Original Article

DOI: 10.7860/JCDR/2025/78621.21247

Effectiveness of Platelet-rich Plasma Therapy and Limberg Flap Reconstruction in the Management of Pilonidal Sinus Disease: A Prospective Observational Study

Surgery Section

S VINITH BALAJI[1], K THINAGARAN[2], REEGAN JOSE[3], NAJEEM FAZIL[4], MOHANA VAMSI[5], ARAFATH IQBAL[6]

ABSTRACT

Introduction: Pilonidal Sinus Disease (PSD) is a chronic inflammatory condition affecting the sacrococcygeal region, commonly seen in young adults. The ideal treatment remains debated, with surgical techniques such as Limberg flap reconstruction and non surgical approaches like Platelet-Rich Plasma (PRP) therapy being explored for their efficacy in reducing recurrence and improving wound healing.

Aim: To compare the wound healing duration, postoperative pain levels, recurrence rates and postoperative complications between PRP therapy and Limberg flap reconstruction in the management of PSD.

Materials and Methods: A prospective observational study was conducted in the Department of General Surgery at SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India from January to December 2024, involving 62 patients. Adults aged 18 to 65 years with Type I or II PSD, who were fit for surgery and willing to provide informed consent, were included. Patients were randomly allocated into two groups: Group A (PRP Therapy, n=31) and Group B (Limberg Flap Reconstruction, n=31). In Group A, PRP was applied both intraoperatively and during the postoperative follow-up, while Group B underwent excision followed by flap reconstruction using the Limberg flap technique. Data on key outcomes, including wound healing time, pain levels {measured using the Visual Analog Scale (VAS)}, recurrence rates and postoperative complications, were collected over a 6-month period. Statistical analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 29.0, with a p-value <0.05 considered statistically significant.

Results: The mean wound healing duration was significantly shorter in Group A (29.0±7.0 days) compared to Group B (39.0±8.0 days, p-value <0.001). Pain scores (VAS) were similar on Day 2 (p-value=0.358), but Group A experienced significantly less pain from Day 3 onwards (p-value <0.05). Recurrence rates were significantly lower in Group A {4 (12.9%)} compared to Group B {10 (32.3%), p-value=0.029}. Postoperative complications were less frequent in Group A {24 (77.4%) had no complications vs. 19 (61.3%) in Group B, p=0.045}, with Group B showing higher rates of seroma formation {5 (16.1%) vs. 3 (9.7%)} and wound dehiscence {4 (12.9%) vs. 1 (3.2%)}. Infection rates were similar in both groups, at 3 (9.7%).

Conclusion: PRP therapy presents a promising and effective alternative for managing PSD, potentially enhancing recovery and minimising complications.

Keywords: Postoperative complications, Recurrence, Wound healing

INTRODUCTION

The PSD is a chronic inflammatory condition affecting the sacrococcygeal region, predominantly observed in young adults [1]. The condition is characterised by the presence of a sinus tract or cyst, often associated with pain, recurrent infections and discharge [2,3]. Although not life-threatening, PSD significantly impacts the quality of life, necessitating effective management strategies [4].

Traditional surgical interventions for PSD include excision with primary closure and flap-based techniques such as the Limberg flap. More recently, PRP therapy has emerged as a minimally invasive alternative, promoting wound healing through bioactive growth factors [5]. Despite various treatment options, the optimal approach remains controversial, necessitating comparative studies to establish the most effective management strategy [6]. The Limberg flap technique has been widely recognised as the gold standard in PSD management due to its low recurrence rates and reliable wound closure outcomes. However, it involves a surgical procedure with inherent risks, including postoperative pain and complications such as seroma formation and flap necrosis [7].

PRP therapy, as an emerging modality, has shown promise in enhancing wound healing by accelerating tissue regeneration and reducing inflammation [8,9]. While individual studies have reported favourable outcomes with PRP, there is a lack of comprehensive comparative analyses between PRP therapy and the Limberg flap [10-13].

