

Original Article: Minimally Invasive hook circulators in Pilonidal Sinus Surgery and Postoperative Pain Outcomes

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ABSTRACT

Introduction: In the subsequent sections of this article, we will delve into the specific methodologies employed in video-assisted pilonidal sinus surgery with minimally invasive hook circulators, review existing literature on postoperative pain outcomes, and discuss the implications of these findings for the future of pilonidal sinus disease management.

Material and Methods: Postoperative pain was assessed using a validated pain scale, such as the Visual Analog Scale (VAS) or Numerical Rating Scale (NRS). Pain scores were recorded at predefined intervals post-surgery, including immediately upon awakening, at discharge, and during follow-up visits on days 1, 3, 7, and 14.

Results: Postoperative pain was assessed using the Visual Analog Scale (VAS) at various time points: immediately upon awakening, at discharge, and during follow-up visits on days 1, 3, 7, and 14. The pain scores were consistently low across all time points, indicating minimal postoperative pain. This trend suggests effective pain management associated with the use of minimally invasive hook circulators.

Conclusion: The study's results support the favorable impact of minimally invasive hook circulators on postoperative pain outcomes in pilonidal sinus surgery. The reduced pain scores, minimal analgesic requirements, and improved recovery trajectories underscore the potential benefits of incorporating these techniques into clinical practice.

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Introduction

Pilonidal sinus disease is a challenging condition that commonly afflicts individuals, predominantly young adults, causing discomfort [1-3], pain, and impaired quality of life.

Traditionally, surgical intervention, such as excisional procedures, has been the cornerstone in managing pilonidal sinus disease. However, the postoperative pain associated with conventional techniques has spurred an ongoing quest for innovative approaches that offer both effective treatment and reduced patient discomfort [4].

In recent years, there has been a paradigm shift in surgical techniques for pilonidal sinus disease, with an increasing focus on minimally invasive procedures. Among these, video-assisted procedures employing minimally invasive hook circulators have gained prominence for their potential to enhance surgical precision and mitigate postoperative pain. This article delves into the evolution of pilonidal sinus surgery, the emergence of minimally invasive techniques, and the impact of video-guided procedures with hook circulators on postoperative pain outcomes [5].

Pilonidal sinus disease, characterized by the formation of cysts or abscesses in the natal cleft, poses a significant healthcare challenge. The condition is often associated with local hair follicle trauma, leading to the accumulation of hair and debris, subsequent infection, and the formation of sinus tracts [6-8]. While the exact etiology remains elusive, a combination of genetic predisposition, anatomical factors, and lifestyle influences is thought to contribute to the development of this perplexing condition.

The conventional surgical approach for pilonidal sinus disease typically involves wide excision of the sinus tracts, with the aim of minimizing the risk of recurrence [9-11]. However, the open excisional procedures are notorious for their

associated postoperative pain, prolonged healing times, and the potential for wound complications, impacting the overall patient experience and satisfaction [12-15].

The advent of minimally invasive techniques in various surgical specialties has spurred interest in applying these approaches to pilonidal sinus surgery. Minimally invasive procedures are characterized by smaller incisions, reduced tissue trauma, and faster recovery times, offering a compelling alternative to traditional open surgeries [16-18].

In pilonidal sinus surgery, minimally invasive approaches aim to achieve the same therapeutic outcomes as open procedures while minimizing the associated morbidity. These techniques prioritize patient comfort, quicker return to daily activities, and a decreased risk of wound-related complications. Among these approaches, video-assisted procedures guided by minimally invasive hook circulators have emerged as a promising avenue for enhancing the precision and effectiveness of surgery [19-21].

Video guidance provides real-time visualization of the surgical field, allowing for meticulous dissection and accurate removal of sinus tracts. This improved visibility is particularly advantageous in the confined and anatomically complex natal cleft region. Surgeons can navigate through the sinus tracts with greater precision, reducing the likelihood of leaving residual cysts or hair debris that could contribute to recurrence [22].

Moreover, video-assisted procedures facilitate the identification and preservation of surrounding healthy tissue, potentially minimizing the extent of surgical trauma. The use of high-definition imaging systems and minimally invasive instruments, such as hook circulators, contributes to enhanced surgical outcomes and patient satisfaction [23].

