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A comprehensive peri-operative protocol to decrease the risk of infection post coccygectomy: a case series study

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Abstract

Background Coccygectomy is the definitive treatment of coccygodynia refractory to conservative therapy, but post operative wound infection poses a significant challenge in these patients. We introduce a novel peri-operative technique incorporating a specific pre-operatively dietary regimen, polyethylene glycol enema, and prophylactic antibiotics. Post-operatively, patients adhered to strict hygienic protocols in addition to receiving antibiotics. This technique successfully reduced the incidence of surgical site infection post coccygectomy to a rate of 0.0%.

Methods A retrospective review was conducted on 21 patients who underwent partial or complete coccygectomy for coccygodynia refractory to 6 months of conservative therapy. Patients were treated using our novel protocol to minimize the infection risk and significant improvement in their pain.

Results All of the patients experienced uneventful post operative recovery except for 1 solitary case of delayed wound healing. This case was treated with a silver impregnated dressing and demonstrated full wound recovery 1 week later. Additionally, pain scores showed a significant reduction of pain before and after surgery. These results highlight the efficacy of our enhanced peri-operative protocol in preventing surgical site infection as well as substantial pain relief.

Conclusion Our findings are consistent with the existing literature, demonstrating that an enhanced peri-operative protocol not only effectively prevents post-operative infections but also facilitates significant pain relief in patients undergoing coccygectomy. This novel peri-operative protocol may offer a new standard for managing post-surgical outcomes in coccygectomy, though prospective studies are needed to further validate these results.

Keywords Coccygectomy, Coccygodynia, Novel surgical technique, Surgical site infection, Pain management, Orthopedic surgery, Retrospective study

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Introduction

Coccygodynia, characterized by persistent pain in the coccyx or tailbone, poses a significant challenge in diagnosis and management within orthopedic and pain management disciplines [1]. It predominantly affects females more than males with the ratio of 5:1 [2]. The etiology of coccygodynia is multifactorial and often postulated to be related to trauma. Traumatic events can include post-partum trauma due to mechanical forces during childbirth, direct injury from epidural injections, or complications arising from previous lumbar spine surgery. These events may lead to structural abnormalities, inflammation, or nerve irritation in the coccyx region, contributing to chronic pain [3, 5]. Despite its relatively low prevalence, this condition profoundly impacts daily activities such as sitting, walking, defecation, and sexual activity.

Patients typically present with localized pain that worsens with sitting or activities that put pressure on the coccyx. Physical examination may reveal tenderness over the coccyx and exacerbation of symptoms with palpation or movement. Imaging studies, such as X-rays, CT scans, or MRI, may be utilized to assess for anatomical abnormalities, including those categorized by the Postacchini classification system [4, 6–9]. Initial management typically involves conservative but, if these measures fail to provide adequate relief, surgical intervention, such as coccygectomy, may be considered [10]. Surgical planning considers the patient’s symptoms, anatomical abnormalities (as per the Postacchini classification), and potential risks, including the heightened incidence of surgical site infections. Coccygeal morphological variation is classified into six types based on the expanded Postacchini and Massobrio classification [23].

Type	Description
Type I	<i>Ventral curvature of the coccyx, with apex directed caudally</i>
Type II	<i>Sharper ventral curvature of the coccyx, with apex directed anteriorly</i>
Type III	<i>Acutely angulated coccyx, with apex directed anteriorly</i>
Type IV	<i>Subluxed sacrococcygeal or intercoccygeal joint</i>
Type V	<i>Retroverted and posterior angulated apex</i>
Type VI	<i>Scoliosis or laterally subluxed coccyx</i>

These morphological variations can impact surgical planning and treatment outcomes. Types II, III, and IV, for instance, may predispose individuals to mechanical stress, inflammation, or impingement of adjacent structures, contributing to pain. Understanding these anatomical classifications helps tailor treatment approaches, especially when conservative therapies prove inadequate [11].

This study introduces a comprehensive peri-operative technique for coccygectomy aimed at reducing the incidence of surgical site infections (SSIs), marking

a significant advancement in surgical practice. This approach underscores its critical importance in improving patient safety and enhancing surgical outcomes for individuals suffering from coccygodynia as the incidence of wound complication rates have been reported in the literature to be as high as 22% [12, 24].

Methodology

Study design

This study is a retrospective case series conducted at King Saud University Medical City, spanning the period from 2019 to 2024.

