

## SURGICAL DILEMMA OF PILONIDAL SINUS DISEASE

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### Abstract

**Background:** Pilonidal Sinus Disease (PSD) is a common Anorectal problem affecting the young population; The mainstay of management of PSD is surgical excision of the sinus tract and wound closure of the midline. The aim is to compare Keystone Perforator Island Flap (KIPF), Limberg Flap (LF) & Karydakias Flap (KF) [widely used in clinical practice to treat pilonidal sinus disease], in terms of early post-op complications. **Materials and Methods:** This prospective, multi-centric study was conducted between August 2020 and August 2021. A series of 60 patients were consecutively & randomly divided into 3 groups. 20 patients (Group I) underwent Karydakias Flap, 20 (Group II) underwent Elliptical Excision and Keystone Perforator Island Flap & 20 patients (Group III) underwent Rhomboid Excision and Limberg Flap, to cover the post-surgical raw area, and the post-op outcome compared in terms of Seroma, Hematoma, Flap Necrosis, Hospital Stay, Wound Dehiscence, Recurrence and Scar Characteristics. **Result:** This study revealed that operative time was significantly less in the KF group (47.5±5.50 Mins) compared to KIPF & LF group which were (82.00±15.68) & (92±22.79) minutes respectively whereas pain-free ambulation and hospital stay was lower in KIPF group which was statistically significant. **Conclusion:** The study revealed that KIPF has low hospital stay and early pain-free ambulation with good scar characteristics.

## INTRODUCTION

Pilonidal Sinus Disease (PSD) first described by Abraham Wendell Anderson around 1847.<sup>[1]</sup> It is a common Anorectal problem affecting the young population; typically, in their middle to late twenties with a reported incidence of 26 cases per 100,000 people. Historically, PSD is associated with obesity, a sedentary lifestyle, and local trauma/irritation. The presence of sinus opening along the midline of the natal cleft is the hallmark finding.<sup>[2,3]</sup>

The mainstay of management of PSD is surgical excision of the sinus tract and wound closure of the midline.<sup>4</sup> many surgical techniques are being used with varying results without any clear consensus on gold standard techniques for excision of PSD. It's a challenge for General Surgeons to choose among the best available techniques for excision of the sinus tract and lower the post-op complications and recurrence. Studies have been conducted in the past comparing the efficacy of the Limberg Flap (LF) & Karydakias Flap (KF) or Limberg Flap (LF) & Keystone Perforator Island Flap (KIPF). However, in the present study, the aim is to compare Keystone Perforator Island Flap (KIPF), Limberg Flap (LF) & Karydakias Flap (KF) [widely used in clinical practice to treat pilonidal sinus disease], in terms of early

post-op complications like Seroma, Hematoma, Flap Necrosis, Hospital Stay, Wound Dehiscence, Recurrence and Scar Characteristics after 3 months follow-up.

## MATERIALS AND METHODS

This is a prospective study conducted at the Department of Surgery, between August 2020 and August 2021. The study population was selected as per the Inclusion criteria: Age above 18 years, 03 months follow-up. Exclusion criteria: Chronically ill patients, bed-ridden patients, patients on steroids or immunomodulators, and diabetic patients.

A series of 60 patients were consecutively & randomly divided into 3 groups. 20 patients (Group I) underwent Karydakias Flap [Figure 1], 20 patients (Group II) underwent Elliptical Excision and Keystone Perforator Island Flap [Figure 2] & 20 patients (Group III) underwent Rhomboid Excision and Limberg Flap [Figure 3], to cover the post-surgical raw area. The nature of surgical procedures was explained to the patients and their informed written consent was obtained. After approval of the ethical committee of the hospital, the surgeries were performed under spinal anesthesia in the prone jack-knife position. Surgical time was noted using a stop-

watch, from skin incision to closure of the wound. Dissection and Hemostasis were performed using electrocautery. The drain was placed as per requirement (depending on tissue handling and dissection). Wound closure was done with Prolene 2-0. The post-op pain was assessed using VAS & non opioid analgesia was used for pain control. Scar characteristics and recurrence were noted after 03 months of follow-up. None of the patients lost follow-up.

**Statistical analysis:** Statistical analysis was done using SPSS Version 22. Continuous variables are expressed as Mean, Median and standard deviation and compared across the groups using Kruskal-Wallis test. Categorical variables are expressed as number of patients and percentage of patients and compared using Pearson's Chi-Square test for independence of attributes/Fisher's Exact test as applicable. p value less than 0.05 has been considered significant.