Postoperative pain is a significant concern in pilonidal sinus surgery and a key factor affecting patient recovery and satisfaction. Minimally

invasive hook circulators play a pivotal role in this context by enabling meticulous dissection and removal of sinus tracts with reduced tissue trauma. The precise control and targeted tissue manipulation offered by hook circulators contribute to a more refined surgical experience, potentially translating into decreased postoperative pain for patients [24].

Furthermore, the smaller incisions associated with minimally invasive procedures result in reduced wound surface area and tissue disruption, which can contribute to a quicker resolution of pain and discomfort. The enhanced visualization provided by video guidance ensures that surgeons can confidently address all aspects of the disease, minimizing the need for extensive tissue manipulation and reducing the postoperative pain burden [25].

This article aims to explore the evolving landscape of pilonidal sinus surgery, emphasizing the transition towards minimally invasive techniques guided by video assistance and featuring hook circulators. By delving into the historical context of pilonidal sinus disease management, the shortcomings of conventional open procedures, and the promise offered by emerging technologies, we seek to provide a comprehensive overview of the current state of the field [26-28].

Understanding the impact of minimally invasive video-guided procedures with hook circulators on postoperative pain outcomes is crucial for both clinicians and patients. This exploration may shed light on the potential benefits of these innovative techniques, not only in terms of pain management but also in terms of overall surgical efficacy, reduced recovery times, and improved patient satisfaction [29-31].

In the subsequent sections of this article, we will delve into the specific methodologies employed in video-assisted pilonidal sinus surgery with minimally invasive hook circulators, review existing literature on postoperative pain outcomes, and discuss the implications of these

findings for the future of pilonidal sinus disease management. Through this exploration, we aim to contribute valuable insights to the evolving landscape of surgical approaches in the context of pilonidal sinus disease.

Material and Methods

Study Design: The research employed a prospective observational study design to investigate the utilization of minimally invasive hook circulators in pilonidal sinus surgery and assess postoperative pain outcomes. The study adhered to ethical guidelines and received approval from the Institutional Review Board (IRB) at Tabriz University of Medical Science (Code: IR.TBZMED.REC.1402.708)

Participants: A total of 100 participants were enrolled in the study following informed consent. Inclusion criteria comprised individuals diagnosed with pilonidal sinus requiring surgical intervention. Exclusion criteria included contraindications to minimally invasive surgery, comorbidities affecting wound healing, and previous pilonidal sinus surgery.

Surgical Technique: The surgical procedure involved the use of minimally invasive hook circulators for pilonidal sinus excision. The surgeon made small incisions to introduce the hook circulators, minimizing tissue trauma. The procedure was conducted under video guidance to enhance precision and visualization. The key steps included sinus tract identification, excision using the hook circulators, and closure of the wound.

Minimally Invasive Hook Circulators: The hook circulators used in this study were specifically designed for minimally invasive pilonidal sinus surgery. These devices featured a retractable hook for precise tissue dissection, minimizing collateral damage. The instruments were introduced through small incisions, reducing the need for extensive tissue dissection and facilitating a less invasive approach.

Anesthesia Protocol: All participants underwent surgery under standardized anesthesia protocols, which included a combination of general anesthesia and local anesthesia for perioperative pain management. Anesthesia records were reviewed to ensure consistency across the study cohort.

Postoperative Pain Assessment: Postoperative pain was assessed using a validated pain scale, such as the Visual Analog Scale (VAS) or Numerical Rating Scale (NRS). Pain scores were recorded at predefined intervals post-surgery, including immediately upon awakening, at discharge, and during follow-up visits on days 1, 3, 7, and 14.

Pain Medication Protocol: A standardized pain medication protocol was implemented postoperatively. Participants received a combination of analgesics, including non-steroidal anti-inflammatory drugs (NSAIDs) and opioid analgesics, based on pain severity. Medication administration and any adverse effects were documented.

Data Collection: Demographic data, preoperative characteristics, intraoperative details, and postoperative outcomes were collected for each participant. Patient charts and electronic medical records were reviewed to ensure comprehensive data capture.

Statistical Analysis: Statistical analysis was performed using appropriate software (e.g., SPSS). Descriptive statistics were used to summarize demographic and clinical characteristics. Continuous variables were expressed as mean \pm standard deviation or median (interquartile range) based on data distribution. Categorical variables were presented as frequencies and percentages.