Patient selection

Inclusion Criteria: Patients included in the study underwent coccygectomy (Complete or Partial) for unresolved coccygodynia with conservative treatment for at least six months, during the specified study period following our novel peri-operative protocol.

Exclusion Criteria: Patients with incomplete medical records or insufficient follow-up data were excluded from the analysis.

Sample size

A total of 21 patients were included in the study, comprising 16 females and 5 males, with an average age of 43.15 years (range 21 to 68 years).

Data collection

Data collected for this retrospective case series on coccygectomy included demographic information such as age, gender, and BMI, along with clinical history detailing comorbidities like diabetes mellitus, hypertension, dyslipidemia, depression, and anxiety. The etiology of coccygodynia varied, including causes such as direct falls, multiple births, or idiopathic reasons. Surgical details encompassed the type of procedure performed, whether total or partial coccygectomy was performed. Pre-operative assessment included pain scores recorded on a visual analogue scale (VAS), where 0 represented no pain and 10 represented the worst pain possible. Radiographs were taken in standing and sitting positions to highlight the deformity type according to the expanded Postacchini and Massobrio classification. Post-operatively, patients were assessed at two weeks for wound evaluation and at six weeks, three months, and six months for pain assessment and overall satisfaction with the procedure.

Outcome measures

Primary Outcome: Incidence of surgical site infections (SSIs) following coccygectomy.

Secondary Outcomes: Pain relief and functional improvement assessed through patient-reported

outcomes, including Visual Analog Scale (VAS) for pain and satisfaction with surgical outcomes.

Comprehensive peri-operative care protocol

We introduced a comprehensive pre-operative and post-operative care protocol designed to significantly reduce the incidence of surgical site infections (SSI) in patients undergoing total or partial coccygectomy. Prior to surgery, patients are advised on a dietary regimen which is low in fiber and semi solid content only, starting three days beforehand, which is then changed to a clear liquid-only diet 24 h prior to procedure. We also administer one PEG (Polyethylene Glycol) enema at 12 h to surgery [13, 15]. The goal is to optimize bowel preparation, which is crucial for minimizing infection risks. Additionally, patients received a dual antibiotic prophylaxis regimen consisting of Cefazolin 2gm standard adult dose (3gm for weight more than 120 Kg) and Metronidazole 500 mg intravenously administered 30 min before skin incision. Cefazolin was chosen for its effectiveness against skin flora [14], while Metronidazole targeted anaerobic organisms, particularly pertinent in reducing infections associated with colorectal surgeries. If any patient is allergic to Cefazolin, Vancomycin was given according to the body weight as an intravenous infusion (<70 kg 1gm, 70–100 kg 1.5gm, and >100 kg 2gm) [17].

During the surgical procedure under general anesthesia and with patient positioned prone, meticulous sterile techniques were observed. This included thorough prepping and draping of the surgical site. A midline vertical incision of about 4 cm [16], directly over the coccyx was made, followed by meticulous subperiosteal dissection aimed at preserving rectal integrity. Special attention was given to ensure complete hemostasis throughout the procedure. The coccyx was carefully removed, and meticulous closure was performed in two layers using interrupted sutures to minimize dead space and potential complications such as seroma or hematoma. Skin closure is performed with interrupted non-absorbable polypropylene (Prolene) 3/0. Finally, a pressure dressing was applied to further reduce the risk of post-operative complications.

Post-operatively, patients were provided with detailed instructions on stringent wound care measures, emphasizing the importance of keeping the surgical site clean and dry, especially given its proximity to the anus. Key postoperative care measures included gentle cleansing of the surgical site with warm water and mineral salts in the event of contamination, beginning 24 h after surgery. After cleansing, the area should be carefully dried with a clean towel, followed by wound packing with sterile gauze, and protection with clean undergarments.

Upon discharge, patients were encouraged to resume their regular diet as tolerated. They were also prescribed

a course of Amoxicillin/Clavulanic acid 1gm twice daily for 3 days and Metronidazole 400 mg every 8 h for 3 days as additional prophylactic measures against both aerobic and anaerobic bacterial infections. This comprehensive protocol aimed not only to optimize surgical outcomes but also to enhance patient recovery and minimize the risk of complications associated with coccygectomy. Sutures are removed at 2 weeks from surgery.

Data analysis

Descriptive statistics were used to summarize patient demographics, clinical characteristics, surgical details, and postoperative outcomes. Continuous variables were presented as means with standard deviations or medians with interquartile ranges, while categorical variables were presented as frequencies and percentages.

