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Anesthetic Management of Ultrasound-Guided Percutaneous Thermal Ablation of Thyroid Nodules in a Day Surgery Setting: From Procedural Sedation with Remimazolam to Short General Anesthesia with a Supraglottic Airway

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Introduction

Minimally invasive image-guided procedures have become an increasingly popular alternative to conventional surgery for benign thyroid nodules. Ultrasound-guided thermal ablation, including radiofrequency ablation, offers effective volume reduction, preservation of thyroid function and reduced complication rates. The procedures are commonly performed in a day-surgery setting and often rely on procedural sedation rather than general anesthesia. However, from an anesthesiology perspective, interventions involving the thyroid gland present specific challenges. The proximity of the thyroid to the trachea, recurrent laryngeal nerves and major vascular structures, combined with manipulation and compression of the neck tissues, may substantially affect airway dynamics and patient comfort. Respiratory movement, coughing, swallowing and even deep spontaneous breathing can compromise procedural precision and safety.

Aim

We present a case illustrating the anesthetic management of a patient undergoing ultrasound-guided percutaneous thermal ablation of thyroid nodules, initially under remimazolam-based sedation with opioid supplementation, followed by conversion to short general anesthesia with a supraglottic airway due to the procedural requirements. This case highlights the strengths and limitations of procedural sedation in thyroid interventions and supports a tailored anesthetic approach prioritising both procedural conditions and patient safety.

Methods

A 38-year-old female patient (American Society of Anesthesiologists physical status II) was scheduled for ultrasound-guided percutaneous thermal ablation of benign thyroid nodules in a day-surgery setting. Preoperative evaluation revealed no significant comorbidities, no history of difficult airway and no known drug allergies. The patient was euthyroid and had previously undergone diagnostic procedures without anesthetic complications. The initial anesthetic plan was procedural sedation with preserved spontaneous ventilation. Sedation was initiated using remimazolam, combined with opioid analgesia (sufentanil 10 μg administered intravenously). Additionally, a target-controlled infusion (TCI) of propofol was used for sedation, employing the Schnider model with a low effect-site target concentration (approximately 0.2–0.4 μg/mL). The aim was to maintain patient cooperation and spontaneous breathing while minimizing movement and discomfort. Despite adequate sedation, the patient exhibited deep spontaneous breathing with pronounced respiratory excursions of the neck and trachea. The interventional radiologist reported that ongoing respiratory movement made accurate ablation technically difficult and potentially unsafe. At this point, the anesthetic team reassessed the situation and concluded that procedural sedation, although pharmacologically adequate, could not provide the immobility required for this phase of the intervention. A decision was made to convert to short general anesthesia. Following deepening of the anesthesia, a second-generation supraglottic airway device (i-gel) was inserted without complications. General anesthesia was maintained exclusively using TCI of propofol with an effect-site target concentration of approximately 1.5 μg/mL, providing stable anesthetic depth, smooth titration and rapid emergence. The total duration of this phase was approximately 30 minutes, and no intraoperative complications were observed. Postoperative assessment using the Post-Anesthesia Discharge Scoring System yielded a score of 9 as early as two hours after emergence from anesthesia, allowing early discharge planning. The limiting factor was moderate postoperative pain, with a visual analog scale score of 4–5, which was managed with standard analgesics.

An episode of intraprocedural urinary incontinence was noted but had no clinical consequences. The patient was discharged home approximately three hours after completion of the procedure with appropriate instructions and follow-up arrangements. This confirmed the suitability of this anesthetic approach for a day-surgery setting.

Results

In our case, remimazolam, combined with low-dose opioid analgesia and TCI using propofol, provided adequate sedation, anxiolysis and patient cooperation during the initial phase of the procedure. Hemodynamic stability was excellent, and recovery was rapid, consistent with existing literature supporting the safety profile of remimazolam. However, this case also highlights the limitations of procedural sedation for interventions involving the thyroid gland. Even in adequately sedated patients, preserved spontaneous ventilation can lead to deep respiratory movements, resulting in substantial displacement of the thyroid and adjacent structures. During thermal ablation, where millimeter-level precision is required to avoid injury to critical structures such as the recurrent laryngeal nerve or trachea, such movement may compromise procedural safety. Conversion to short general anesthesia provided several advantages:

- Complete control of ventilation.
- Elimination of respiratory-related neck movement.
- Improved procedural conditions for the interventional radiologist.

Conclusion

Ultrasound-guided percutaneous thermal ablation of thyroid nodules can be safely performed in a day-surgery setting. Remimazolam-based procedural sedation is a valuable, safe option for the initial phase of such interventions, offering excellent hemodynamic stability and rapid recovery. However, due to the anatomical and functional relationship between the thyroid and the airway, respiratory movement during spontaneous breathing may significantly interfere with procedural precision. In selected cases, particularly during the ablation phase, short general anesthesia with a supraglottic airway and controlled ventilation may provide superior procedural conditions and enhance overall safety. An individualised, flexible anesthetic strategy combining the advantages of modern short-acting sedatives with the readiness to convert to general anesthesia when required appears to be the optimal approach for these increasingly common minimally invasive thyroid procedures.