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ORIGINAL ARTICLE

Temporary in situ catheters to extend autonomic neural blockade after laparoscopic sleeve gastrectomy: A feasibility and safety study

Catéteres temporales *in situ* para prolongar el bloqueo neural autonómico tras la gastrectomía en manga laparoscópica: Estudio de viabilidad y seguridad

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Abstract

Introduction. Autonomic neural blockade (ANB) effectively reduces visceral pain, opioid and overall analgesic consumption, associated autonomic symptoms, and anesthetic requirements, while providing hemodynamic stability after laparoscopic sleeve gastrectomy (LSG). However, the limited duration of ANB remains a constraint. This study explores the use of temporary catheters to extend ANB beyond the intraoperative period.

Methods. We conducted a prospective feasibility and safety evaluation of temporary in situ catheters for postoperative ANB after LSG. Bupivacaine 0.5% and dexamethasone were administered at 12 and 24 hours postoperatively. Feasibility, technical considerations, safety observations, hemodynamic effects, and descriptive clinical responses were recorded.

Results. Catheter placement was successful in five of six cases (83%). No bleeding, procedural complications, or catheter-related adverse events were observed. Redosing was performed as planned without hemodynamic changes. Patients who exhibited postoperative visceral symptoms experienced prompt symptom improvement, temporarily associated with ANB redosing, while asymptomatic patients remained clinically stable. Catheter removal was uneventful in all cases.

Conclusions. The use of temporary in situ catheters to extend ANB beyond the intraoperative period is technically feasible and appears to be safe in patients undergoing LSG. This preliminary experience provides anatomical and technical insights into catheter type, placement, and redosing strategies. Efficacy conclusions are intentionally deferred until larger, controlled studies are conducted.

Keywords: autonomic nerve block; catheters; bariatric surgery; sleeve gastrectomy; visceral pain; postoperative nausea and vomiting.

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Resumen

Introducción. El bloqueo neural autonómico (BNA) reduce eficazmente el dolor visceral, el uso de opioides y el requerimiento global de analgésicos y anestésicos, al tiempo que proporciona estabilidad hemodinámica tras la gastrectomía en manga laparoscópica (LSG). Sin embargo, la duración del BNA sigue constituyendo una limitación. Este estudio explora el uso de catéteres temporales para prolongar el BNA más allá del período intraoperatorio.

Métodos. Se realizó una evaluación prospectiva de la viabilidad y la seguridad de los catéteres temporales *in situ* para el BNA posoperatorio tras una LSG. Se administró bupivacaína al 0,5 % y dexametasona a las 12 y 24 horas del posoperatorio. Se registraron las consideraciones técnicas, seguridad, efectos hemodinámicos y respuestas clínicas.

Resultados. La colocación del catéter fue exitosa en cinco de los seis casos (83 %). No hubo hemorragia, complicaciones del procedimiento ni eventos adversos relacionados con el catéter. Los pacientes que presentaron síntomas viscerales postoperatorios experimentaron una pronta mejoría, temporalmente asociada a la redosificación del BNA, mientras que los pacientes asintomáticos permanecieron clínicamente estables. El retiro del catéter transcurrió sin incidentes.

Conclusiones. El uso de catéteres temporales *in situ* para prolongar el bloqueo nervioso regional más allá del período intraoperatorio es técnicamente factible y parece ser seguro en pacientes sometidos a LSG. Esta experiencia preliminar aporta información anatómica y técnica sobre el tipo de catéter, su colocación y las estrategias de redosificación. Las conclusiones relativas a la eficacia se posponen deliberadamente hasta que se realicen estudios controlados de mayor envergadura.

Palabras clave: bloqueo nervioso autónomo; catéteres; cirugía bariátrica; manga gástrica; dolor visceral; náusea y vómito posoperatorios.

Introduction

Despite advances in balanced anesthesia, parietal blocks, and Enhanced Recovery After Surgery (ERAS) protocols, effective control of visceral pain and its associated autonomic symptoms remain challenging. This is particularly true for minimally invasive procedures, where visceral and autonomic pathways often drive postoperative discomfort. Laparoscopic sleeve gastrectomy (LSG) is a procedure in which autonomic symptoms—visceral pain, nausea, vomiting, and sympathetic activation—are especially prominent during the first 24–48 hours. These symptoms delay recovery, increase resource utilization, and contribute to unplanned admissions and opioid exposure, undermining patient-centered, opioid-sparing recovery strategies [1-3].

Autonomic neural blockade (ANB) is an emerging technique that selectively modulates visceral pain by interrupting autonomic afferent pathways. Our group has contributed to the development and clinical evaluation of ANB through four randomized controlled trials and multiple publications, demonstrating its safety and ability to reduce visceral pain, opioid and anesthetic requirements, and postoperative nausea and vomiting while maintaining hemodynamic stability during upper gastrointestinal surgery. We have also explored different anesthetic combinations and extended ANB to other minimally invasive visceral procedures, including colectomies and gynecologic surgery, by targeting procedure-specific autonomic pathways [4-12].

