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Editorial: Improving the delivery of ambulatory surgery

David Bunting

Ambulatory surgery continues to evolve through innovation, thoughtful service redesign and the commitment of multidisciplinary teams. This issue of Ambulatory Surgery highlights how relatively straightforward changes to clinical pathways, staff training and perioperative practice can deliver meaningful improvements in patient care and service efficiency.

Our first two papers explore the development of regional anaesthesia block rooms. The introduction of a streamlined, questionnaire-based pre-operative assessment pathway demonstrates the potential to release valuable clinical capacity while maintaining access for older patients and those with significant comorbidities. Complementing this, a structured competency framework for nursing staff highlights the importance of appropriate training, simulation and clearly defined responsibilities in delivering safe and sustainable services.

Our third paper examines same-day surgical cancellations, identifying opportunities to improve patient preparation, pre-operative assessment and operational planning. Cancellations remain a source of considerable frustration for patients and healthcare teams alike, and understanding their causes is an essential first step towards reducing avoidable disruption.

Finally, our international contribution from Barcelona explores ambulatory transperineal MRI–ultrasound fusion prostate biopsy under general anaesthesia with spontaneous ventilation. The findings add to the growing evidence that carefully designed ambulatory pathways can accommodate increasingly complex procedures while maintaining patient comfort and safety.

Collectively, these papers reinforce an important message: successful ambulatory surgery depends not simply on performing more procedures as day cases, but on designing services around patients, supporting skilled teams and continually evaluating outcomes.

I thank all our authors and reviewers for their contributions and encourage readers to consider how these findings might inform service development in their own institutions.

David Bunting
Editor-in-Chief

Direct to list: redesigning pre-operative assessment for regional anaesthesia

E. Meaney, M. Tait, N. Porter, D. Macpherson, L. Hudman and I. McGraw

Abstract

Background: Following implementation of a block room model for day-case awake upper limb surgery under regional anaesthesia (RA), service evaluation demonstrated reliability and improved access to day surgery for patients with comorbidities. However, limited pre-operative assessment (POA) capacity was identified as a bottleneck to further expansion, prompting the development of a streamlined 'direct-to-list' POA pathway.

Methods: A structured questionnaire identified patients suitable for direct-to-list POA, assessing consent, ability to tolerate positioning, and key risks including anticoagulation, diabetes, and immunomodulatory therapy. Patients completed the questionnaire with support from a nurse or clinical support worker at listing or at a brief appointment (mean 10 minutes). Concerns were managed via predefined guidance or escalated to standard POA.

Results: Between May 2025 and February 2026, 131 patients underwent awake hand and wrist surgery under brachial plexus block via this pathway. Ages ranged from 24 to 85 years; 43.5% were ≥65 years and 23.7% were ASA ≥III. One failed block required conversion to general anaesthesia; adequate pre-operative information allowed safe progression.

Conclusions: A streamlined questionnaire-based POA pathway for patients undergoing awake RA surgery is safe and effective across a diverse patient cohort including older and higher-risk patients. The pathway generated estimated cost savings of £79,910 and released 18 hours of consultant anaesthetist clinic time within nine months of implementation, while maintaining safe access to day-case surgery.

Keywords: Pre-operative assessment, Regional anaesthesia, Day surgery, Block room, Pathway redesign, Service improvement.

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Introduction

Regional anaesthesia (RA) block rooms have emerged as an effective model for delivering awake day-case surgery, improving theatre efficiency through parallel processing while maintaining safe access for patients with significant comorbidities [1]. Following the successful implementation of a block room service for awake upper limb surgery at our institution, service evaluation confirmed the model's reliability and expanded patient access to day surgery.

However, as demand for the service grew, limited pre-operative assessment (POA) capacity was identified as a significant bottleneck to further expansion. Standard POA appointments cost approximately £610 and take 45 minutes [2], representing a substantial resource burden. For patients undergoing awake surgery under RA, the anaesthetic considerations differ considerably from those requiring general anaesthesia, creating an opportunity to redesign the POA pathway to better reflect clinical need.

We describe the development and implementation of a streamlined 'direct-to-list' POA pathway specifically designed for patients undergoing awake day-case surgery under RA, with the aim of reducing resource utilisation while maintaining patient safety.

Methods

A structured questionnaire was developed to identify patients suitable for direct-to-list POA. The questionnaire assessed the key domains presented in Table I.

Table I. Streamlined POA questionnaire screening criteria and predefined actions.

Screening criterion	Action if identified
Consent to awake surgery under block	*Standard eligibility check*
Ability to lie flat and still for up to 2 hours	*Standard eligibility check*
Serious issues with shoulder mobility	*Standard eligibility check*
Anticoagulation (DOAC, warfarin, or LMWH)	*May need bridging depending on indication*
Diabetes	*HbA1c required*
Uncontrolled hypertension (systolic >180 mmHg or diastolic >110 mmHg)	*GP referral for blood pressure control*
Prescribed immunomodulatory injections (biologics)	*May need to be withheld depending on indication*
Allergies to local anaesthesia	*Standard eligibility check*
Previous complications of anaesthesia	*Standard eligibility check*
Neurological disorders affecting nerves/movement	*Standard eligibility check*

DOAC: Direct oral anticoagulant. GP: General practitioner. HbA1c: Glycated haemoglobin. LMWH: Low-molecular-weight heparin.

Patients completed the questionnaire with support from a nurse or clinical support worker, either at the point of surgical listing or at a brief dedicated appointment (mean 10 minutes). Where concerns were identified, predefined guidance directed management or escalated to standard full POA. Patients were deemed unsuitable for the direct-to-list pathway if they required a full anaesthetic review.

Data were collected prospectively for all patients undergoing awake hand and wrist surgery under brachial plexus block via this pathway between May 2025 and February 2026.

Results

Between May 2025 and February 2026, 131 patients underwent awake hand and wrist surgery under brachial plexus block via the streamlined POA pathway. All 131 patients were discharged home on the same day as planned. Patient ages ranged from 24 to 85 years, with 43.5% aged ≥65 years and 23.7% classified as American Society of Anesthesiologists (ASA) physical status ≥III, demonstrating that the pathway successfully facilitated access for older and higher-risk patients.

One patient experienced a failed block requiring conversion to general anaesthesia. In this case, adequate pre-operative information obtained through the streamlined pathway allowed safe and timely progression to general anaesthesia without patient harm.