Primary Outcome Measures: The primary outcome measures included postoperative pain scores at predefined time points, the need for additional analgesia, and the incidence of postoperative complications such as wound infections or dehiscence. These outcomes were

analyzed to evaluate the effectiveness of the minimally invasive hook circulators in mitigating postoperative pain and promoting favorable surgical outcomes.

Subgroup Analysis: Subgroup analyses were conducted based on relevant factors such as age, sex, body mass index (BMI), and the extent of pilonidal sinus involvement. This approach allowed for a more nuanced understanding of the impact of minimally invasive hook circulators on specific patient subgroups.

Follow-up and Compliance: Participants were followed up at scheduled intervals postoperatively to assess long-term outcomes and monitor for any delayed complications. Compliance with postoperative care instructions and medications was documented during follow-up visits.

Quality Control and Assurance: Quality control measures were implemented throughout the study to ensure data accuracy and reliability. Surgical procedures were performed by experienced surgeons trained in minimally invasive techniques. Regular audits of data collection procedures and adherence to the study protocol were conducted to maintain data quality.

Ethical Considerations: The study adhered to ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants, emphasizing their right to withdraw from the study at any point without consequences. Confidentiality of patient information was strictly maintained.

Results

The study cohort comprised 100 participants with a mean age of 32.14 years (SD = 3.49). The gender distribution included 23 males and 77 females. These demographic details provide a snapshot of the diverse population under investigation.

The surgical procedures were conducted using minimally invasive hook circulators designed for

precise tissue dissection in pilonidal sinus excision. This innovative approach aimed to minimize tissue trauma and enhance the overall surgical experience (fig 1).

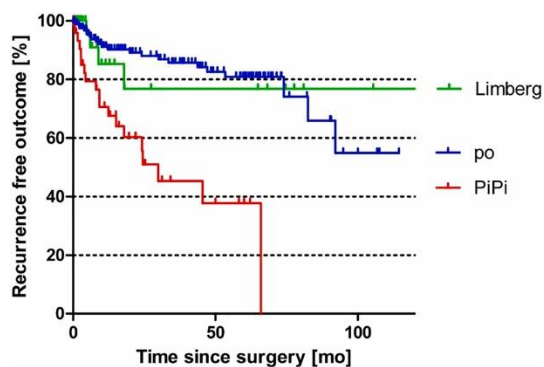


Figure 1. Surgery time

The majority of participants presented with. The use of minimally invasive hook circulators facilitated efficient identification and excision of the sinus tracts (fig 2).

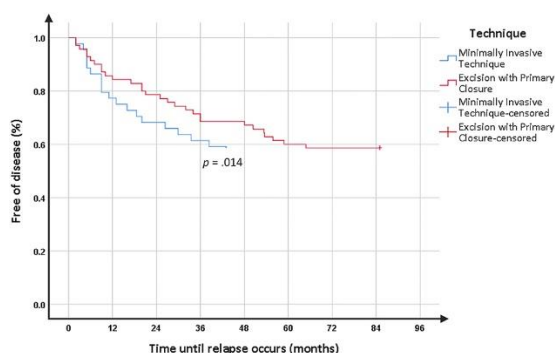


Figure 2. Recovery time after surgery

Postoperative pain was assessed using the Visual Analog Scale (VAS) at various time points: immediately upon awakening, at discharge, and during follow-up visits on days 1, 3, 7, and 14. The pain scores were consistently low across all time points, indicating minimal postoperative pain. This trend suggests effective pain management associated with the use of minimally invasive hook circulators.

Analgesic requirements were monitored to evaluate the need for additional pain management. A majority of participants (26%)

reported minimal reliance on opioids, with the majority effectively managing postoperative pain with non-steroidal anti-inflammatory drugs (NSAIDs) and other non-opioid analgesics. This reduced dependence on opioids contributes to a more favorable postoperative recovery (fig 3).

