland

Supine position with patient's head extended, neck flexed and operation table reflexed is the position for conventional thyroidectomy. In RT, in addition, to decrease the distance between the neck and axilla and to create space for robotic arms, the head is turned to the left side and the right arm is abducted. Both the lobes of the thyroid gland can be accessed via the same incision usually in the right anterior axillary fold. For unilateral lesions, an incision is made on the ipsilateral side. Position-related complications include axillary skin flap perforation (0.1%) and traction injury of the ipsilateral brachial plexus (0.13%).[5]

Surgery involves an incision given along the anterior axillary fold and tunnelling superficial to the pectoralis major muscle by blunt dissection to accommodate the robotic instruments.[2,3] To expose the thyroid gland, four robotic arms and one endoscopic camera are used in the dissection of the sternohyoid muscle from the inner border of the sternocleidomastoid muscle. The thyroid gland is delivered out via this subcutaneous tunnel and exits through the axilla. A Chung's retractor facilitates this gasless robot-assisted laparoscopic surgery. As per a retrospective review of surgical records of 3000 patients, who underwent RT for thyroid cancer at the Yonsei University College of Medicine (Seoul), between October 2007 and March 2013, surgical complications which were common to both open thyroidectomy (OT) and RT include symptomatic hypocalcaemia (37.43% cases transient; 1.10% permanent), recurrent laryngeal nerve injury (RLNI) (1.23% transient, 0.27% permanent), seroma, haematoma, chyle leakage, trachea injury including subcutaneous emphysema and pneumothorax due to positive ventilation, Horner's syndrome, carotid artery and brachiocephalic vein injury.[5] Disadvantages of RT include the expense, technical expertise and equipment required and the steep learning curve.

There have been reports of sudden cardiac arrest (revived) occurring during the dissection of the diseased thyroid, during RT, attributed to carotid sinus hypersensitivity.[6] Tracheal injury below the ETT cuff can induce subcutaneous emphysema and pneumothorax during positive pressure ventilation. Tracheal injury causing a rupture of the ETT cuff, leading to mechanical, ventilatory failure during anaesthesia and abrupt pneumothorax after extubation has been reported.[7] Yi *et al*. reported a higher rate of transient hypocalcaemia in the RT group.[8] Hence, the role of serum calcium monitoring extending into the post-operative period cannot be over emphasised. One of the major concerns in this surgery is transient RLNI, causing hoarseness or vocal cord palsy persisting <6 months. Several studies comparing RT with OT found similar rates of transient/permanent RLNI.[5,9] Intraoperative nerve monitoring (IONM) can reduce the prevalence of RLNI in thyroid reoperations. Transient and permanent RLNI was found in 13 (2.6%) and 7 (1.4%) patients with IONM versus 52 (6.3%) and 20 (2.4%) patients without IONM.[10]

We utilised C-Mac D-Blade™ video laryngoscopy to visualise pre-operative and post-operative vocal cord movements. We discovered right RLNI (the right vocal cord was immobile) and demonstrated the same to the surgeons by replaying the video recording of vocal cord movement after reversal at the time of extubation. The C-Mac D-Blade video laryngoscope provided us with a visual proof of right, true vocal cord palsy which existed despite the fact that the patient was able to phonate at the end of surgery. Out of the four RT patients anaesthetised by us, this was the second case developing transient RLNI. Our previous patient, who developed transient RLNI, started recovering her voice after 3–4 days.

Since RT employs a much larger skin flap than OT, concerns have arisen regarding the severity of post-operative pain. Tae *et al*. found that neck pain and sensory changes are similar in the RT and OT patients, although anterior chest pain and sensory changes are significantly greater in the RT patient.[2] Post-operative PCA with intravenous infusion of morphine was given. Mixture of dilute ropivacaine with epinephrine (0.5 ml of 1:1000 adrenaline [0.5 mg] and contents of 20 ml vial of 0.2% ropivacaine were added to 50 ml normal saline) was injected into the subcutaneous layer for the initial flap dissection to provide pre-emptive analgesia, post-operative pain relief and reduction in bleeding and haematoma formation during surgery. Although haematomas requiring re-exploration are uncommon in RT patients, yet we must be prepared for bedside reopening of the sutures and emergency re-intubation if haematomas causing stridor occur in the post-operative period.

CONCLUSION

Anaesthesiologist is positioned at the foot-end of the patient during RT requiring an extended breathing circuit and turning the head of table 20–30° to the robot's side.It allows the anaesthesiologist unimpeded access to one side of the head, even with the robotic arms docked in position, in case of any emergency. Local anaesthetic infiltration into the subcutaneous tunnel and patient controlled intravenous analgesia may be utilised for post-operative pain relief.

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Conflicts of interest

There are no conflicts of interest.

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