This study aimed to address the existing research gap by systematically evaluating the effectiveness of PRP therapy versus Limberg flap reconstruction in the treatment of PSD. The primary objective of the study was to compare the efficacy of PRP therapy and Limberg flap reconstruction in managing PSD. Specific objectives include assessing and comparing the wound healing time between the two treatment modalities, evaluating recurrence rates at three and six months postoperatively in both groups, analysing postoperative pain levels using VAS across different time points and determining the incidence of postoperative complications such as infection, seroma formation, wound dehiscence and flap necrosis.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of General Surgery at SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India from January 2024 to December 2024. Ethical approval for the study was obtained from the Institutional Ethics Committee at SRM Medical College Hospital and Research Institute, Kattankalathur, with the ethics clearance number SRMIEC-ST0224-1020.

Inclusion criteria: Adults aged 18 to 65 years with PSD (types 1 and 2) [14], who were fit for surgical intervention and willing to provide informed consent, were included in the study.

Exclusion criteria: Patients with severe systemic illnesses such as autoimmune disorders or cardiovascular diseases, a history of malignancies, mental health conditions affecting surgical outcomes, acute abscess formation, anaemia, those on immunosuppressive medications, patients with recurrent PSD or coagulation disorders and those unwilling to consent were excluded from the study.

Sample size: The sample size was calculated based on a similar study by Boztug CY et al., [10]. The expected mean wound healing times were 54.4±24.3 days in Group 1 and 37.1±16.6 days in Group 2 [10]. Using the standard formula for two independent means, the required sample size was determined to be n ≥31 per group. A consecutive sampling method was employed to minimise selection bias, ensuring that all eligible patients were included until the required sample size was achieved.

Allocation of Study Groups

Two groups were randomly selected from among the participants using a computer-generated random number sequence in Microsoft Excel. Group A (PRP Therapy) consisted of 31 patients who received PRP therapy, while Group B (Limberg Flap Reconstruction) included 31 patients who underwent Limberg flap surgery. For Group A, PRP was applied both intraoperatively and during postoperative follow-up on days 2, 3, 4 and 5. In contrast, patients in Group B received the standard Limberg flap reconstruction, which involved the excision of the sinus tract and the transposition of adjacent skin to cover the defect.

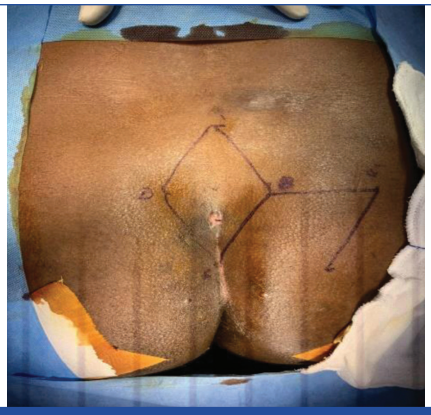
Preoperative Examination

All patients underwent a comprehensive preoperative evaluation, which included a detailed clinical history, physical examination and baseline investigations. Imaging, including an Magnetic Resonance Imaging (MRI) fistulogram, was performed to assess the external and internal openings of the sinus.

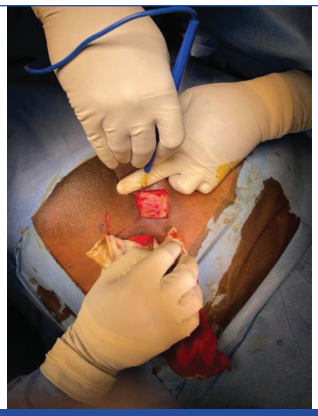
Surgical Procedures

In Group A (PRP therapy), after spinal anaesthesia, the sinus tract was curetted and debrided to remove necrotic tissue and PRP was applied to the wound cavity. PRP was prepared using a two-stage centrifugation method with the patient's own blood. Initially, 10-15 mL of venous blood was drawn into a sterile, citrate-containing tube. The first centrifugation (soft spin) was performed at 1500 rpm for 10 minutes, separating the plasma from the red blood cells. The second centrifugation (hard spin) was conducted at 2500 rpm for 10 minutes, resulting in a concentrated PRP layer. The final PRP volume, approximately 3-5 mL, was then activated using calcium chloride (0.1 mL per mL of PRP) before application. Intraoperatively, after curetting the cavity, autologous PRP was injected into the wound cavity and a sterile dressing was applied. The amount of PRP to be injected was determined based on the cavity size. Postoperatively, the same process was reapplied daily on postoperative days 2 to 5, followed by a sterile dressing. Complete epithelialisation of the wound was considered the endpoint for healing assessment.