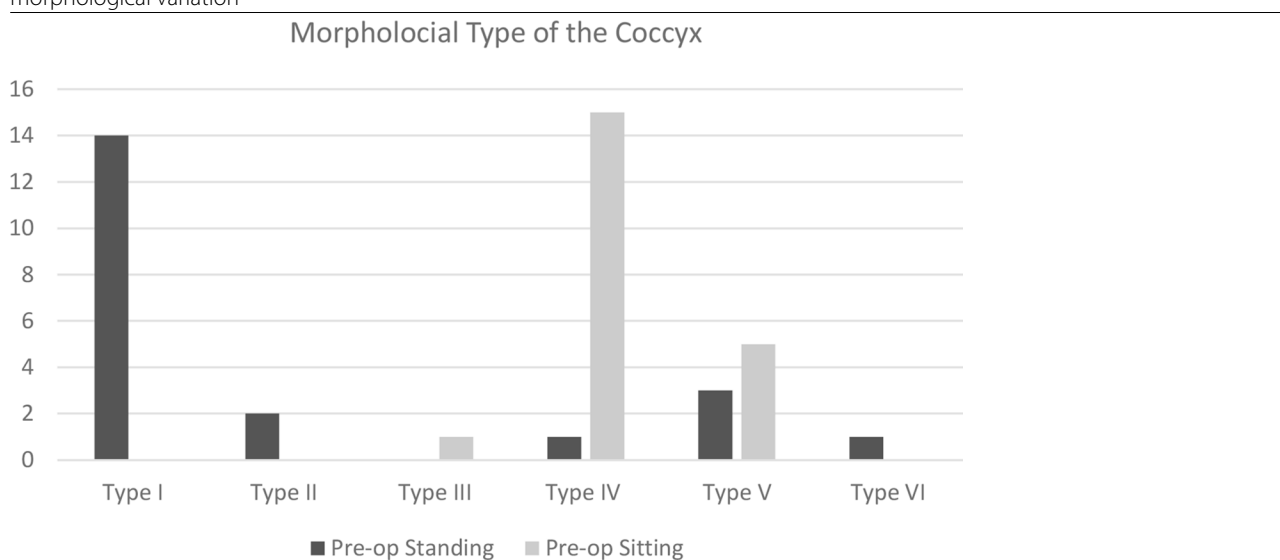
Ethical considerations

This study is conducted in accordance with the principles outlined in the Declaration of Helsinki. Institutional review board approval was obtained from King Saud University Medical City prior to data collection. Patient confidentiality was strictly maintained throughout the study process.

Results

In our study of coccygectomy for unresolved pain, we employed a comprehensive peri-operative technique to minimize wound infections. The results indicated a largely successful outcome. All patients experienced an uneventful post-operative recovery, with only one case of delayed wound healing. Remarkably, every patient demonstrated significant improvement in pain scores following the procedure, highlighting the efficacy of our enhanced peri-operative protocol in not only preventing infections but also contributing to substantial pain relief.

The study group consisted of 16 female patients and 5 male patients who underwent total or partial coccygectomy, with an average age of 43.15 years (ranging from 21 to 68 years). The average BMI for all patients was 31.25 kg/m². Comorbidities other than obesity were also recorded. Diabetes mellitus was present in eight patients, hypertension in five, and anxiety or depression in three. Additionally, one patient had Crohn's disease, while six patients were free from significant medical or surgical issues. The most common etiology of coccydynia in our patients was due to a traumatic incidence accounting for 52% of our cases. The morphological type of the coccyx was determined by pre-operative standing and sitting images with the most common morphology being type 1 (66%) in the standing images and type 4 (71%) in the sitting images highlighting the importance of dynamic imaging in accurately diagnosing coccygeal instability (Table 1).

Table 1 Morphological type of the coccyx based on the expanded postacchini and Massobrio classification of coccygeal morphological variation

All 21 patients adhered to the pre and post-operative protocols and were compliant with maintaining high levels of hygiene as well as the post-operative antibiotics. Pre-operative pain scores were severe, ranging from 8 to 9/10, with 11 patients reporting a pain score of 8/10 and 10 patients reporting 9/10.

Wound healing occurred within 2 weeks for 20 patients, while one patient developed delayed wound healing. However, this patient did not experience a surgical site infection or wound dehiscence. This patient was a female with a high BMI of 35.2 kg/m². The patient was instructed to use a silver-impregnated dressing. Upon evaluation one week later, the wound demonstrated significant improvement and had fully healed effectively.