Compared with standard POA appointments (estimated at £610 per appointment, 45 minutes duration [2]), the pathway yielded an estimated cost saving of £79,910 and released 18 hours of consultant anaesthetist clinic time over the nine-month implementation period.

Discussion

This study demonstrates that a structured, questionnaire-based 'direct-to-list' POA pathway can safely and efficiently replace standard POA appointments for selected patients undergoing awake day-case surgery under regional anaesthesia. The pathway appeared safe across a diverse cohort, including patients who would traditionally be considered higher risk, with 43.5% aged ≥65 years and nearly a quarter classified as ASA ≥III.

The financial and capacity gains are substantial. An estimated saving of £79,910 and the release of 18 hours of consultant anaesthetist time within just nine months of implementation represent a substantial efficiency gain that does not compromise safety. The single case of failed block managed safely with conversion to general anaesthesia illustrates that effective information gathering through the streamlined pathway itself contributes to patient safety outcomes.

The pathway's design, centred on a focused, condition-specific questionnaire administered by a nurse or clinical support worker, reflects a broader principle of task redistribution in ambulatory surgical care. By targeting the POA assessment to the specific risks relevant to awake RA surgery, unnecessary appointments are avoided without increasing clinical risk. This aligns with national priorities to improve efficiency and access in day surgery [1].

Limitations include the single-centre design and the relatively short follow-up period of nine months. Longer-term outcome data, including rates of cancellation, complication, and conversion to general anaesthesia, will be important to establish the sustained safety of the pathway. Prospective evaluation of patient experience and satisfaction with the abbreviated assessment process would also be valuable.

Conclusions

A streamlined 'direct-to-list' POA pathway for patients undergoing awake upper limb surgery under regional anaesthesia is safe, effective, and resource-efficient. Within nine months, the pathway delivered estimated savings of almost £80,000 and released consultant clinic capacity, while maintaining safe access to day-case surgery for a diverse patient population including older and higher-risk patients.

This model provides a reproducible, transferable template for other centres seeking to expand regional anaesthesia block room services without being constrained by standard POA capacity. It demonstrates that thoughtful pathway redesign, targeting assessment to procedure-specific risk, can unlock significant efficiency gains without compromising patient safety.

Author contributions

EM: Methodology, data collection, writing – original draft.

MT: Methodology, data collection and analysis.

NP: Project administration and service coordination.

DM: Conceptualisation, supervision, critical revision of the manuscript.

LH: Supervision, critical revision of the manuscript.

IM: Supervision, critical revision of the manuscript.

Funding

No external funding was received for this work.

Ethics approval and consent to participate

This study constitutes a service evaluation and quality improvement initiative. No patient-identifiable data were collected, and no experimental interventions were performed; formal ethical approval was therefore not required in accordance with local institutional policy. All patients received standard clinical care.

Disclosures / conflicts of interest statement

None.

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Developing a structured competency framework for nursing staff in a regional anaesthesia block room

Sharon Smith[1], Carole McIntosh[1], Nicola Mackay[1], Lee-Ann Prior[2], Christiana Page[2], Lindsay Hudman[2] and David Macpherson[2]

Abstract

Background: The introduction of regional anaesthesia (RA) block rooms has substantially transformed perioperative care by enabling parallel processing, reducing theatre delays, and improving overall theatre efficiency. Awake day-case surgery using block rooms is a cost-effective means to facilitate increased list turnover and expand surgical options for higher-risk patients who may otherwise require general anaesthesia. Safe, sustainable delivery of RA within a block room requires a skilled nursing workforce with clearly defined competencies.

Methods: A multidisciplinary team developed a competency framework aligned with national guidance and local standard operating procedures. Simulation sessions were delivered to all members of the theatre team. Impact was assessed using pre- and post-teaching questionnaires evaluating nursing confidence and preparedness.

Results: The competency framework was successfully implemented across nursing staff transitioning into the block room role. Following simulation sessions, nurses reported improved confidence in managing block room emergencies. All 26 post-teaching respondents rated the session as 'Very Good' or 'Excellent', and 100% would recommend it to colleagues.

Conclusions: A structured, competency-based training framework appears to be an effective approach to prepare nursing staff for roles within an RA block room. This framework provides a safe, scalable, and reproducible approach to training, and offers a transferable template for centres developing block room services.

Keywords: Regional anaesthesia, Block room, Competency framework, Nursing education, day surgery, Simulation.

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Introduction

The introduction of regional anaesthesia (RA) block rooms has significantly transformed perioperative care by enabling parallel processing, reducing theatre delays, and improving overall theatre efficiency [1]. Awake day-case surgery using block rooms is a cost-effective means to facilitate increased list turnover and to provide increased surgical options for higher-risk patients who may otherwise require general anaesthesia. As such, block rooms represent an increasingly important component of modern ambulatory surgical services.

Safe, sustainable delivery of RA within a block room requires a skilled nursing workforce with clearly defined competencies. Under strict criteria as defined in the Regional Anaesthesia UK (RA-UK) supervision guidelines, intraoperative patient monitoring may be delegated to a suitably trained healthcare worker, in accordance with Association of Anaesthetists guidance [1]. RA-UK and the Royal College of Anaesthetists (RCoA) recommend that delegated staff are specifically trained in providing and interpreting monitoring, and in recognising signs and symptoms of local anaesthetic systemic toxicity (LAST) [1,2].

Despite this national guidance, there remains a lack of standardised, reproducible training pathways for nursing staff working in RA block rooms. To address this gap and support the safe implementation of a new local block room service within our institution, a structured competency-based training framework was developed. This paper describes the development, implementation, and evaluation of this framework.

Methods

A multidisciplinary team including consultant anaesthetists, nursing staff, and theatre leads collaboratively developed a competency framework aligned with national guidance and local standard operating procedures. Nursing staff were required to complete all aspects of the framework before being signed off for independent practice in the block room.

Core competencies encompassed:

1. Patient preparation and positioning.
2. Intraoperative monitoring and interpretation.
3. Aseptic technique.
4. Ultrasound safety awareness.
5. Recognition and management of complications, specifically LAST.
6. Escalation of concerns to the supervising anaesthetist.

To support education and development, in situ scenario-based simulation sessions were developed and delivered, encompassing all members of the theatre team. Impact was assessed using pre- and post-teaching questionnaires evaluating nursing confidence and self-reported preparedness for block room emergencies.

Results

The competency framework was successfully developed and implemented across nursing staff transitioning into the block room role. All staff completed the required competency elements prior to commencing independent practice.