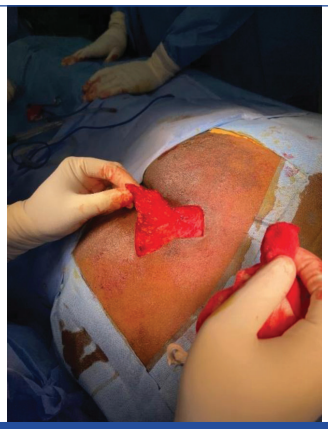
In Group B (Limberg flap reconstruction), after spinal anaesthesia, a rhomboid-shaped skin area was marked [Table/Fig-1,2]. A flap was then designed and raised [Table/Fig-3] and the sinus tract was excised [Table/Fig-4]. The flap was subsequently transposed to cover the defect and the wound was closed in layers using absorbable and non absorbable sutures to ensure proper healing and minimise tension at the surgical site. A drain tube was placed before the final closure [Table/Fig-5].



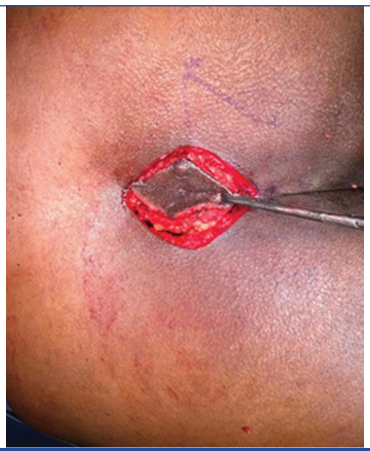
[Table/Fig-1]: Pilonidal sinus with preoperative skin markings.



[Table/Fig-2]: Rhomboid incision made during Limberg flap procedure.



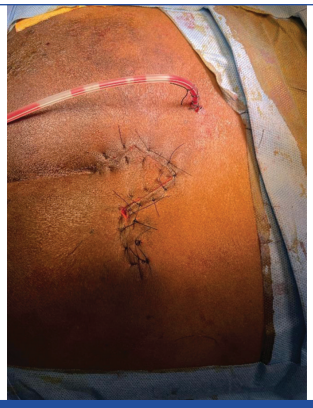
[Table/Fig-3]: Flap raised and prepared for transposition.



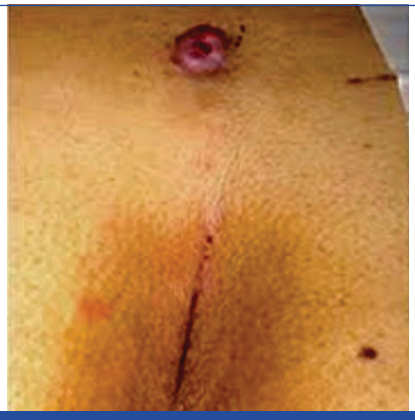
[Table/Fig-4]: Sinus tract excised during the procedure.

Postoperative Care and Follow-Up

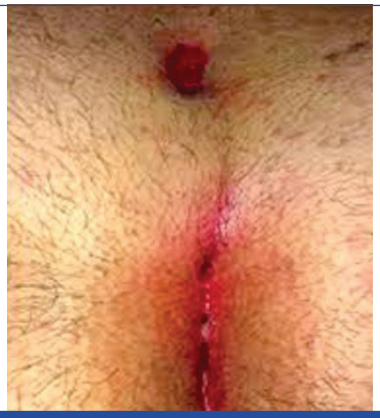
Postoperative follow-up for Group A included daily visits for PRP application and wound assessment until day 5, followed by evaluations at 1, 2, 4, 12 and 24 weeks for healing and recurrence monitoring [Table/Fig-6-8]. Patients in Group B were