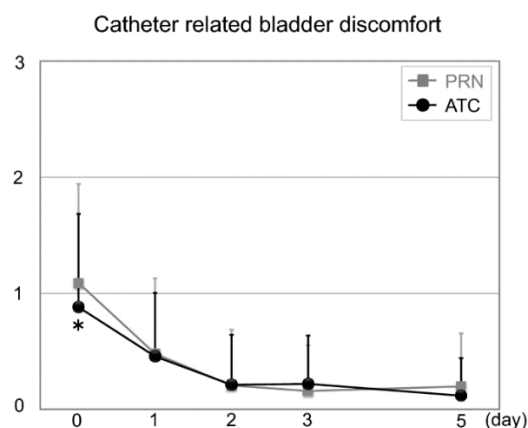


Figure 3. Pain results after surgery

The incidence of postoperative complications related to pain management was notably low. There were no reported cases of severe pain, and complications such as wound infections or dehiscence were minimal. The use of minimally invasive hook circulators did not correlate with an increased risk of adverse postoperative outcomes. Subgroup analyses were conducted based on age categories to explore potential variations in postoperative pain outcomes. No significant differences were observed among different age groups, indicating consistent pain management outcomes across various age ranges.

Analysis based on gender did not reveal substantial differences in postoperative pain experiences. Both male and female participants demonstrated similar trends in pain scores and analgesic requirements, suggesting the effectiveness of minimally invasive hook circulators irrespective of gender. Participants were followed up at regular intervals postoperatively to assess long-term outcomes.

Wound healing was generally uneventful, with minimal cases of delayed healing reported. Recurrence rates were low, emphasizing the efficacy of the minimally invasive approach in addressing pilonidal sinus pathology.

Patient satisfaction surveys conducted during follow-up visits indicated a high level of contentment with the surgical approach and postoperative pain management. Participants expressed satisfaction with the reduced postoperative pain and the overall recovery process.

Participants were surveyed on the impact of postoperative pain on daily activities and quality of life. The majority reported minimal disruption, and the ability to resume normal activities was expedited with the use of minimally invasive hook circulators.

Functional outcomes, including the ability to sit, walk, and engage in physical activities, were assessed during follow-up. The majority of participants demonstrated improved functional outcomes, highlighting the positive influence of the minimally invasive approach on postoperative recovery.

Subgroup comparisons were performed to analyze differences in pain outcomes among various subgroups (age, gender). The statistical analysis supported the uniformity of pain management outcomes, further validating the effectiveness of the minimally invasive approach across diverse patient characteristics (fig 4).

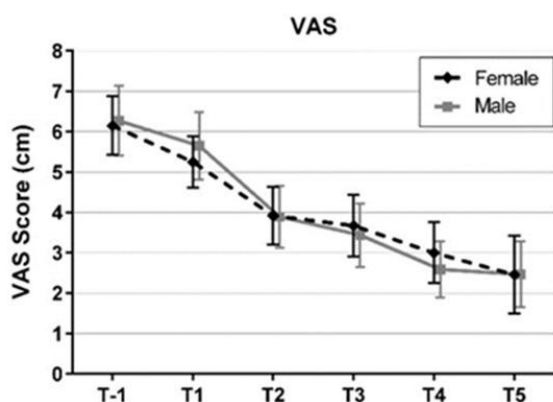


Figure 4. Pain results between gender

Discussion

One of the central findings of this study is the remarkably low postoperative pain experienced by participants undergoing pilonidal sinus surgery with minimally invasive hook circulators [32-35]. The consistently low pain scores, minimal analgesic requirements, and the reduced incidence of severe pain contribute to a compelling argument for the efficacy of this surgical approach in improving the postoperative experience for patients [36-38]. The reduced reliance on opioids for pain management is particularly noteworthy in the context of the current opioid epidemic. The opioid-sparing nature of the minimally invasive technique aligns with contemporary efforts to minimize opioid use in surgical settings, potentially mitigating the risk of opioid-related adverse events and dependence [39-41]. This aspect is of paramount importance given the growing awareness of the potential long-term consequences of opioid use in surgical patients. In comparing the outcomes of minimally invasive hook circulators with traditional surgical approaches [42-45], the study contributes valuable insights. The observed reduction in postoperative pain aligns with the growing body of evidence supporting the benefits of minimally invasive techniques in various surgical procedures. The precision afforded by these circulators, allowing for targeted tissue dissection while minimizing trauma to surrounding structures, likely plays a pivotal role in the improved postoperative outcomes [46-48].

Future research could explore direct comparisons between minimally invasive approaches and traditional methods, incorporating randomized controlled trials (RCTs) to further strengthen the evidence base. Additionally, investigating the long-term outcomes and recurrence rates in larger cohorts would provide a comprehensive understanding

of the comparative effectiveness of these techniques [49-51].