The principal limitation of ANB has been its duration. Despite prolonged effects achieved with combinations of bupivacaine, dexamethasone, and liposomal formulations, a subset of patients experience recurrence of visceral symptoms 12–24 hours after LSG. Extending the duration of ANB without increasing invasiveness or systemic exposure represents an unmet need.

Accordingly, this study aimed to evaluate the technical feasibility, safety, and anatomical considerations of using temporary in situ catheters to allow postoperative redosing of autonomic neural blockade following laparoscopic sleeve

gastrectomy. This exploratory investigation was not designed to assess clinical efficacy, which will require dedicated prospective studies.

Methods

Study design

This prospective feasibility study evaluated the use of temporary in situ catheters for postoperative redosing of autonomic neural blockade. All patients received ANB at the outset of LSG and a transversus abdominis plane (TAP) block at the end of the procedure, in accordance with previously described protocols [6-8]. Temporary in situ catheter placement was attempted in all patients. When placement was successful, redosing was performed at 12 and 24 hours postoperatively.

Patient selection

Six consecutive adult patients undergoing laparoscopic sleeve gastrectomy at Clínica Iberoamérica in Barranquilla, Colombia, a high-volume bariatric center, between October 1 and December 20, 2025, were included.

Technical description

Two catheter systems were used. The first five cases used stylet-guided catheters without a needle tip, requiring removal of the LSG epigastric trocar for intraperitoneal introduction. The sixth case used an over-the-needle catheter introduced percutaneously without trocar removal. All catheters were pigtail-locking, 20–30 cm in length, 6–8 French (Fr) in caliber, with distal side holes concentrated near the tip.

Catheters were placed in one of three anatomically selected locations, depending on individual anatomy:

- Retroperitoneal region above the emergence of the left gastric artery.
- Anterior paragastric region along the lesser curvature.
- Posterior paragastric region along the lesser curvature, accessed from the neo-greater curvature after sleeve completion.
- For stylet-guided systems, a fine-tip Maryland dissector was used to create a small rent in the target tissue. The catheter was advanced until the distal holes were within the desired plane, the stylet was removed, and the pigtail was deployed. For over-the-needle systems, the needle was inserted directly into the target fatty tissue, withdrawn, and the catheter was advanced until the distal holes were no longer visible before deploying the pigtail (Figures 1 and 2).

Catheters were secured at the skin with 3-0 nylon and a three-way stopcock. Position was observed during abdominal deflation. A sterile dressing covered the site, leaving the stopcock accessible. A link to a video demonstrating successful catheter placements is included [13].

Redosing protocol

Redosing consisted of 15 mL of 0.5% bupivacaine with 8 mg of dexamethasone, administered through the catheter at 12 and 24 hours postoperatively, regardless of symptoms. Heart rate, blood pressure, pain, nausea, and vomiting were assessed before administration and again 10 minutes after. Catheters were then removed, and patients were discharged when clinically stable.

Analgesia protocol

All patients received scheduled non-opioid analgesics with acetaminophen or dipyrone. NSAID were administered 12 hours postoperatively to eligible patients and used as first-line rescue analgesia. Oxycodone was reserved as a second-line rescue medication. Clear liquids were initiated on postoperative day one.

Variables

Patients were assessed at 12, 24, and 48 hours for pain on a 1-10 numeric scale and for the presence of nausea, vomiting, or other autonomic symptoms. Changes in symptoms and hemodynamic parameters before and after redosing were recorded.