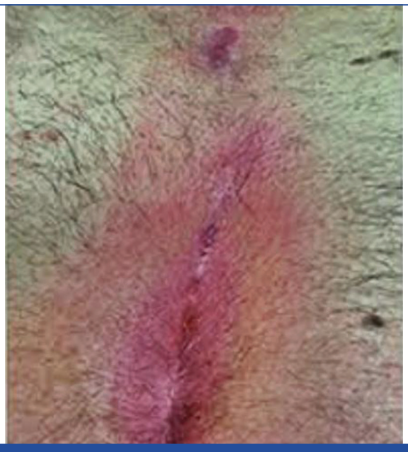
[Table/Fig-5]: Flap transposed and closed with a drain tube placed for postoperative drainage.



[Table/Fig-6]: Postoperative Day 1- Post PRP application.



[Table/Fig-7]: Postoperative Day 14 of PRP application.



[Table/Fig-8]: Postoperative Day 30 of PRP application.

similarly followed with assessments on days 2, 3, 4 and 5, along with further evaluations at 1, 2, 4, 12 and 24 weeks for wound healing and recurrence surveillance. Both groups were monitored for complications such as infection, seroma formation and wound dehiscence, with additional care provided as necessary.

Outcome Variables

The study assessed primary, secondary and tertiary outcome variables. The primary outcomes included wound healing time, defined as the number of days from surgery to complete epithelialisation and recurrence rate, measured at three and six months postoperatively. Secondary outcomes included postoperative pain, evaluated using the VAS from 0 to 10 and complication rates, which encompassed infection, seroma, haematoma and wound dehiscence [15]. Tertiary outcomes involved wound cavity volume, measured using saline injection with a 50 cc syringe.

STATISTICAL ANALYSIS

To control for potential bias, consecutive sampling was implemented and statistical analysis was performed using SPSS version 29. Categorical data were presented as frequency counts and percentages, while continuous variables were reported as mean values with standard deviations. The Chi-square test was used for categorical data comparison and the Independent t-test was applied for continuous data analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the patients in Group A and Group B was 41.2±8.6 years and 39.9±7.9 years, respectively. No statistically significant differences were found between the groups in terms of age, gender, Body Mass Index (BMI) and sinus grade [Table/Fig-9].

Demographic characteristics		Group A	Group B	p-value
Age[a]		41.2±8.6	39.9±7.9	0.538
Gender[b] n (%)	Male	20 (64.5)	18 (58.1)	0.602
	Female	11 (35.5)	13 (41.9)	
BMI[a]		28.2±9.8	26.2±8.6	0.397
Sinus grade[b] n (%)	I	15 (48.4)	11 (35.5)	0.303
	II	16 (51.6)	20 (64.5)	

[Table/Fig-9]: Demographic characteristics of study participants.
[a]Independent t-test; [b]Chi-square test

Group A had a mean healing duration of 29.0±7.0 days, while Group B had a mean of 39.0±8.0 days. The p-value <0.001, indicating a statistically significant difference between the groups.

On Day 2, the mean VAS scores were similar for both groups (8.3 for Group A and 8.6 for Group B), with a p-value of 0.358, indicating no significant difference. However, from Day 3 onward, Group A consistently reported lower VAS scores than Group B, with significant differences observed on Days 3, 4, 5, 7, 14, 28 and at 3 and 6 months [Table/Fig-10].