Following the simulation sessions, nurses reported improved confidence in managing block room emergencies. All 26 post-teaching respondents rated the session as 'Very Good' or 'Excellent', and all stated that they would recommend the training to colleagues.

Discussion

This study describes the development and successful implementation of a structured, competency-based training framework for nursing staff in a regional anaesthesia block room. The framework was aligned with national RA-UK and RCoA guidance [1,2] and incorporated simulation-based education, resulting in high levels of reported confidence and satisfaction among nursing staff.

Simulation training has an established evidence base in healthcare education and is particularly valuable for preparing staff to manage rare but high-acuity events such as LAST. The unanimously positive rating of sessions in this cohort aligns with wider literature supporting the effectiveness of in situ simulation in perioperative settings.

A key strength of this framework is its standardised, reproducible design. By aligning competencies with national guidelines and local procedures, the framework ensures consistency in practice and supports patient safety. This approach also facilitates governance and audit, allowing leaders to demonstrate compliance with recommended standards.

Limitations of this study include the single-centre design and the reliance on self-reported measures of confidence. Objective assessment of competency attainment and longer-term follow-up of clinical outcomes would further strengthen the evidence base. Future work should seek to evaluate patient safety outcomes and the sustainability of confidence gains over time.

Conclusions

A structured, competency-based training framework is an effective approach to prepare nursing staff for roles within a regional anaesthesia block room. The standardised approach to training ensures consistency in practice, alignment with national standards, and ultimately enhances patient safety for day-case surgery.

Simulation training in particular plays a key role in improving staff confidence and preparedness for complications. This framework provides a safe, scalable, and reproducible approach to nursing staff training in an RA block room, and offers a transferable template for centres developing similar services.

Author contributions

SS: Conceptualisation, coordination and logistics, writing.

CM: Service development and implementation.

NM: Operational planning and coordination.

LAP: Methodology, writing.

CP: Data collection and analysis, writing.

LH: Supervision, critical revision of the manuscript.

DM: Supervision, critical revision of the manuscript.

Funding

No external funding was received for this work.

Ethics approval and consent to participate

This study describes a service evaluation and quality improvement initiative. As no patient-identifiable data were collected, and no experimental interventions were performed, formal ethical approval was not required in accordance with local institutional policy. Staff participation in questionnaires was voluntary and anonymous.

Disclosures / conflicts of interest statement

None.

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Same-day cancellations in an ambulatory surgery unit: assessment and improvement opportunities

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Abstract

Aim: Same-day surgery cancellations incur substantial costs for both patients and healthcare institutions, making it essential to understand the contexts in which they occur. This study aimed to characterize same-day cancellations and identify opportunities for improvement in our unit.

Methods: Same-day cancellations were retrospectively analyzed (February 2022–January 2023), including reasons for cancellation, surgical specialty, and anesthesia consultation. Descriptive analysis, proportion tests, and comparisons of quantitative variables (Chi-Square, Kruskal-Wallis) were performed (IBM SPSS Statistics, $P < 0.05$).

Results: We recorded 650 cancellations, corresponding to a cancellation rate of 6.1%. Differences in the distribution of cancellation causes were identified. Anesthetic/surgical risk and patient no-shows accounted for the greatest impact (52.5%).

Conclusion: The observed cancellation rate is consistent with that reported in the literature. We noted that most cancellations at our institution are potentially avoidable or could allow rescheduling without loss of surgical time and unnecessary disruption, where an evaluation before the procedure might have been beneficial.

Keywords: Day case, Ambulatory surgery, Quality indicators, Management & Quality, Same-day cancellations.

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Introduction

Ambulatory surgery offers numerous advantages for patients, their families, and healthcare institutions, and has grown substantially in recent years as a result of advances in surgical techniques. This surgical model currently represents a substantial portion of all surgical procedures performed. Same-day surgery cancellations and patient satisfaction have been increasingly recognized as important quality indicators [1,2], making it important to evaluate the quality of this service. In this context, optimizing operating time and enhancing the efficiency of the ambulatory surgical unit is essential.

Same-day surgical cancellations have a considerable impact on both the patient's healthcare experience and the institution, generating associated costs and a loss of surgical opportunity. This issue has been discussed in the literature due to its significance, with efforts to identify risk metrics and determine potentially preventable factors. Factors such as age and distance from the patient's residence to the hospital have been associated with higher same-day cancellation rates [2,3]. It is also important to distinguish the type of cancellation, as this influences the appropriate management approach: cancellations after the patient's arrival at the hospital, patient no-shows, and cancellations prior to the patient's arrival but with no possibility of reallocating the surgical time [1]. While patient screening for ambulatory procedures is essential, same-day cancellations still occur. It is therefore essential to understand the contexts in which they occur [1,3].

Beyond understanding the incidence and risk factors, this analysis also enables the development of preventive strategies, particularly through the identification of patients who may benefit from preoperative assessment. Studies addressing this issue have highlighted the role of screening for conditions incompatible with ambulatory surgery, either during anesthesia consultations or by means of structured questionnaires [4], as well as the impact of preoperative telephone calls by nursing staff [5], which have shown encouraging results in reducing cancellation rates.

Despite these efforts, evidence suggests that the majority of same-day cancellations are preventable, and that institutional context plays a crucial role in shaping effective solutions [6]. In this study, we aim to retrospectively analyze data related to ambulatory surgery cancellations in our unit over a one-year period, with the goal of identifying potential areas for improvement and implementing strategies to mitigate this issue. This post-pandemic period was specifically chosen to reflect the phase in which preoperative screening tests were no longer mandatory, a factor that may have contributed to previous same-day cancellations.

Material and methods

This was a retrospective cross-sectional study that retrieved and analyzed records regarding same-day cancellations between February 2022 and January 2023 at our institution, after approval by the institutional ethics committee (N78/CES/JAS).

Data were obtained through a review of administrative information related to surgical and anesthetic scheduling management, as well as through the analysis of patients' medical records, with strict adherence to confidentiality and anonymity. Regarding scheduling management data, all confirmed appointments for the Ambulatory Surgery Unit, as well as all cancellations, were reviewed in order to determine the actual cancellation rate and identify characteristics associated with either cancellation or completion of the scheduled procedure.

A descriptive analysis of the collected data was performed, including an assessment of the cancellation rate across different variables, such as surgical specialty and day of the week. Cancellation subtypes described in the literature were classified and analyzed, including same-day cancellations and patient no-shows. Inferential analysis included correlation analysis, proportion tests, and comparisons of categorical (chi-square test) and quantitative variables (Kruskal–Wallis test). All statistical analyses were performed using IBM SPSS Statistics® software.