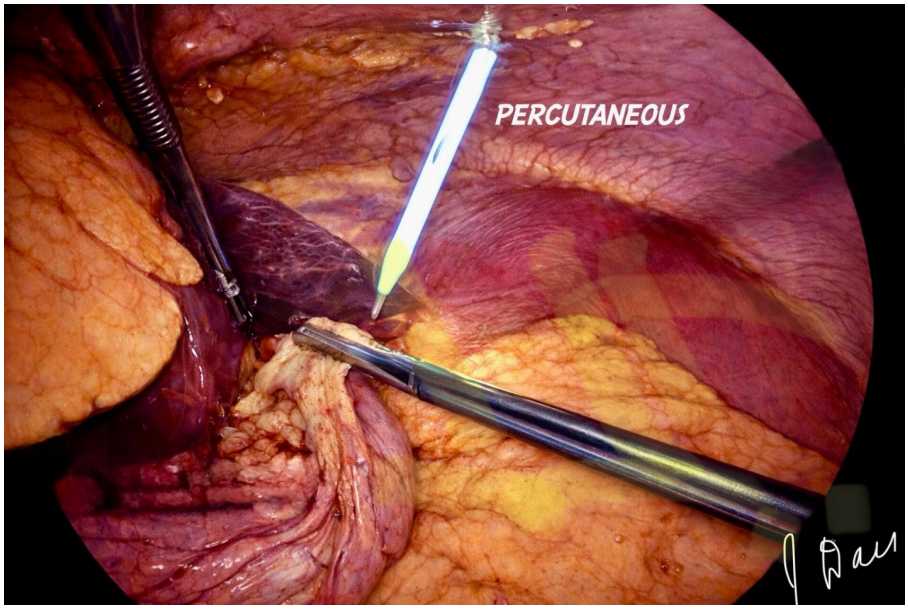

Figure 1. Percutaneous placement of an over-the-needle catheter during laparoscopic sleeve gastrectomy. The catheter is inserted percutaneously through the left subcostal region without removal of the epigastric trocar, thereby maintaining stable liver retraction. Under direct laparoscopic visualization, the catheter is then advanced toward the anterior paragastric area using a grasper (not shown).

Source: original digital design by the lead author.

Figure 2. Illustration of catheter placement for autonomic neural blockade after laparoscopic sleeve gastrectomy. The catheter is positioned in the anterior paragastric region along the lesser curvature of the stomach, within the pathway of autonomic afferent fibers. The pigtail tip is visualized within the surrounding fatty tissue, confirming stable positioning in the intended anatomical plane.

Source: original digital design by the lead author.

Results

All patients underwent intraoperative autonomic neural blockade at the outset of LSG [14], followed by TAP blocks at completion of the procedure. Baseline patient characteristics are summarized in table 1. Catheter placement was attempted at the conclusion of the operation. Among the five successful cases, catheter placement was achieved in three anatomically targeted regions: two catheters were placed in the anterior paragastric region along the lesser curvature, two in the posterior paragastric region, and one in the anterosuperior region near the left gastric artery. In the third attempted case, removal of the epigastric trocar resulted in inadequate liver retraction in a patient with hepatomegaly, and catheter placement was aborted. The irrigation test confirmed confined distribution at the intended site in all successfully placed catheters. Overall technical success was achieved in five of six cases (83%), with one aborted attempt due to exposure limitations. Case-level technical details, catheter type, anatomical location, and clinical observations are summarized in table 2.

The procedure was completed efficiently despite being our initial experience, and no bleeding, procedural complications, or catheter-related adverse events were observed. Redosing was performed as planned in all successful cases. No clinically relevant changes in heart rate or blood pressure were observed 10 minutes after redosing. Most patients had unremarkable symptoms at 12, 24, and 72 hours after surgery. One patient (case 2) experienced nausea, vomiting, and moderate visceral pain (4/10) before redosing, with prompt improvement thereafter. Given the subjective nature and low intensity of symptoms in the remaining patients, no conclusions about efficacy were drawn.

Table 1. Baseline patient characteristics.

Case	Sex	Age (years)	Weight (kg)	Height (cm)	BMI (kg/m^2)	Procedure	ANB catheter location
1	Female	18	90	167	32.3	Sleeve gastrectomy	Anterior paragastric
2	Female	40	118	165	43.3	Sleeve gastrectomy	Above celiac plexus
3	Female	29	105	164	39.0	Sleeve gastrectomy	Not placed
4	Female	32	154	178	48.6	Sleeve gastrectomy	Posterior paragastric
5	Male	47	71	149	32.0	Sleeve gastrectomy	Anterior paragastric
6	Female	32	154	178	48.6	Sleeve gastrectomy	Posterior paragastric

Table 2. Case-level summary of temporary in situ catheter placement and redosing outcomes.

Case	Catheter type	Anatomical location	Successful placement	Symptoms at redosing	Clinical response
1	Stylet-guided	Retroperitoneal (left gastric artery)	Yes	None	N/A
2	Stylet-guided	Retroperitoneal (left gastric artery)	Yes	Pain 5/10, nausea/vomiting	Complete symptom resolution
3	Stylet-guided	Retroperitoneal (left gastric artery)	Yes	Minimal	N/A
4	Stylet-guided	Anterior paragastric (lesser curvature)	Yes	Minimal	N/A
5	Stylet-guided	Attempted epigastric access	No (aborted)	N/A	N/A
6	Over-the-needle	Posterior paragastric (lesser curvature)	Yes	minimal	N/A

Minimal: when no nausea or vomiting was present and the pain level was less than 3/10.

Discussion

Previous studies support the safety and efficacy of intraoperative ANB as an adjunct to combined anesthesia for managing visceral pain, preventing nausea and vomiting, reducing analgesic use (especially opioids), and promoting hemodynamic stability during minimally invasive procedures, particularly LSG [2,5,7-10]. The duration of the blockade effect has been the most critical limitation to date, despite improvements with combinations of bupivacaine and other medications. The use of temporary in situ catheters represents a logical extension of intraoperative ANB and, to our knowledge, has not been previously reported. The catheters are placed in areas through which the afferent autonomic pathways pass.