**Surgical technique:** Karydakis flap: First discovered by a Greek surgeon named Dr George Karydakis. This technique involves the excision of pilonidal pits and off-midline closure of wounds with lateralization of margins. The excision site was marked 1 cm away from the midline involving sinus. Then an elliptical incision was made that extended to the sacrococcygeal fascia. The sinus tract was resected and hemostasis was completed by applying electrocautery. The wound closed in layers after minimal tissue dissection to reduce tension over the surgical wound [Figure 1].<sup>[5]</sup>

Keystone Island Perforator Flap: First described by Behan FC, it's a locoregional flap based on multiple perforators. After the excision of defects, the trapezoid flap whose long axis is adjacent to the long axis of the defect is used to fill the defect [Figure 2].<sup>[6]</sup>

Limberg Flap: A rhomboid transposition flap in which the skin laxity is used for defect closure. First described by Dr Alexander Alexandrovich Limberg in 1945. In the technique, tissue was excised in a rhomboid fashion till sacrococcygeal fascia and adjacent tissue mobilized and rotated to cover the defect [Figure 3].

## RESULTS

The present study was performed on 60 patients with age above 18 years, between August 2020 and August 2021. 60 patients were randomly divided into 3 groups. 20 patients (Group I) underwent Karydakis Flap, 20 (Group II) underwent Elliptical Excision and Keystone Perforator Island Flap & 20 patients (Group III) underwent Rhomboid Excision and Limberg Flap to cover the post-surgical raw area. The demographic profile is comparable in all three groups with no statistical significance seen. However, the mean operative time in KF was  $47.50 \pm 5.50$  minutes which was significantly less compared to KIPF:  $82 \pm 15.68$  minutes and LF:  $92 \pm 22$  minutes respectively. Similarly, the hospital stay in KIPF was  $3.45 \pm 1.32$

days compared to  $5.85 \pm 1.46$  days in KF &  $5.55 \pm 2.74$  days in LF respectively and statistically significant. Pain-free ambulation calculated in days using VAS was significantly less in KIPF:  $2.15 \pm 0.59$  days compared to KF:  $4.35 \pm 0.67$  days & LF:  $3.55 \pm 1.32$  days respectively [Table 1].

