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Anaesthetic management of total thyroidectomy with central compartment clearance in a patient with FNAC-proven medullary thyroid carcinoma and left vocal cord palsy: A case report

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Abstract
Background: Medullary thyroid carcinoma (MTC) poses significant anaesthetic challenges due to its potential for airway compression, vocal cord involvement, and the need for intraoperative nerve monitoring (IONM). A tailored anaesthetic approach is essential to ensure airway safety, hemodynamic stability, and optimal surgical conditions.
Case Presentation: We report the anaesthetic management of a 48-year-old euthyroid female with FNAC-proven MTC, presenting with anterior neck swelling, left vocal cord palsy, and tracheal deviation. Preoperative evaluation revealed adequate airway parameters and normal thyroid function. After securing two 20G IV lines and attaching standard ASA monitors with BIS, induction was done with fentanyl 100 mcg and propofol 100 mg. Intubation was performed via video laryngoscopy using a 6.5 mm ETT, following a single dose of atracurium (25 mg). Maintenance was with TIVA using TCI of propofol and remifentanil (Minto model), without inhalational agents or additional relaxants to preserve neuromuscular function for IONM. Balanced salt solution (Sterofundin®) was used for fluid management. The patient remained hemodynamically stable and was extubated uneventfully.
Conclusion: A TIVA-based anaesthetic technique using propofol and remifentanil, along with cautious airway management and avoidance of muscle relaxants post-intubation, provides optimal conditions for safe airway control, nerve monitoring, and rapid recovery in complex thyroid surgeries involving medullary carcinoma.

Keywords: FNAC-Proven, Anaesthetic management, medullary carcinoma, total thyroidectomy

Introduction
Medullary thyroid carcinoma (MTC) is a rare neuroendocrine malignancy originating from parafollicular C cells, accounting for approximately 3-5% of all thyroid cancers [1]. Surgical resection remains the mainstay of treatment and often includes total thyroidectomy with central compartment lymph node dissection. Anaesthetic management in such cases presents multiple challenges due to airway distortion, proximity to vital structures, and the high risk of recurrent laryngeal nerve (RLN) injury.
Intraoperative nerve monitoring (IONM) has become a valuable adjunct in thyroid surgery to reduce the risk of RLN injury. However, its effectiveness depends on preserving neuromuscular transmission and avoiding agents that interfere with electromyographic (EMG) signals. In this context, Total Intravenous Anaesthesia (TIVA) using propofol and remifentanil offers a significant advantage over inhalational agents, which are known to suppress EMG signal amplitude [2, 3]. We present the case of a 48-year-old female with FNAC-proven MTC, presenting with anterior neck swelling, left vocal cord palsy, and tracheal deviation due to bilateral compressive thyroid lesions. This report highlights the successful anaesthetic management using a TIVA-based induction and maintenance strategy tailored to facilitate IONM, ensure hemodynamic stability, and enable a smooth recovery.

Case Presentation
A 48-year-old female, weighing 50 kg with a height of 148 cm (BMI 22.8 kg/m²), presented with a progressively enlarging anterior neck swelling over the past 4 months, along with hoarseness of voice.

There was no history of dyspnoea, dysphagia, stridor, prior neck surgeries, radiation exposure, or systemic illness. Fine-needle aspiration cytology [FNAC] confirmed medullary carcinoma of the thyroid. The patient was clinically euthyroid, and thyroid function tests were within normal limits: T_3-1.12 ng/mL, T_4-8.6 µg/dL, TSH-2.9 µIU/mL. Serum calcitonin level was elevated at 450 pg/mL, consistent with medullary thyroid carcinoma. Hemoglobin was 13.4 g/dL. ECG and 2D echocardiography were normal, with an ejection fraction of 60%. Other basic investigations were within normal limits. Indirect laryngoscopy showed left-sided vocal cord palsy. Neck X-ray (AP and lateral views) revealed tracheal deviation to the right, with no evidence of tracheal compression or retrosternal extension. Contrast-enhanced MDCT of the neck and thorax revealed two well-defined lobulated lesions located posterior and inferior to both thyroid lobes, causing bilateral tracheal compression and posterior displacement of the oesophagus, along with enlarged mediastinal and left paratracheal lymph nodes with fat stranding. A 6.4 mm subpleural nodular opacity was noted in the posterior segment of the right lower lobe. Airway examination showed a mouth opening > 3 fingers, thyromental distance > 3 fingers, full range of neck motion, and Mallampati Class II. The patient was posted for total thyroidectomy with central compartment lymph node dissection and was counselled in advance regarding the potential need for tracheostomy, with informed consent obtained. In the operating room, standard ASA monitors-ECG, NIBP, SpO_2, $EtCO_2$, and temperature along with Bispectral Index (BIS) monitoring were applied. Two 20G IV cannulas were secured in the left upper limb. Following preoxygenation, anaesthesia was induced using fentanyl 100 µg and propofol 100 mg (2 mg/kg). Neuromuscular blockade was achieved with atracurium 25 mg [0.5 mg/kg]. Video laryngoscopy was used to visualize the vocal cords, and intubation was performed with a 6.5 mm cuffed endotracheal tube. Anaesthesia was maintained with Total Intravenous Anaesthesia (TIVA) using propofol (TCI at 3-5 µg/mL) and remifentanil (TCI at 2-4 ng/mL) via the Minto model, titrated to maintain BIS between 40-60. No additional doses of muscle relaxant were given to facilitate effective intraoperative nerve monitoring [IONM] of the recurrent laryngeal nerves. Inhalational agents were avoided. The patient was positioned with a shoulder roll to achieve optimal neck extension, and all pressure points were well padded. Eyes were protected with hypoallergenic tape and moistened pads to prevent corneal injury. Hemodynamics remained stable throughout the procedure, with heart rate and mean arterial pressure within 20% of baseline. Intraoperative fluid management was guided by clinical assessment and urine output, and approximately 1.2 liters of balanced salt solution (Sterofundin®) was administered. At the end of the surgery, neuromuscular blockade was reversed with Myopyrolate® (neostigmine 2.5 mg + glycopyrrolate 0.4 mg IV). After confirming adequate spontaneous ventilation and full recovery of airway reflexes, the patient was extubated uneventfully and transferred to the post-anaesthesia care unit (PACU) for further monitoring and postoperative care.