VAS		Mean±Std. Deviation	T value	p-value
Day 2	Group A	8.3±1.1	-0.925	0.358
	Group B	8.6±1.1		
Day 3	Group A	6.9±0.9	-1.928	0.049*
	Group B	7.4±1.1		
Day 4	Group A	5.5±0.8	-5.761	<0.001*
	Group B	6.9±1.1		
Day 5	Group A	4.0±0.8	-7.02	<0.001*
	Group B	5.8±1.2		
Day 7	Group A	4.1±0.9	-5.347	<0.001*
	Group B	5.3±0.8		
Day 14	Group A	3.9±0.8	-5.141	<0.001*
	Group B	5.0±0.8		
Day 28	Group A	1.9±1.0	-8.402	<0.001*
	Group B	3.9±0.8		

3 months	Group A	1.6±0.5	-1.734	<0.001*
	Group B	2.9±0.8		
6 months	Group A	1.7±0.5	-2.132	0.037*
	Group B	2.1±0.9		

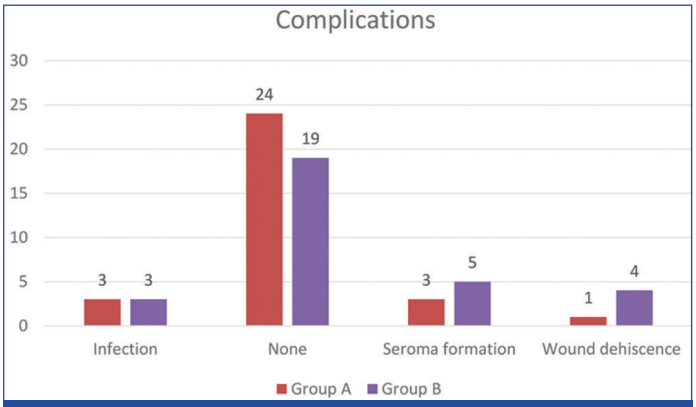
[Table/Fig-10]: Comparison of VAS between groups.

In Group A, 4 (12.9%) of individuals had recurrence compared to 10 (32.3%) in Group B. The p-value of 0.029 indicates a statistically significant difference in recurrence rates between the two groups [Table/Fig-11].

Recurrence	Group A n (%)	Group B n (%)	Total n (%)	Chi-square value	p-value
No	27 (87.1)	21 (67.7)	48 (77.4)	4.769	0.029*
Yes	4 (12.9)	10 (32.3)	14 (22.6)		

[Table/Fig-11]: Comparison of recurrence rate at 6th-month follow-up between groups.

Group A had a higher percentage of individuals with no complications (24, 77.4%) compared to Group B (19, 61.3%). The p-value of 0.045 indicates a statistically significant difference in the overall pattern of complications between the groups [Table/Fig-12].



[Table/Fig-12]: Comparison of postoperative complications between groups.

In Group A, the mean wound cavity volume was 37.9±5.0, while Group B had a mean of 37.7±5.1. The p-value of 0.9 shows no statistically significant difference in wound cavity volume between the two groups.

DISCUSSION

The results revealed no statistically significant differences between the two groups in terms of age distribution (p-value=0.538) or gender distribution (p-value=0.602), with both treatment groups showing a higher male predominance, consistent with the literature on the higher incidence of pilonidal sinus in males [11,16]. However, present study highlighted a relatively middle-aged demographic in both groups, compared to earlier studies that report a younger population for both PRP and Limberg Flap treatments [12,17].

Regarding clinical characteristics, the study found no significant differences between the PRP and Limberg Flap groups in terms of BMI (p-value=0.397). These findings were in contrast to those of other studies, where BMI has been shown to influence treatment outcomes, particularly in PRP studies [18,19]. The cavity volume, while similar in both groups, did not impact the healing outcome, suggesting that the choice of treatment can be applied regardless of the size of the initial wound or cavity, as reported in a few studies [10,20].

In terms of outcomes, present study demonstrated that PRP therapy significantly reduced wound healing time. The faster healing observed in the PRP group aligns with findings by Spyridakis M et al., and Reboa G et al., who reported quicker recovery times in patients treated with PRP [13,18]. Additionally, pain scores were significantly lower in the PRP group from Day 3 onward, indicating superior pain management, which corroborates findings from studies by Bahar MM et al., and Mohammadi S et al., where PRP-treated patients experienced less pain postsurgery [11,21].