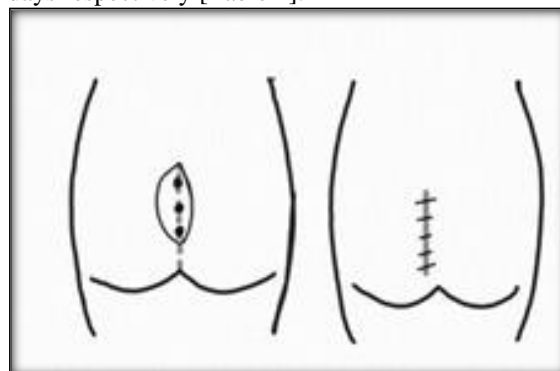


Figure 1: Karydakis flap

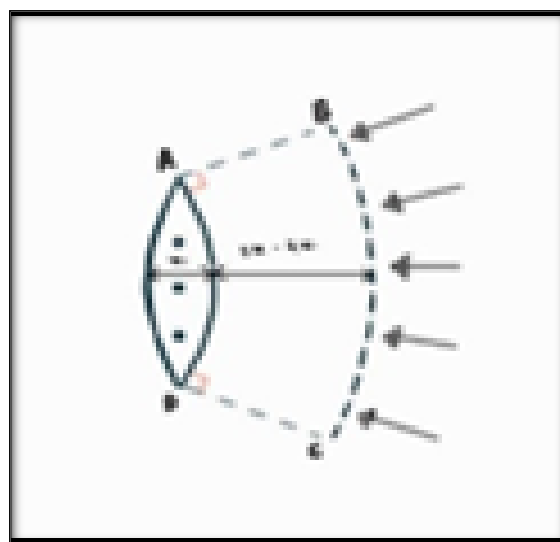


Figure 2: Keystone Island perforator flap

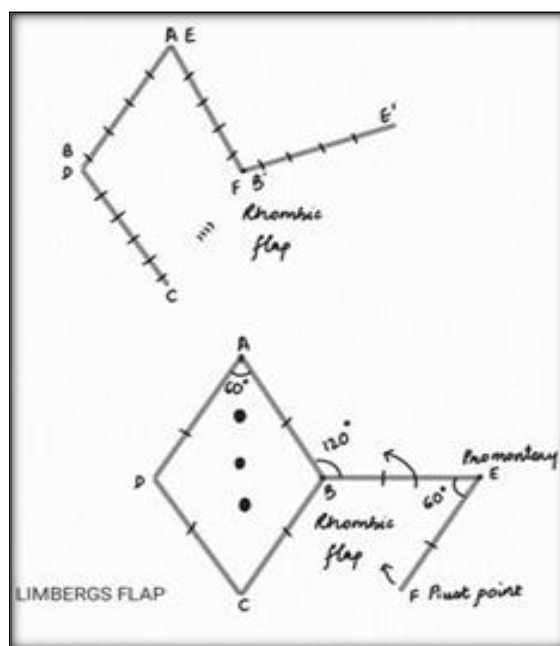


Figure 3: Limberg flap

Early post-op complications seen in all 3 groups were statistically non-significant. However, wound dehiscence was observed in 4(20%) patients in KF, 1(5%) each in KIPF & LF group. Seroma formation was seen in 5(25%) patients in KF, 1(5%) in KIPF and 2(10%) patients in LF group. Flap necrosis was observed in 1(5%) patient in KF & 3(12%) in LF. 1(5%) patient developed hematoma in LF group [Table 2].

During follow-up after 03 months, none of the groups presented with recurrence but 04 patients (20%) in KF group had scar tenderness with hypertrophic scar [Table 3]. Patients who underwent Keystone flap showed early recovery and lower duration of hospital stay as compared to other surgical procedures and early return to work [Table 4].

**Table 1: Demographic profile and characteristic of study population.**

GROUP		AGE	BMI	Operative time	Hospital stay	Pain-free ambulation
KARYDAKIS FLAP	Mean	30.95	22.35	47.50	5.85	4.35
	Median	31.50	22.22	45.00	5.50	4.00
	Std. Deviation	6.68	2.42	5.50	1.46	0.67
KEYSTONE FLAP	Mean	31.65	22.93	82.00	3.45	2.15
	Median	34.50	23.12	90.00	3.00	2.00
	Std. Deviation	6.95	2.81	15.68	1.32	0.59
LIMBERG FLAP	Mean	31.05	22.92	92.00	5.55	3.55
	Median	32.50	23.41	90.00	4.00	3.00
	Std. Deviation	6.60	2.36	22.79	2.74	1.32
p Value		0.897	0.586	<0.001	<0.001	<0.001
Significance		Not Significant	Not Significant	Significant	Significant	Significant

**Table 2: Post-Operative complications.**

		Group			Total	P value	Significance
		Karydakias flap	Keystone flap	Limberg flap			
Wound dehiscence	NO	16 (80%)	19 (95%)	19 (95%)	54 (90%)	0.344	Not Significant
	YES	4 (20%)	1 (5%)	1 (5%)	6 (10%)		
Seroma	NO	15 (75%)	19 (95%)	18 (90%)	52 (86.67%)	0.246	Not Significant
	YES	5 (25%)	1 (5%)	2 (10%)	8 (13.33%)		
Flap necrosis	NO	19 (95%)	20 (100%)	18 (90%)	57 (95%)	0.310	Not Significant
	YES	1 (5%)	0 (0%)	2 (10%)	3 (5%)		
Hematoma	NO	20 (100%)	20 (100%)	19 (95%)	59 (98.33%)	0.362	Not Significant
	YES	0 (0%)	0 (0%)	1 (5%)	1 (1.67%)		
Additional management	NO	14 (70%)	19 (95%)	14 (70%)	47 (78.33%)	0.107	Not Significant
	YES	6 (30%)	1 (5%)	6 (30%)	13 (21.67%)		

