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**Limberg flap for previously recurrent complex sacrococcygeal pilonidal sinus surgeries**

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Abstract---Background: The Limberg flap, a rotational rhomboid flap, is used for complex or recurrent pilonidal disease. This study evaluates the Limberg flap's effects on sacrococcygeal pilonidal sinus, focusing on wound infection, seroma formation, postoperative pain, recurrence rates, return to work, cosmetic results, and patient satisfaction. Methods: From January 2022 to March 2023, 10 patients with complex or recurrent pilonidal disease underwent the Limberg flap procedure. Results: All patients successfully underwent surgery, experiencing mild to moderate postoperative pain. The average hospital stay was 3 days, and return to work occurred after 6 weeks. Flap edema was observed in 5 patients, 1 patient had a wound infection, and no flap necrosis or recurrences were reported within an average follow-up of 3 months. Edema resolved in 2-3 weeks with regular dressing. Patient satisfaction and cosmetic outcomes were positive. Conclusions: The Limberg flap for sacrococcygeal pilonidal sinus is effective for preventing recurrences and is well accepted by patients, despite increased postoperative pain, infection rates, and a longer return to work compared to open procedures.

Keywords---Limberg flap, postoperative pain, recurrence, sacrococcygeal pilonidal sinus, wound infection.

Introduction

Sacrococcygeal pilonidal disease is an epithelium-lined tract, situated a short distance behind the anus, containing hairs and unhealthy diseased granulation tissue (Bhama & Davis, 2022). It is due to the penetration of hairs through the skin into subcutaneous tissue. It is common in hairdressers (seen in interdigital clefts), and Jeep drivers as called in the II WW.

The projected occurrence rate is 26 cases per 100,000 individuals. Typically, it manifests as a cyst, abscess, or sinus passage, with or without any discharge (Humphries & Duncan, 2010). The condition tends to affect men more frequently than women, and it is uncommon both prior to puberty and after the age of 40. On rare occasions, it might occur during the fourth decade of life (Aithal et al., 2013).

A rhomboid flap, also known as a Limberg flap is a rotational flap classified as a local transposition flap that moves laterally about a pivot point into an adjacent defect (Bhama & Davis, 2022; Tavassoli et al., 2011). It was first described by Limberg in 19467 and was subsequently modified by Dufourmentel in 1962 and Webster in 1978. This technique, which was used to close head and neck defects initially, can be used to close defects almost anywhere on the body including the intergluteal cleft defect resulting after the sacrococcygeal pilonidal sinus surgery (Daphan et al., 2004). Due to its minimal rate of complications and satisfactory
long-term outcomes, opting for the rhomboid excision and Limberg flap procedure is more favourable when compared to the simple excision and primary closure for treating SPD (Akca et al., 2005).

**Materials and Methods**

**Procedure**

The procedure can be performed under local anesthesia in an office setting, intravenous sedation, or general anesthesia. This mainly depends on patient tolerance and the invasiveness of the procedure itself (Kapan et al., 2002a). The patient was put in a prone position with buttocks strapped apart.

**Technique**

We start by mapping the site of excision, which is done by identifying the extent of the pits and marking the diamond shape with the superior and inferior apices of the diamond just to the left of the midline. The expected excision site should include any former incision and drainage scars (Bhama & Davis, 2022; Tavassoli et al., 2011).

The marking of the flap starts from the lateral apex of the diamond, typically on the right side. Incisions are first made to resect the diamond-shaped tissue down to the sacral fascia (Wolfe, 1975). Next, the lipocutaneous flap is raised. Care should be taken to ensure that the flap is undermined appropriately to allow for a tension-free closure without creating ischemia.

The flap can be secured into place with absorbable sutures. The final layer of the skin can be closed with vertical mattress sutures, and some may choose to apply surgical glue. The use of a drain is per the surgeon's preference. The long axis of the rhomboid in the midline is marked as A–C, C being adjacent to perianal skin, A placed so that all diseased tissues can be included in the excision. The line B–D transects the midpoint of A–C at right angles and is 60% of its length. D–E is a direct continuation of the line B–D and is of equal length to the incision B–A, to which it will be sutured after rotation. E–F is parallel to D–C and of equal length. After rotation, it will be sutured to A–D. The skin and subcutaneous fat are excised down to the deep fascia, and a rhomboid area including the pilonidal sinus is removed. Then the flap is raised so that it includes skin, subcutaneous fat, and the fascia overlying gluteus maximus, rotated to cover the midline rhomboid defect.

The defect thus created can be closed linearly. Deep absorbable sutures including fascia and fat are placed over a vacuum drain (if needed) (Ertan et al., 2005). Finally the skin is closed in interrupted sutures. The operation produces a tension-free flap of unscarred skin in the midline (Ertan et al., 2005). Antibiotics were given for 3 days intravenously, and then orally. The suction drain was removed after 2 days, sutures were removed completely around the 10th day.
Ethical considerations

This study was approved by the ethical committee at the Jordanian Royal Medical Services (approval number: 11.2023 #7).