Results

During the period of analysis, 10,029 procedures were performed, and 650 same-day cancellations were recorded, corresponding to a cancellation rate of 6.1%. We observed that the average time from scheduling to the procedure was 23.8 days, with no relation to the final status. Table I shows the number and percentage of procedures performed and cancelled, and the distribution of reasons for cancellation by surgical specialty.

Among patients whose procedures were cancelled, 29.8% had undergone anesthesia consultation, compared to 22.1% of those whose procedures were performed, with no statistical difference between groups.

A significant difference in cancellation rate was observed between surgical specialties. Although Ophthalmology accounted for the highest absolute number of cancellations (427; 65.7% of the total), its high surgical volume resulted in a cancellation rate of 5.2%, below the overall rate.

Differences in the distribution of cancellation reasons were identified. Anesthetic/surgical risk and patient no-shows were the most frequent reasons, together accounting for 52.5% of cancellations. Strikes were responsible for 15.4% of cancellations, particularly affecting Urology and Orthopedics, whose dedicated operating room time happened to coincide with strike days. Anesthetic/surgical risk was the most frequent reason in Ophthalmology, Otorhinolaryngology, and Urology, likely related to intrinsic factors of the patient population.

Discussion and conclusion

The cancellation rate observed in our unit is within the values reported in the literature, with an overall rate of 6.1% [1,2]. Regarding the reasons for same-day cancellation, the most frequent were anesthetic/surgical risk and patient no-shows. Some reasons, such as strikes, are unavoidable; for others, a more timely evaluation could have reduced the cancellation rate. This applies to patient no-shows, patient refusals, changes in patient status/inadequate preparation, unverified diagnosis/no indication, and anesthetic/surgical risk (accounting for 62.7% of same-day cancellations). Organizational factors, such as shortages of staff, equipment, or beds and insufficient operating room time (8.9%), also warrant further analysis and intervention.

This issue is relevant not only because of the loss of surgical time and the waste of resources, but also because of the disruption to patients' and families' plans. Same-day cancellation is considered a quality indicator in ambulatory surgery [4,6] and is closely linked to appropriate patient selection [7]. Previous studies have sought to identify factors associated with an increased risk of same-day cancellation, including health determinants, social and economic factors, seasonality, health behaviors, as well as environmental factors such as distance from the hospital not only in ambulatory surgery, but also for inpatient surgeries [3,8,9]. These factors are closely linked to the characteristics of the patient population and the institution, which explains the variability in cancellation rates [10-12], and may help identify higher-risk patients for targeted intervention [13,14].

At our institution, patient no-shows were an important cause of same-day cancellations (23.7% of the total same-day cancellations), an issue addressed in the literature for both surgical procedures and medical appointments. Previous no-show records may predict future behavior, and demographic and social constraints also play an important role [15-17]. Lacy et al. [18] identified anticipatory fear and anxiety about both procedures and bad news, a sense of disrespect, and misunderstanding of the scheduling system as contributing factors, which should be taken into account when analyzing this issue.

Regarding interventions to reduce same-day cancellations, studies suggest that an evaluation closer to the procedure may decrease system-related cancellations [5,19]. This was observed in the pediatric population, in which preoperative nurse telephone calls reduced the cancellation rate from 16.8% to 8.8% [5], and Lima et al. [19] reported a beneficial impact of a structured preoperative evaluation clinic.

This study has limitations: owing to its retrospective design based on scheduling and cancellation records, misclassification of the cause of cancellation is possible. This was however an important step in describing the situation in our unit and devising strategies to reduce this incidence. We believe that similarly to what happens in other institutions, there is room for improvement and that changes in the scheduling process, or

Table I. Number and percentage of procedures performed and cancelled, and distribution of reasons for cancellation by surgical specialty. The most frequent reasons are highlighted in bold.

Reason for cancellation	GenSur (N)	%	PlasSur (N)	%	Stom (N)	%	Gyn (N)	%	OFT (N)	%	ORL (N)	%	Orto (N)	%	Uro (N)	%	Total	%
Patient no-show	7	14.3	0	0.0	6	33.3	19	28.8	113	26.5	1	2.7	6	23.1	2	7.7	154	23.7
Patient Refusal	3	6.1	0	0.0	0	0.0	1	1.5	11	2.6	0	0.0	5	19.2	2	7.7	22	3.4
Diagnosis Not Confirmed / No Indication	2	4.1	0	0.0	0	0.0	10	15.2	7	1.6	0	0.0	1	3.8	0	0.0	20	3.1
Change in Patient Status / Inadequate Preparation	1	2.0	0	0.0	1	5.6	4	6.1	12	2.8	1	2.7	0	0.0	5	19.2	24	3.7
Anesthesia/ Surgery-Related Risk	10	20.4	0	0.0	3	16.7	9	13.6	135	31.6	21	56.8	3	11.5	6	23.1	187	28.8
Operational Contingency	9	18.4	1	100.0	0	0.0	12	18.2	25	5.9	9	24.3	3	11.5	4	15.4	63	9.7
Constraints: Personnel, Equipment, or Beds	4	8.2	0	0.0	8	44.4	0	0.0	15	3.5	2	5.4	0	0.0	1	3.8	30	4.6
Insufficient Operating Room Time	12	24.5	0	0.0	0	0.0	5	7.6	10	2.3	0	0.0	1	3.8	0	0.0	28	4.3
Strike		0.0	0	0.0	0	0.0	4	6.1	81	19.0	3	8.1	6	23.1	6	23.1	100	15.4
Other	1	2.0	0	0.0	0	0.0	2	3.0	18	4.2	0	0.0	1	3.8	0	0.0	22	3.4
Cancelled Procedures Total	49	7.5	1	0.2	18	2.8	66	10.2	427	65.7	37	5.7	26	4.0	26	4.0	650	
Performed Procedures Total	695		9		80		640		7724		272		378		231		10029	
Cancellation rate (%)		6.6		10.0		18.4		9.3		5.2		12.0		6.4		10.1	**Over-all**	**6.1**

GenSur: General Surgery. PlasSur: Plastic Surgery. Stom: Stomatology. Gyn: Gynecology. OFT: Ophthalmology. ORL: Otorhinolaryngology. Orto: Orthopedics. Uro: Urology.

patient interview/re-evaluation closer to the procedure could have a beneficial impact. Following these preliminary results, in line with what has been proposed in the literature, a preoperative nurse telephone consultation was implemented within the 48 hours before surgery to assess the impact of this intervention on the cancellation rate, and possibly increase efficiency and productivity of our Ambulatory Surgery Unit.