At six weeks post-operatively, three patients reported a pain score of 4/10 and another three reported 3/10, while the remaining patients experienced remarkable improvement, with pain scores as low as 0–1/10. Additionally, the three patients who continued to rate their pain as 4/10 after the coccygectomy were those who had been diagnosed with generalized anxiety disorder or depression pre-operatively.

Discussion

Our study demonstrates that the enhanced pre-operative protocol contributes to largely uneventful post-operative recoveries, with only one patient experiencing delayed wound healing, and no cases of infection or wound dehiscence. This finding emphasizes the effectiveness of our approach in preventing post-operative infections and achieving substantial pain relief.

Our success in preventing infections aligns with the findings from Dhole S et al. [22]. (2023), who reported that comprehensive pre-operative protocols, including

targeted antibiotic prophylaxis and meticulous wound care, significantly reduce the risk of post-operative infections. Similarly, Doursounian L et al. [18]. (2004) observed that implementing structured infection prevention strategies led to a lower incidence of SSIs in coccygectomy patients. Our results, showing no infections and minimal wound complications, are consistent with these studies, highlighting the importance of peri-operative measures in reducing infection rates.

The significant improvement in pain scores observed in our study, with most patients reporting a drastic reduction to scores of 0–1/10, mirrors the findings of Mulpuri N et al. [19]. (2022), who noted substantial pain relief following coccygectomy. Their study also highlighted that many patients experienced significant pain reduction post-operatively, similar to the outcomes we observed. However, Kwon H and colleagues [2] (2012) found that while many patients report significant pain relief, a subset continue to experience moderate pain. This variability in pain outcomes can be influenced by various factors, including the presence of comorbid conditions or psychological factors, which our study also suggests.

The solitary case of delayed wound healing in our study, which did not involve infection or wound dehiscence, is comparable to findings from Ogur H et al. [20]. (2017), who reported occasional delayed healing in their cohort, but noted that these cases typically did not involve infections. In a recent study Cotterell A [21] and coworkers (2024) has similarly observed that higher BMI is associated with a higher risk of delayed wound healing, a factor present in our case. This suggests that while our peri-operative protocols effectively prevent infections, additional considerations may be needed for patients with higher BMI to further minimize complications.

This study demonstrates notable strengths, including the implementation of an innovative peri-operative protocol that effectively minimizes wound infections and results in significant pain relief, with most patients reporting pain levels as low as 0–1/10. This protocol's success is supported by the comprehensive patient data, encompassing a diverse range of ages, BMIs, and comorbidities, which enhances the generalizability of the findings. Additionally, the minimal post-operative complications and high adherence to the protocol further reinforces the study's reliability. However, the study is limited by its small sample size of 21 patients, which may not fully capture the variability in outcomes and limits the generalizability of the findings. Being a single-center study, its findings might not be applicable to other settings or populations. Furthermore, the absence of a comparison group diminishes the ability to benchmark the effectiveness of the new protocol against standard practices. Lastly, while the study acknowledges the influence of psychological factors on pain outcomes, it does not delve deeply into these aspects, and the observed impact of high BMI on wound healing suggests that additional strategies may be necessary for this subgroup.

Conclusion

Overall, our study's results are consistent with the existing literature, demonstrating that an enhanced peri-operative protocol effectively prevents post-operative infections and facilitates significant pain relief in coccygectomy patients. The occurrence of delayed wound healing in one patient with a high BMI reflects findings from other studies, suggesting that further interventions may be necessary for this subgroup. Future research should continue to explore strategies to optimize outcomes, particularly in patients with higher BMI and those with comorbid conditions. We also recommend further multi-center prospective studies to validate our findings.

Abbreviations

CT	Computed Tomography
MRI	Magnetic Resonance Imaging
BMI	Body Mass Index

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Author contributions

The manuscript version of this contribution has been read and approved by all authors, and each author has committed to being personally responsible for the work. Conceptualization, idea, and research design: WA; Manuscript writing: WA, MW, MA, RM, OS; Project management: WA, RM, OS; Manuscript review: MW, RM, WA, MA.

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Data availability

This study is based on confidential patient data which is available upon request from the author MW.

Declarations

Ethics approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations, adhering to the principles of the Declaration of Helsinki. Institutional Review Board (IRB) approval was obtained from King Saud University Medical City (IRB Approval No. E-24-9109) prior to data collection, with a waiver of patient consent due to the retrospective nature of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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