Results

In this study, 10 patients were included. Among them 4 were males and 6 were females. Mean age was 30 years (range 20–35 years). Of the 5 patients, all of them came up after having a recurrent complex disease with 4 of them having a previous incision and drainage for abscess. All patients who came with pilonidal sinus, in January 2022, were assessed for its severity and investigated, and then they underwent Limberg flap surgery under spinal anesthesia. Figure 1 and 2 show examples of the intraoperative markings for planning the surgery and the final surgery results.

![Figure 1. Patient's intra-operative markings](image1)

![Figure 2. Final result of surgery](image2)

Postoperatively the patient was made to lie on their sides, then made ambulant after the first postoperative day, with drain in situ. The patient received antibiotics and regular dressing of the wound. The drain was removed
approximately on the second postoperative day. Sutures were removed partially during follow-up around the 7th day and completely at around 14 days.

All patients are followed up initially weekly for 1 month, then monthly for the next 3 months (Figure 3). Two patients had flap edema which took 3 weeks to disappear completely with pressure dressing and usage of antibiotics. All other patients’ wounds healed with accepted scarring, with moderate postoperative pain which was managed with multimodal treatment without narcotics. No recurrence till the time of study and during the follow-up. Most patients returned to work after 6 weeks and were very satisfied with the final result.

Figure 3. Follow-up at 1, 2, 3, 4 weeks post-operatively

Discussion

The presented case series highlights the procedure and outcomes of using the Limberg flap technique for treating sacrococcygeal pilonidal sinus. The choice of anesthesia—local, intravenous sedation, or general anesthesia—was based on patient tolerance and procedural invasiveness, underscoring the importance of personalized care.

Treating sacrococcygeal pilonidal sinus with a Limberg flap is promising but needs a proper patient selection and a skilled surgeon (Aithal et al., 2013; Tavassoli et al., 2011). Good short-term and long-term follow-ups are mandatory and eventually reflect on the patient outcome. The lack of comparisons between the flap and other procedures for sacrococcygeal pilonidal sinus at this point is present and needs more work (Can et al., 2010; Topgül et al., 2003).

Several series reported recently about the usefulness of this flap in the treatment of sacrococcygeal pilonidal sinus in terms of recurrence, infection, and morbidity (Ates et al., 2011; Katsoulis et al., 2006). In our series we had two patients flap edema out of 10 patients, which took 3 weeks to resolve, no recurrences so far, and no unexpected complications. Bali et al. showed that the application of the Limberg flap exhibited a reduced incidence of complications, a briefer hospitalization period, an expedited resumption of work, diminished pain ratings, heightened patient contentment, and improved duration for comprehensive recovery (Bali et al., 2015). When dealing with patients characterized by
recurrence and the presence of multiple sinuses, the strategy involves the utilization of lateral flap rotations achieved through the removal of the midline (Kapan et al., 2002b).

In a long-term study by Topgül et al. of 200 patients with pilonidal sinus who underwent the Limberg flap, minimal complications were reported, of which 6 cases of post-operative necrosis, wound infection, and seroma in three patients (Topgül et al., 2003).

Furthermore, the selection of techniques for treating sacrococcygeal pilonidal disease (SPD) is influenced by several critical patient-related factors, including the presence of comorbidities, expected patient compliance, and the patient’s attitude toward the disease (Iesalnieks et al., 2016). On the other hand, local conditions play a significant role, influenced by factors like the proximity of the condition to the anus, the quantity and location of pits and sinuses, and the history of prior SPD surgery. Expert opinions in favour of specific techniques are often guided by perceptions of low recurrence rates, familiarity with the technique, and the overall positive outcomes experienced by patients (Karydakis, 1992; Nyandoro et al., 2023).

Conclusion

Sacrococcygeal pilonidal sinus is sometimes challenging to treat keeping in mind that complexity and recurrence are not rare to deal with, and selecting the proper patients for the proper procedure - including the flap- is mandatory and hard in the lack of strict and clear indications for one procedure over the others Limberg flap for sacrococcygeal pilonidal sinus is promising and have good outcome in the presence of surgeon and patients cooperation. The technique is not hard to perform, we found it useful mainly for complex and recurrent diseases, with very low complication and recurrence rates. Other advantages are low morbidity and patient satisfaction with the final result.

Statements and Declarations

Competing interests

None of the authors declare conflicts of interest.

Funding

This study received no funding.

Ethical approval

This study was approved by the ethical committee at the Jordanian Royal Medical Services (approval number: 11.2023 #7).
Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

References