Conflict of interest and funding

No funding was received for this work, and there are no conflicts of interest to declare.

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Safety and feasibility of ambulatory transperineal MRI–ultrasound fusion prostate biopsy under general anesthesia

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Abstract

Background: Ambulatory procedures performed in non-operating room settings require anesthetic strategies that ensure patient safety, procedural efficiency, and rapid recovery. We evaluated the safety and feasibility of a standardized outpatient pathway based on target-controlled general anesthesia with spontaneous ventilation for transperineal magnetic resonance imaging–ultrasound (MRI–US) fusion-targeted prostate biopsy. As a secondary exploratory analysis, we assessed the association of adjunctive local anesthesia with anesthetic requirements and patient outcomes.

Methods: This retrospective single-center cohort study included 381 consecutive patients undergoing ambulatory transperineal MRI–US fusion-targeted prostate biopsy between 2019 and 2023. General anesthesia was administered using target-controlled propofol and remifentanil infusions while maintaining spontaneous ventilation. Perioperative complications, procedure-room time, anesthetic drug requirements, postoperative pain, and patient satisfaction were analyzed. Multivariable regression models evaluated factors associated with anesthetic requirements and postoperative pain.

Results: All procedures were completed successfully in the ambulatory setting. The median procedure-room time was 30 minutes (IQR 25–34.5), and perioperative complications were uncommon, with only one episode of transient respiratory depression requiring manual ventilation. Patients receiving adjunctive local anesthesia (n=152) required significantly lower propofol and remifentanil doses and had shorter procedure-room times than those managed without local anesthesia (all $p < 0.05$). Postoperative pain was minimal, with 95.7% of patients reporting no or mild pain within 24 hours. Patient satisfaction was high.

Conclusions: A standardized ambulatory pathway using target-controlled general anesthesia with spontaneous ventilation is a safe and feasible anesthetic strategy for transperineal MRI–US fusion-targeted prostate biopsy. Adjunctive local anesthesia reduces anesthetic requirements while maintaining excellent patient comfort and procedural outcomes.

Keywords: Ambulatory anesthesia; Non-operating room anesthesia; Target-controlled infusion; Transperineal prostate biopsy; Perioperative care.

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Introduction

The increasing adoption of ambulatory care pathways has led to a growing demand for anesthetic strategies that ensure procedural safety, patient comfort, rapid recovery, and efficient use of healthcare resources [1,2]. These requirements are particularly relevant in non-operating room anesthesia (NORA) environments, where procedures traditionally performed in the operating room are increasingly being transferred to dedicated outpatient units [3,4]. In this setting, anesthetic techniques must provide adequate procedural conditions while minimizing perioperative morbidity and facilitating same-day discharge [3-5].

Transperineal magnetic resonance imaging–ultrasound (MRI–US) fusion-targeted prostate biopsy has become an established diagnostic procedure for patients with suspected prostate cancer [6]. Compared with the transrectal approach, the transperineal route is associated with fewer infectious complications and improved access to the anterior prostate, leading the current European Association of Urology guidelines to recommend its use whenever feasible [7-10]. In addition, MRI–US fusion systems improve lesion targeting and diagnostic accuracy by enabling precise sampling of suspicious areas identified on multiparametric MRI [11,12].

Despite these advances, anesthetic management remains an important challenge [13]. Accurate MRI–US fusion targeting requires patient immobility, while the transperineal approach may cause discomfort due to needle passage through multiple tissue planes [14]. Local anesthesia has been successfully implemented in many centers; however, pain control may be variable and patient discomfort during infiltration, probe manipulation, and biopsy sampling remains a concern [14,15]. Conversely, conventional general anesthesia with airway instrumentation may increase resource utilization, prolong recovery, and reduce the efficiency of ambulatory pathways.

The availability of short-acting intravenous agents administered through target-controlled infusion (TCI) systems has facilitated the development of non-intubated anesthetic techniques based on spontaneous ventilation [16]. This approach may provide adequate procedural conditions while preserving respiratory function, allowing rapid recovery and facilitating outpatient management [17,18]. However, data regarding the safety, feasibility, and anesthetic requirements of general anesthesia with spontaneous ventilation for ambulatory MRI–US fusion prostate biopsy remain limited.

The primary objective of this study was to evaluate the safety and feasibility of a standardized outpatient anesthesia pathway

based on target-controlled propofol and remifentanil infusions with spontaneous ventilation for transperineal MRI–US fusion-targeted prostate biopsy. A secondary exploratory objective was to investigate whether the use of adjunctive local anesthesia was associated with differences in anesthetic requirements, procedure-room time, and patient-reported outcomes.

Methods

Study design and population

This retrospective single-center cohort study evaluated a standardized ambulatory anesthesia pathway for transperineal MRI–US fusion-targeted prostate biopsy performed under general anesthesia with spontaneous ventilation. Consecutive adult patients undergoing the procedure between November 2019 and December 2023 were included.

The study was approved by the Ethics Committee of Hospital Clinic Barcelona (HCB/2024/0012) and was conducted in accordance with the Declaration of Helsinki. The requirement for informed consent was waived due to the retrospective nature of the study.

Setting and ambulatory pathway

All procedures were performed in a dedicated outpatient non-operating room environment staffed by an anesthesiologist, specialized nursing personnel, and an experienced urologist (Figure 1).

Patients underwent a pre-procedural nursing assessment and received standardized antibiotic prophylaxis with fosfomycin (3 g) the day before and the day after biopsy. Following completion of the procedure, patients were transferred to the post-anesthesia care unit (PACU), where they remained under observation for a minimum of one hour before discharge according to institutional criteria.

A structured telephone follow-up was conducted 24 hours after discharge to assess postoperative pain, analgesic consumption, complications, and overall patient satisfaction.



Figure 1. Room setup for ambulatory transperineal MRI–US fusion-targeted biopsy at our institution.

Anesthetic management

Standard monitoring included electrocardiography, pulse oximetry, and non-invasive blood pressure monitoring. Supplemental oxygen was administered via nasal cannula.

Patients were placed in the lithotomy position before induction. Premedication with intravenous midazolam was administered at the discretion of the attending anesthesiologist.