The recurrence rate was significantly lower in the PRP group, which was consistent with studies by Reboa G et al., who found lower recurrence rates in patients treated with regenerative techniques like PRP [18]. While Limberg flap studies generally report lower recurrence rates [16,22], present study findings suggest that PRP therapy may be more effective in reducing recurrences through enhanced wound healing and tissue regeneration. Additionally, the infection rates between the two groups were similar. This suggests that PRP not only accelerates healing but may also reduce postoperative complications, a finding supported by studies such as those by Bahar MM et al., and Sevinc B et al., [11,12].

Overall, the results of this study support the use of PRP therapy as an effective adjunct to traditional surgical techniques, particularly for reducing wound healing time, minimising pain, lowering recurrence rates and decreasing complications. However, further research with larger sample sizes and long-term follow-up is needed to fully explore the potential of PRP in the treatment of pilonidal sinus and to optimise its clinical application.

Limitation(s)

It cannot establish causal relationships between the treatment methods and outcomes due to the lack of temporal data. Conducting the study at a single centre may introduce biases, limiting the generalisability of the findings to other clinical settings. Moreover, the follow-up duration may not be long enough to capture late complications or recurrence rates. The assessment of pain scores was based on self-reported measures, which can introduce subjectivity and variability in pain perception among patients. Finally, while computer-generated randomisation was used for classification, the study remains a comparative study rather than a randomised controlled trial. As such, there may be confounding factors such as the presence of co-morbidities like diabetes, obesity, or immunosuppression, which can significantly impact wound healing, that were not accounted for, potentially affecting the validity of the comparisons made between the two treatment methods.

CONCLUSION(S)

The PRP therapy offers significant advantages over Limberg flap reconstruction in the management of pilonidal sinus. Given the better overall outcomes associated with PRP therapy, it may be considered a promising and effective alternative treatment modality for pilonidal sinus, potentially improving patient recovery and reducing the risk of complications. Further research, particularly larger-scale and longer-term studies, is warranted to confirm these results and explore the full potential of PRP therapy in diverse patient populations.

REFERENCES

[1] Keighley MRB, Williams N, editors. Pilonidal sinus. In: Surgery of the Anus, Rectum & Colon. Vol. 1. 2nd ed. London: W.B. Saunders; 2001. p. 539-63.
[2] Gul VO, Destek S, Ozer S, Etkin E, Ahioglu S, Ince M, et al. Minimally invasive surgical approach to complicated recurrent pilonidal sinus. Case Rep Surg. 2015;2015:759316.
[3] Steele SR, Perry WB, Mills S, Buie WD; Standards Practice Task Force of the American Society of Colon and Rectal Surgeons. Practice parameters for the management of pilonidal disease. Dis Colon Rectum. 2013;56:1021-27.
[4] Standards Task Force of the American Society of colon and rectal surgeons. Practice parameters for ambulatory anorectal surgery. Dis Colon Rectum. 1991;34:285-87.
[5] Harries RL, Alqallaf A, Torkington J, Harding KG. Management of sacrococcygeal pilonidal sinus disease. Int Wound J. 2019;16:370-78. Doi: 10.1111/iwj.13042.
[6] Tocchi A, Mazzoni G, Bononi M, Fornasari V, Miccini M, Drumo A, et al. Outcome of chronic pilonidal disease treatment after ambulatory plain midline excision and primary suture. Am J Surg. 2008;196:28-33.
[7] Aithal SK, Rajan CS, Reddy N. Limberg flap for sacrococcygeal pilonidal sinus: A safe and sound procedure. Indian J Surg. 2013;75(4):298-301. Doi: 10.1007/s12262-012-0489-5.