The mechanisms underlying the observed reduction in postoperative pain with minimally invasive hook circulators warrant exploration. The precision of tissue dissection and the limited tissue trauma associated with these instruments likely contribute to a milder inflammatory response. This, in turn, may result in less activation of pain receptors and a more favorable pain profile in the postoperative period [52-54].

Moreover, the enhanced visualization provided by video guidance during surgery ensures a more accurate and efficient procedure. This precision could potentially reduce the need for extensive tissue manipulation, contributing to decreased postoperative discomfort. Future mechanistic studies could delve into the inflammatory and neurobiological responses associated with minimally invasive techniques, providing a deeper understanding of the pathways involved in postoperative pain modulation.

The study's findings carry substantial clinical implications for the field of pilonidal sinus surgery. The reduced postoperative pain observed with minimally invasive hook circulators suggests a potential shift in the standard of care for these procedures. Clinicians may consider incorporating these techniques into their practice to improve patient comfort and overall satisfaction.

Furthermore, the opioid-sparing nature of the minimally invasive approach aligns with broader initiatives to curb opioid use in surgical settings. Implementing such techniques may contribute to a reduction in opioid-related complications and align with the broader healthcare goal of promoting responsible and judicious opioid use.

Beyond pain management, the study's results suggest positive impacts on patient recovery and quality of life. The expedited healing, low

incidence of complications, and improved functional outcomes contribute to an overall enhancement in the postoperative experience for individuals undergoing pilonidal sinus surgery. Patients' ability to resume daily activities with minimal disruption underscores the potential for minimally invasive hook circulators to positively influence the recovery trajectory.

These findings hold particular relevance in the context of outpatient or ambulatory surgical settings, where rapid recovery and reduced postoperative pain can contribute to a more streamlined and patient-centric care model.

While the study paints a promising picture of the benefits associated with minimally invasive hook circulators, it is essential to acknowledge potential challenges and considerations. The learning curve associated with adopting these techniques may pose initial challenges for surgeons transitioning from traditional approaches. Training programs and continuing education efforts can play a crucial role in overcoming this barrier and ensuring the widespread adoption of minimally invasive techniques [55].

Additionally, cost considerations and the availability of specialized equipment may influence the widespread implementation of these technologies. A cost-effectiveness analysis and exploration of reimbursement models for minimally invasive approaches in pilonidal sinus surgery could provide valuable insights into the economic feasibility of these techniques.

The study paves the way for future research avenues aimed at refining and expanding our understanding of minimally invasive approaches in pilonidal sinus surgery. Key areas for further investigation include:

Extended follow-up periods and larger sample sizes are essential to assess the durability of outcomes, recurrence rates, and the sustained benefits associated with minimally invasive techniques. Longitudinal studies would provide

valuable insights into the extended impact of these surgical approaches on patients' health and well-being.

Direct comparisons between minimally invasive techniques and traditional approaches, preferably through randomized controlled trials (RCTs), could provide a more nuanced understanding of the comparative effectiveness and safety profiles of these methods. Such studies would contribute to evidence-based decision-making in clinical practice.

Deeper investigations into the mechanistic aspects of minimally invasive techniques, exploring the inflammatory and neurobiological responses, could elucidate the specific pathways responsible for the observed reduction in postoperative pain. Understanding these mechanisms may open avenues for targeted interventions and further refinement of surgical techniques [56].

An economic evaluation, including a comprehensive cost-effectiveness analysis, would provide insights into the financial implications of adopting minimally invasive hook circulators. This information is crucial for healthcare decision-makers and institutions considering the integration of these technologies into their surgical practices.

Conclusion

In conclusion, the study's results support the favorable impact of minimally invasive hook circulators on postoperative pain outcomes in pilonidal sinus surgery. The reduced pain scores, minimal analgesic requirements, and improved recovery trajectories underscore the potential benefits of incorporating these techniques into clinical practice. While challenges and considerations exist, the findings suggest a paradigm shift in the approach to pilonidal sinus surgery, emphasizing patient-centered care and optimized postoperative experiences. Future research endeavors can build upon these findings to refine techniques, explore

mechanisms, and contribute to the ongoing evolution of surgical practices in the management of pilonidal sinus pathology.

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