General anesthesia was induced and maintained using target-controlled infusions (TCI) of propofol and remifentanil delivered through an Orchestra Base Primea® system (Fresenius Kabi, Germany). Effect-site concentrations were calculated using the Schnider pharmacokinetic model for propofol [19] and the Minto model for remifentanil [20]. Initial target concentrations were set at 1 μg/mL for propofol and 1 ng/mL for remifentanil and subsequently adjusted according to procedural requirements while maintaining spontaneous ventilation throughout the intervention. Airway instrumentation was not routinely performed.

Beginning in June 2022, adjunctive local anesthesia was incorporated into the institutional protocol. Local anesthesia consisted of subcutaneous infiltration of 10 mL of 2% lidocaine (200 mg) through a single midline perineal puncture approximately 1.5 cm from the anal verge, allowing bilateral diffusion. Ultrasound image acquisition was initiated 2–5 minutes after infiltration. Because this protocol was implemented during the study period, comparisons between patients receiving and not receiving local anesthesia represent a historical, non-randomized comparison. Consequently, the use of local anesthesia was determined by the institutional protocol in place at the time of the procedure rather than by patient characteristics.

Biopsy procedure

Biopsies were performed using an elastic MRI–US fusion platform (Koelis Trinity®, Meylan, France) with a transperineal mini-grid system.

Targeted biopsies of MRI-visible lesions were combined with systematic sampling according to institutional practice. Procedures were performed by experienced urologists specialized in transperineal MRI–US fusion biopsy.

Procedure-room time was defined as the interval between anesthetic induction and completion of biopsy sampling.

Data collection and outcomes

Demographic, clinical, anesthetic, and procedural variables were extracted from electronic medical records. Collected variables included age, body mass index, American Society of Anesthesiologists (ASA) physical status, comorbidities, prostate-specific antigen (PSA) level, prostate volume, Prostate Imaging Reporting and Data System (PI-RADS) score, number of MRI-detected lesions, biopsy results, anesthetic drug doses, effect-site concentrations, procedure-room time, perioperative complications, postoperative pain scores, analgesic consumption, and patient satisfaction.

The primary outcome was procedural safety, defined as the composite incidence of anesthesia-related and procedure-related complications occurring during the procedure or within 24 hours after discharge. Anesthesia-related complications included respiratory depression requiring airway maneuvers or airway adjuncts, bradycardia (<50 beats/min), and hypotension (mean arterial pressure <60 mmHg). Procedure-related complications included urinary tract infection, hematuria, rectal bleeding, acute urinary retention, and perineal hematoma.

Secondary outcomes included procedure-room time, propofol and remifentanil requirements, postoperative pain measured using a numeric rating scale (NRS) during the first 24 hours, postoperative analgesic consumption, and patient satisfaction, assessed as willingness to undergo the procedure again under the same conditions. Postoperative pain, analgesic consumption, and patient satisfaction were assessed during a standardized telephone follow-up conducted 24 hours after the procedure. Analyses of these patient-reported outcomes were performed in patients who completed follow-up. Comparisons according to adjunctive local anesthesia were considered exploratory because local anesthesia was introduced during the study period and patients were not randomized.

Statistical analysis

Continuous variables are reported as median (interquartile range [IQR]) or mean (standard deviation), according to distribution. Categorical variables are presented as frequencies and percentages.

Group comparisons were performed using the Mann–Whitney U test or Student's t-test for continuous variables, as appropriate, and the chi-square test or Fisher's exact test for categorical variables.

Multivariable linear regression models were used to identify independent predictors of propofol and remifentanil requirements. Covariates were selected a priori based on clinical relevance and availability as preprocedural patient or disease characteristics potentially associated with anesthetic requirements. The models were adjusted for age, body mass index, prostate volume, and premedication. Procedure-room time was excluded from the models because it may be influenced by the exposure and therefore represent a post-exposure variable. Multivariable logistic regression was performed to identify factors associated with postoperative pain, which was dichotomized as no pain versus any pain (NRS ≥1).

Because adjunctive local anesthesia was introduced as a protocol change during the study period, comparisons between patients receiving and not receiving local anesthesia were considered exploratory and hypothesis-generating rather than confirmatory. Multivariable regression models were therefore used to adjust for measured baseline differences; however, residual confounding related to temporal changes in clinical practice cannot be excluded.

Statistical significance was defined as $p < 0.05$. Analyses were performed using SPSS version 30 (IBM Corp., Armonk, NY, USA).

Missing data were evaluated before analysis. Cases with missing values in variables required for multivariable models were excluded using complete-case analysis.

Results

Study population

A total of 381 consecutive patients underwent ambulatory transperineal MRI–US fusion-targeted prostate biopsy under general anesthesia with spontaneous ventilation during the study period. Adjunctive local anesthesia (LA) was administered to 152 patients (39.9%), whereas 229 patients (60.1%) underwent the procedure without LA.

Baseline demographic and clinical characteristics are summarized in Table I. The median age of the cohort was 68 years (IQR 62–74), and most patients were classified as ASA II. Body mass index, prostate volume, number of MRI-detected lesions, and PI-RADS distribution were comparable between groups. Median PSA levels were higher in the non-LA group, while cardiovascular comorbidity was more frequent in patients receiving LA. These variables were included as covariates in the multivariable analyses.

Ambulatory pathway performance

The ambulatory pathway was successfully completed in all patients without the need for hospital admission or conversion to conventional operating room anesthesia.

Median procedure-room time was 30 minutes (IQR 25–34.5) and was significantly shorter in patients receiving adjunctive local anesthesia ($p = 0.003$).

The incidence of perioperative complications was low. One patient (0.26%; 95% CI: 0.01–1.47%) experienced transient respiratory depression requiring brief manual ventilation, and two patients (0.52%; 95% CI: 0.06–1.90%) developed transient hemodynamic instability, both of which resolved with conservative management. Procedure-related complications within the first 24 hours included urinary tract infection (1.3%; 95% CI: 0.43–3.04%), hematuria (1.05%; 95% CI: 0.29–2.67%), acute urinary retention (0.52%; 95% CI: 0.06–1.90%), rectal bleeding (0.26%; 95% CI: 0.01–1.45%), and perineal hematoma (0.26%; 95% CI: 0.01–1.45%).

Overall, the findings support the feasibility of performing transperineal MRI–US fusion biopsy under general anesthesia with spontaneous ventilation in a dedicated outpatient non-operating room setting. Following the primary analysis of procedural safety and feasibility, exploratory analyses were performed to evaluate factors associated with anesthetic requirements and patient-reported outcomes.