Postoperative Course

The patient was extubated uneventfully and monitored in the post-anaesthesia care unit. She remained hemodynamically stable with no signs of airway compromise or respiratory distress. Postoperative pain was assessed regularly using the Visual Analog Scale (VAS), with scores maintained below 3/10. Pain management included intravenous paracetamol 1 gram every 6 hours and fentanyl 25 mcg boluses as needed for breakthrough pain during the first 24 hours, followed by transition to oral analgesics. Serum calcium levels were monitored and remained within normal limits. Vocal cord function was stable, consistent with the preoperative palsy. No complications such as hematoma or infection were observed. The patient was discharged on postoperative day four with planned follow-up for serum calcitonin levels and vocal cord assessment.

Discussion

The anaesthetic management of medullary thyroid carcinoma (MTC) with total thyroidectomy and central compartment clearance presents significant challenges, particularly in cases complicated by airway distortion, vocal cord palsy, and enlarged mediastinal lymph nodes, all of which increase the risk of difficult airway and postoperative airway compromise. Our patient's left vocal cord palsy and tracheal deviation posed a high risk for difficult intubation and potential airway obstruction, necessitating careful preoperative assessment and planning. However, awake fiberoptic intubation, often considered the gold standard for anticipated difficult airway, was not employed in this case. The patient had a stable airway with adequate mouth opening (> 3 fingers), full neck mobility, and no signs of stridor or respiratory distress, indicating that the airway was manageable with video laryngoscopy under intravenous induction. Awake fiberoptic intubation is typically reserved for cases with critical airway compromise or severe tracheal compression and requires patient cooperation; it can be distressing and may provoke coughing or airway trauma, which could exacerbate swelling or precipitate airway obstruction in patients with large neck masses [1-4]. Given these considerations and the availability of video laryngoscopy providing excellent visualization, our approach balanced airway safety, patient comfort, and optimal surgical conditions.

Induction with propofol and fentanyl was chosen to ensure smooth and rapid induction while minimizing hemodynamic instability, which is critical in patients with potentially compromised airway and cardiovascular status. Propofol provides favorable pharmacokinetics for quick onset and recovery, while fentanyl attenuates sympathetic responses to laryngoscopy, thereby reducing the risk of hypertension or tachycardia that could exacerbate bleeding or airway edema [7]. The decision to administer a single dose of atracurium for intubation, followed by avoidance of additional muscle relaxants, was guided by the need to preserve neuromuscular function for effective intraoperative nerve monitoring (IONM). Residual neuromuscular blockade can diminish electromyographic (EMG) signal quality, risking false-negative nerve injury detection, hence, maintaining spontaneous neuromuscular activity was essential for reliable RLN monitoring.

Maintenance of anesthesia was achieved using total intravenous anesthesia (TIVA) with propofol and remifentanil, administered via target-controlled infusion (TCI) models guided by Bispectral Index (BIS) monitoring to maintain optimal anesthetic depth and hemodynamic stability [10]. TIVA offers significant advantages in thyroid

surgery requiring IONM because volatile anesthetics have been shown to suppress EMG signals, compromising nerve monitoring accuracy. Propofol-remifentanil TIVA preserves neuromuscular transmission and maintains the integrity of nerve monitoring, thus enhancing surgical safety. Additionally, remifentanil's ultra-short half-life allows for rapid postoperative recovery and early neurological assessment, crucial in this patient with pre-existing vocal cord palsy [13]. Propofol's inherent antiemetic properties also reduce postoperative nausea and vomiting, decreasing the risk of airway irritation and wound complications common in head and neck surgeries [14].

Other risk factors such as prolonged surgery and patient positioning were managed by careful padding of pressure points and eye protection to prevent neuropathies and corneal injuries [15]. Intraoperative fluid management with balanced salt solution (Sterofundin®) maintained volume status and electrolyte balance, supporting hemodynamic stability and tissue perfusion.

Finally, preoperative counselling regarding the possibility of tracheostomy was an important risk mitigation strategy, ensuring the patient was informed and prepared for potential airway interventions, which is critical in cases with significant airway involvement and vocal cord paralysis.

In conclusion, the anesthetic plan successfully addressed the inherent risks of this complex thyroid surgery by employing an induction and maintenance strategy that facilitated safe airway management, preserved nerve monitoring efficacy, maintained hemodynamic stability, and allowed for rapid postoperative recovery, aligning with best evidence-based practices.

Conclusion

The anaesthetic management of medullary thyroid carcinoma with extensive neck involvement and vocal cord palsy requires meticulous planning to address airway challenges and preserve recurrent laryngeal nerve function. Intravenous induction with propofol and fentanyl combined with video laryngoscopy provided a smooth, hemodynamically stable intubation. Avoidance of additional muscle relaxants post-intubation enabled reliable intraoperative nerve monitoring, while maintenance with TIVA using propofol and remifentanil preserved neuromuscular function and ensured rapid postoperative recovery. This approach minimized risks associated with airway compromise and nerve injury, underscoring the importance of individualized anesthetic strategies in complex thyroid surgeries.

Conflict of Interest

Not available

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Not available

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