Key findings and interpretation

Placement of stylet-guided catheters was successful in 4 of 5 attempts. The need to remove a trocar—most commonly the epigastric port, which provides optimal access for catheter positioning—compromised exposure in one case, leading to procedural abortion. Moreover, the need to open a small rent in the mesentery to advance a small (6 Fr) stylet-driven catheter is not ideal, as some fluid may escape, especially during the irrigation test. For that reason, we switched to a similar over-the-needle catheter for the sixth case. We placed it percutaneously in the left paramedial subcostal area (without removing a trocar) and then in the anterior paragastric area along the lesser curvature of the stomach. Based on this preliminary experience, over-the-needle catheters with a pigtail lock, small caliber (6 Fr), and distal side holes appear to offer technical advantages. They may be the preferred option for this application.

The proper catheter location depends on the anatomy of the case. We identified three plausible sites for correct catheter placement: the retroperitoneal area above the emergence of the left gastric artery, and the anterior and posterior paragastric regions of the upper part of the lesser curvature of the stomach. These locations correspond to areas near the celiac plexus or along paragastric afferent pathways en route to the plexus, supporting their physiological relevance for autonomic modulation.

We did not observe complications during placement or after surgery. Redosing and catheter removal were uneventful. Moreover, we observed no hemodynamic changes after redosing. This contrasts with intraoperative ANB, in which a median decrease of approximately 10 points in heart rate and blood pressure is typically observed and considered a hallmark of effective blockade.

A plausible explanation is that the patient's autonomic system is stimulated during surgery by pneumoperitoneum, visceral manipulation, retraction, division, suturing, anesthesia administration, among other factors. In contrast, the postoperative redosing environment lacks these stimuli, which may explain the absence of measurable autonomic responses despite clinical symptom modulation.

Most patients had mild symptoms throughout the postoperative period, supporting the effectiveness of the ANB and TAP blocks performed during the LSG. The observed reduction in nausea, vomiting, and moderate pain in the only symptomatic patient before redosing is encouraging. However, definitive assessment of clinical effectiveness will require dedicated prospective studies with standardized symptom evaluation over longer follow-up intervals.

Strengths and limitations

The strengths of this study include its deliberate framing as a preliminary technical feasibility assessment, its transparent acknowledgment of uncertainty, and its intentionally limited cohort, designed to explore safety and procedural refinement rather than efficacy.

The limitations of this study include the small sample size, which can be viewed both as a constraint and as an intentional feature of an exploratory feasibility investigation, and the inability to reliably determine catheter displacement except in the limited number of cases in which redosing produced a clear clinical response.

An additional limitation is the need to define better patient subgroups most likely to benefit from this approach, such as individuals with heightened visceral sensitivity, multiple analgesic intolerances, or a history of postoperative nausea and vomiting.

Importantly, this study was not designed to compare analgesic efficacy between techniques, but rather to establish technical feasibility and procedural safety.

Future research directions

Once efficacy is established, this redosing strategy may be applied to other procedures, including minimally invasive visceral operations such as colectomy and complex upper gastrointestinal procedures.

Conclusion

Temporary in situ catheter placement for postoperative redosing of autonomic neural blockade is feasible and safe following laparoscopic sleeve gastrectomy, providing a platform to extend autonomic modulation beyond the intraoperative period and warranting further prospective evaluation of clinical efficacy.

Compliance with ethical standards

Informed consent: Institutional approval was obtained for this feasibility study (Clínica Iberoamérica. Barranquilla, Colombia). All patients provided written informed consent. The intervention used approved devices and medications in accordance with established clinical practice and was conducted as part of an institutional prospective clinical improvement initiative, in accordance with institutional policy and the Declaration of Helsinki. All procedures adhered to the ethical standards of the national and institutional committees responsible for human experimentation (Resolution 008430 of 1993 issued by the Colombian Ministry of Health).

Conflicts of interest: Jorge Daes and Daniel García-De La Rosa have no competing interests. Eric Pauli has the following relevant disclosures: Speaking/Teaching Honoraria- Becton Dickinson, Medtronic, Ovesco, Boston Scientific. Consulting Fees- Boston Scientific, Actuated Medical, Baxter, Cook Biotech, Neptune Medical, Allergan, Surgimatix, Noah Medical.

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Author's contributions:

- Study design and conception: Jorge Daes.
- Data acquisition: Daniel García-De La Rosa.
- Data analysis and interpretation: Jorge Daes, Daniel García-De La Rosa.
- Manuscript drafting: Jorge Daes.
- Critical review and final approval: Jorge Daes, Daniel García-De La Rosa, Eric M. Pauli.

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