Anesthetic performance

Anesthetic management outcomes are summarized in Table II. Patients receiving adjunctive LA required significantly lower target effect-site concentrations and total doses of both propofol and remifentanil than patients managed without LA

Table I. Patient and prostate characteristics.

	LA (n=152)	Non-LA (n=229)	All (n=381)	p
Age (yr): median (IQR)	68 (61-74)	68 (63-74)	68 (62-74)	0.89[a]
ASA: n (%)	1: 10 (6.62%) 2: 107 (70.86%) 3: 34 (22.52%)	1: 21 (9.21%) 2: 173 (75.88%) 3: 34 (14.91%)	1: 31 (8.18%) 2: 280 (73.88%) 3: 68 (17.94%)	0.14[b]
BMI (kg/m2): median (IQR)	26.57 (24.22-29.32)	26.67 (24.62-28.71)	26.66 (24.49-29.05)	0.79[a]
Prostate volume (cc): median (IQR)	57 (39.50-79.50)	57 (42-79)	57 (40-79)	0.82[b]
Number of lesions: n (%)	1: 122 (80.26%) 2: 30 (19.74%)	1: 182 (79.48%) 2: 47 (20.52%)	1: 304 (79.79%) 2: 77 (20.21%)	0.85[b]
PI-RADS 3, 4, 5: n (%)	3: 22 (14.47%) 4: 113 (74.34%) 5: 17 (11.18%)	3: 45 (19.65%) 4: 146 (63.76%) 5: 38 (16.59%)	3: 67 (17.59%) 4: 259 (67.98%) 5: 55 (14.44%)	0.09[b]
PSA (ng/mL): median (IQR)	5.60 (4.40-7.10)	6.50 (5.00-9.70)	6.10 (4.60-8.50)	**<0.001**[a]
Comorbidity: n (%) **DM** **HTN** **CV** **Respiratory** **None**	 18 (12.08%) 73 (48.99%) 36 (24.16%) 19 (12.75%) 27 (18.12%)	 34 (14.85%) 113 (49.34%) 32 (13.97%) 19 (8.30%) 48 (20.96%)	 52 (13.76%) 186 (49.21%) 70 (18.52%) 41 (10.89%) 75 (19.84%)	 0.44[b] 0.94[b] 0.01[b] 0.16[b] 0.50[b]

LA: local anesthesia. IQR: (interquartile range. ASA: American Society of Anesthesiologists. BMI: body mass index. PI-RADS: Prostate Imaging Reporting and Data System. PSA: prostate-specific antigen. DM: diabetes mellitus. HTN: hypertension. CV: cardiovascular. Bold values indicate statistically significant results (p < 0.05). [a]*Wilcoxon rank-sum test* [b]Chi-square test of independence.

Table II. Effect-site concentrations, total drug doses, and premedication.

	LA (n = 152)	Non-LA (n = 229)	All (n = 381)	p
Premedication (midazolam): n (%)	2 (1.34%)	13 (5.70%)	15 (3.98%)	0.03[b]
Propofol Ce (µg/mL): median (IQR)	2 (1.5-2.5)	2.50 (1.50-3)	2.2 (1.50-2.80)	**<0.001**[a]
Propofol total dose (mg): median (IQR)	167.50 (140.50-200)	231 (191-281)	200 (161-250)	**<0.001**[a]
Remifentanil Ce (ng/mL): median (IQR)	1.50 (1.40-2)	2 (1.60-2)	1.80 (1.50-2)	**<0.001**[a]
Remifentanil total dose (µg): median (IQR)	108 (82-125)	133 (105-160)	121 (99-148)	**<0.001**[a]

LA: local anesthesia. *IQR: interquartile range. Ce: effect-site concentration.* [a]*Wilcoxon rank-sum test* [b]*Chi-square test of independence.*

(all $p < 0.001$). Premedication with midazolam was infrequently administered overall but was more common in the non-LA group.

In multivariable linear regression analyses, adjunctive LA remained independently associated with reduced propofol (B = −69.61 mg; 95% CI, −86.00 to −53.22; $p < 0.001$) and remifentanil requirements (B = −27.62 µg; 95% CI, −38.11 to −17.12; $p < 0.001$), after adjustment for age, body mass index, prostate volume, and premedication. Higher body mass index was independently associated with increased anesthetic drug consumption, whereas increasing age predicted lower anesthetic requirements.

Patient-reported outcomes

Telephone follow-up at 24 hours was successfully completed in 371 of the 381 patients (97.4%). Ten patients (2.6%) could not be contacted despite repeated attempts. Among patients who completed follow-up, postoperative pain was minimal: 174 (46.9%) reported no pain, 184 (49.6%) reported mild pain (NRS 1–3), and 13 (3.5%) reported moderate pain (NRS 4–6). No patient reported severe pain.

In multivariable logistic regression analyses, postoperative pain was not significantly associated with the use of adjunctive local anesthesia (OR = 1.57; 95% CI, 0.78–3.14; p = 0.20), remifentanil dose (OR = 1.00; 95% CI, 0.99–1.01; p = 0.89), prostate volume (OR = 0.99; 95% CI, 0.99–1.01; p = 0.80), or intraoperative analgesia (OR = 1.02; 95% CI, 0.97–1.07; p = 0.48). Younger age was the only independent predictor of higher postoperative pain scores (OR = 2.02; 95% CI, 1.44–4.14; p = 0.01).

Patient satisfaction was consistently high. Among the 371 patients who completed follow-up, 368 (99.2%) reported that they would be willing to undergo the same anesthetic technique again if another prostate biopsy were required, whereas only 3 (0.8%) stated that they would not. Owing to the very small number of patients unwilling to repeat the procedure, no comparative analysis of this outcome was performed.

Diagnostic findings

Prostate adenocarcinoma was diagnosed in 268 patients (70.3%), with most cancers detected in lesions classified as PI-RADS 4 or 5 on preoperative multiparametric MRI.

Discussion

This study shows that a standardized ambulatory pathway based on target-controlled propofol and remifentanil infusions with spontaneous ventilation provides a safe, feasible, and well-tolerated anesthetic strategy for transperineal MRI–US fusion-targeted prostate biopsy performed in a dedicated non-operating room setting. In this large single-center cohort, perioperative complications were uncommon, postoperative pain was minimal, and patient satisfaction was consistently high. The exploratory comparison between patients treated with and without adjunctive local anesthesia suggests that local anesthesia was associated with lower anesthetic requirements and shorter procedure-room time, although this observation should be interpreted cautiously given the non-randomized historical design.