[8] Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: From Pure Platelet-Rich Plasma (P-PRP) to Leucocyte- and Platelet-Rich Fibrin (L-PRF). Trends Biotechnol. 2009;27:158-67.
[9] Bolton L. Platelet-rich plasma: Optimal use in surgical wounds. Wounds Compend Clin Res Pract. 2021;33:219-21.
[10] Boztug CY, Karaagac Akyol T, Benlice C, Koc MA, Doganay Erdogan B, Ilhami Ozcebe O, et al. Platelet-rich plasma treatment improves postoperative recovery in patients with pilonidal sinus disease: A randomized controlled clinical trial. BMC Surg. 2021;21:373. Doi: 10.1186/s12893-021-01370-5.
[11] Bahar MM, Ali Akbarian M, Azadmand A. Investigating the effect of autologous platelet-rich plasma on pain in patients with pilonidal abscess treated with surgical removal of extensive tissue. Iranian Red Crescent Med J. 2013;15(11):e6301. Doi: 10.5812/ircmj.6301.
[12] Sevinc B, Damburacı N, Karahan Ö. Long-term results of minimally invasive treatment of pilonidal disease by platelet-rich plasma. J Visceral Surg. 2020;157:33-35. Available from: https://www.sciencedirect.com.
[13] Spyridakis M, Christodoulidis G, Chatzitheofilou C, Symeonidis D, Tepetes K. The role of platelet-rich plasma in accelerating the wound-healing process and recovery in patients being operated for pilonidal sinus disease: Preliminary results. World J Surg. 2009;33:1764-69.
[14] Tezel E. A new classification according to navicular area concept for sacrococcygeal pilonidal disease. Colorectal Disease. 2007;9(6):575-76. Doi: 10.1111/j.1463-1318.2006.01194.x.
[15] Homossany M, Abdallah H. Evaluation of different kinds of occlusal splints therapy in the management of myofascial pain. Egypt Dent J. 2018;64:1405-20. Doi: 10.21608/edj.2018.77400. Available from: https://doi.org/10.1007/s00268-009-0046-y\.
[16] Singh M, Dalal S, Raman S. Management of pilonidal disease with Limberg flap: Our experience. Int Surg J. 2020;7(5):1575-79. Available from: https://doi.org/10.18203/2349-2902.isj20201872.
[17] Chandu S, Ramya Y. Limberg flap reconstruction for pilonidal sinus: Our experience. J Evol Med Dent Sci. 2014;3(45):10986-91. Doi: 10.14260/jemds/2014/3433.
[18] Reboa G, Gipponi M, Testa T, Giannini G, Scala M, Dalla Costa R, et al. Regenerative medicine for the definitive surgical repair of pilonidal sinus: A new method of wound reconstruction. In Vivo. 2007;21:529-34.
[19] Song Y, Zang Y, Chen Z, Li J, Zhu M, Zhu H, et al. The application of the Limberg flap repair technique in the surgical treatment of pilonidal sinus disease. Int Wound J. 2023;20(7):2241-49. Doi: 10.1111/iwj.14105.
[20] Kayaalp C, Aydin C. Review of phenol treatment in sacrococcygeal pilonidal disease. Tech Coloproctol. 2009;13(3):189-93.
[21] Mohammadi S, Nasiri S, Mohammadi MH, Malek Mohammadi A, Nikbakht M, Zahed Panah M, et al. Evaluation of platelet-rich plasma gel potential in acceleration of wound healing duration in patients underwent pilonidal sinus surgery: A randomized controlled parallel clinical trial. Transfus Apher Sci. 2017;56(2):226-32. Doi: 10.1016/j.transci.2016.12.032.
[22] Uçaner B, Çimen Ş, Buldanlı MZ. Evaluation of single center clinical experience in patients undergoing modified Limberg flap technique in pilonidal sinus disease. J Med Palliat Care. 2023;4(6):694-98.

PARTICULARS OF CONTRIBUTORS:
1. Junior Resident, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India.
2. Professor and Head, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India.
3. Assistant Professor, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India.
4. Assistant Professor, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India.
5. Junior Resident, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India.
6. Junior Resident, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. S Vinith Balaji,
Junior Resident, Department of General Surgery, SRM Medical College Hospital and Research Institute, Chennai-603211, Tamil Nadu, India.
E-mail: vb020797@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Feb 22, 2025
- Manual Googling: Jun 19, 2025
- iThenticate Software: Jun 21, 2025 (10%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Feb 21, 2025**
Date of Peer Review: **May 10, 2025**
Date of Acceptance: **Jun 23, 2025**
Date of Publishing: **Jul 01, 2025**