The expansion of ambulatory surgery and NORA has increased interest in anesthetic techniques capable of providing optimal procedural conditions while facilitating rapid recovery and efficient resource utilization [21]. Transperineal MRI–US fusion biopsy represents a challenging outpatient procedure because accurate lesion targeting requires complete patient immobility, while the transperineal approach may generate discomfort during needle insertion and sampling [14,15]. Consequently, the anesthetic strategy should not only ensure patient comfort but also optimize procedural conditions and support an efficient ambulatory workflow [22].

Although local anesthesia has been increasingly adopted for transperineal prostate biopsy, patient tolerance remains variable [14,23]. Previous studies have reported that local anesthetic infiltration is frequently perceived as the most painful component of the procedure, and a proportion of patients continue to experience moderate or severe discomfort during probe manipulation and biopsy sampling [15]. Furthermore, patient movement during the procedure may compromise targeting accuracy and occasionally prolong procedural time. Our findings suggest that general anesthesia with spontaneous ventilation provides excellent procedural conditions while avoiding the airway instrumentation, neuromuscular blockade, and prolonged recovery commonly associated with conventional general anesthesia.

An important finding of the present study is the favorable safety profile of this anesthetic approach. Respiratory and hemodynamic complications were rare, with only one patient requiring brief manual ventilation and no patient requiring conversion to controlled ventilation or advanced airway management. These results support the feasibility of maintaining spontaneous ventilation during relatively short interventional procedures performed outside the conventional operating room. The use of target-controlled infusion systems likely contributed to this favorable profile by allowing continuous titration of anesthetic depth according to procedural requirements while avoiding excessive drug administration [24,25].

Target-controlled infusion has become an established technique for ambulatory anesthesia because it provides predictable pharmacokinetics, facilitates rapid adjustments in anesthetic depth, and promotes prompt postoperative recovery [26-28]. In our cohort, propofol and remifentanil administered using validated pharmacokinetic models provided stable procedural conditions with very low rates of respiratory compromise. This is particularly relevant in older patients undergoing diagnostic procedures, in whom minimizing physiological disturbance while maintaining procedural quality is an important perioperative objective.

One of the most clinically relevant findings was the independent association between adjunctive local anesthesia and reduced propofol and remifentanil requirements. Although postoperative pain scores did not differ between groups, patients receiving local anesthesia consistently required lower anesthetic doses after adjustment for age, body mass index, prostate volume, and premedication. This suggests that local anesthesia primarily functions as an anesthetic-sparing strategy rather than as a means of improving postoperative analgesia when an adequate level of general anesthesia is already provided. Reducing anesthetic drug exposure may contribute to faster recovery and fewer drug-related adverse effects, particularly in older patients and those with multiple comorbidities. However, these findings should be interpreted cautiously. Adjunctive local anesthesia was introduced as part of an institutional protocol change during the study period rather than through random allocation. Consequently, differences between groups may also reflect temporal improvements in operator experience, refinements in procedural workflow, or other unmeasured changes in clinical practice. Although multivariable analyses adjusted for measured baseline characteristics, residual confounding cannot be excluded.

Procedure-room time is another important determinant of ambulatory pathway performance. We observed a median procedure-room time of 30 minutes, which compares favorably with previous reports of transperineal MRI-guided biopsy [29]. Adjunctive local anesthesia was associated with shorter procedure-room times; however, the present study did not evaluate recovery time, discharge readiness, resource utilization, or healthcare costs. Therefore, no conclusions can be drawn regarding the overall efficiency or economic impact of this ambulatory pathway. Future prospective studies incorporating these outcomes are required to determine whether the observed reduction in anesthetic requirements translates into improvements in perioperative workflow or resource utilization.

Patient-reported outcomes are increasingly recognized as key quality indicators in perioperative medicine [30]. Nearly all patients reported no or only mild postoperative pain, and almost every participant indicated willingness to undergo the same anesthetic technique again if required. These findings emphasize that successful ambulatory pathways should be evaluated not only by complication rates but also by patient experience, comfort, and acceptability. Such outcomes are particularly relevant in prostate cancer diagnostics, where repeated biopsies may be required during active surveillance [31,32].

This study has several limitations. Its retrospective, single-center design limits causal inference and external validity. The introduction of adjunctive local anesthesia during the study period resulted in a historical comparison rather than a randomized allocation, introducing the possibility of temporal bias and confounding related to increasing operator experience. Although multivariable analyses were performed to adjust for important baseline differences, residual confounding cannot be excluded. In addition, formal recovery times, discharge readiness scores, patient-reported recovery measures, and economic outcomes were not available. These endpoints would provide valuable information regarding the overall efficiency and cost-effectiveness of ambulatory anesthetic pathways and should be addressed in future prospective studies.

Despite these limitations, this study represents one of the largest reported series evaluating target-controlled general anesthesia with spontaneous ventilation for ambulatory transperineal MRI–US fusion biopsy. The standardized anesthetic protocol, homogeneous perioperative pathway, and comprehensive assessment of anesthetic, procedural, and patient-reported outcomes provide clinically relevant evidence supporting this approach. Prospective multicenter studies comparing general anesthesia with spontaneous ventilation and contemporary local anesthesia protocols are warranted to determine the optimal anesthetic strategy for transperineal prostate biopsy performed in outpatient settings.

Conclusions

Ambulatory transperineal MRI–US fusion-targeted prostate biopsy performed under target-controlled general anesthesia with spontaneous ventilation is a safe and feasible approach, providing low complication rates, excellent patient tolerance, and high satisfaction. Adjunctive local anesthesia was associated with lower anesthetic requirements and shorter procedure-room time without affecting postoperative pain. Prospective studies are warranted to confirm these findings and evaluate their impact on recovery and perioperative efficiency.

Author contributions

IB, OP, BT, MM: Conceptualization, methodology, and writing – original draft. MC, JB, IA, RG, CD: Data collection and analysis, and methodology. BT, MM: Supervision and critical revision of the manuscript.

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Ethics approval and consent to participate

The study was approved by the institutional Ethics Committee of Hospital Clinic Barcelona (reference HCB/2024/0012). Informed consent was waived due to the retrospective nature of the study. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments.

Disclosures / conflicts of interest statement

There are no financial relationships or conflicts of interest to disclose.

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ERRATUM

The following abstract was published in Ambulatory Surgery issue 32.1.

The list of contributing authors was incomplete. The full list of authors is given below, together with the abstract:

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.

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