**Table 3: Follow up comparison.**

		Group			Total	P Value	Significance
		Karydakias flap	Keystone flap	Limberg flap			
Additional management	Delayed primary suturing	5 (25%)	0 (0%)	2 (10%)	7 (11.67%)	0.070	Not Significant
	Secondary intention healing	1 (5%)	1 (5%)	2 (10%)	4 (6.67%)		
	Ssg	0 (0%)	0 (0%)	2 (10%)	2 (3.33%)		
	No	14 (70%)	19 (95%)	14 (70%)	47 (78.33%)		
Scar characteristic	Hypertrophic scar	5 (25%)	1 (5%)	2 (10%)	8 (13.33%)	0.066	Not Significant
	Supple	15 (75%)	19 (95%)	15 (75%)	49 (81.67%)		
	No	0 (0%)	0 (0%)	3 (15%)	3 (5%)		
Scar tenderness	No	16 (80%)	20 (100%)	20 (100%)	56 (93.33%)	0.030	Significant
	Yes	4 (20%)	0 (0%)	0 (0%)	4 (6.67%)		

**Table 4: Return to work comparison.**

GROUP		Return to work	STITCH REMOVAL
KARYDAKIS FLAP	Mean	14.10	10.00
	Median	14.50	10.00
	Std. Deviation	2.29	1.30
KEYSTONE FLAP	Mean	11.70	8.05
	Median	12.00	8.00
	Std. Deviation	1.72	1.10
LIMBERG FLAP	Mean	14.00	10.30
	Median	14.00	10.00
	Std. Deviation	3.04	2.83
p Value		0.003	<0.001
Significance		Significant	Significant

**Table 5: Comparison with previous study.**

	Karydakís flap (KF)			Keystone perforator island flap (KIPF)			Limberg flap (LF)		
	Hospital stays (days)	Operative time (mins)	Pain free ambulation (days)	Hospital stay (days)	Operative time (mins)	Pain free ambulation (days)	Hospital stay (days)	Operative time (mins)	Pain free ambulation (days)
	14.6 ± 2.46	41.7 ± 4.22					16.8 ± 2.39	51.5 ± 4.17	
Marius D. Roatis et al. <sup>[9]</sup>	-	-	-	2.33 ± 0.48	-	9.06 ± 1.48	4 ± 1.98		9.60 ± 1.45
Mina Alvandipour et al. <sup>[11]</sup>	1.41 ± 0.49	23.03 ± 6.06					1.48 ± 0.50	29.15 ± 7.69	
Akin Calisir et al. <sup>[10]</sup>				2.21 ± 0.84	35.86 ± 8.29		2.42 ± 0.65	45.31 ± 6.19	
İlhan Bali et al. <sup>[12]</sup>	1.44	48	1				3	54	2
Sabahattin Destek et al. <sup>[13]</sup>	2.5	45					2.3	54	
Present Study	5.85 ± 1.46	47.50 ± 5.5	4.35 ± 0.67	3.45 ± 1.32	90.0 ± 15.68	2.15 ± 0.59	5.55 ± 2.74	92.0 ± 22.79	3.55 ± 1.32

## DISCUSSION

Pilonidal Sinus Disease (PSD), as the Latin origin of the name, suggests hair (pilus) and the nest (nidus), is caused by shed hair drawn into the natal cleft by motion from the buttocks. This motion creates a vacuum effect forcing hair into the skin through the pits in the midline. The foreign body reaction produced by trapped hair may lead to hair-filled abscess in the cavity. The abscess can drain spontaneously through the skin or back through the sinus tracts. Men are at higher risk because they tend to be more hirsute. Other associations with Pilonidal disease are obesity (37%), sedentary occupations (44%) and local irritation or trauma (34%).<sup>[8]</sup> Majority of patients will initially present with an abscess cephalad to natal cleft. The presence of sinus openings along the midline of the natal cleft 4 to 8 cm from the anus is the hallmark finding in pilonidal disease. Usually, KF, LF & KIPF techniques are applied to treat PSD without any clear consensus on which procedure has a better and uneventful outcome. Previously, various studies have been conducted comparing KIPF vs. LF or KF vs. LF. In our study, we compared all 3 surgical procedures in terms of early & late post-op outcomes. This study revealed that operative time was significantly less in KF group (47.5±5.50 Mins) compared to KIPF & LF group which were (82.00±15.68) & (92±22.79) minutes respectively whereas pain-free ambulation and hospital stay were lower in KIPF group which was statistically significant [Table 1].

Our study also led to an inference that the patient who underwent KIPF has less duration of hospital stay and early return to work as compared to other surgical procedures. [Table 4]

We have compared the results of this study with various studies conducted in the past [Table 5]. Marius D. Roatis et al in their comparative study of LF and KIPF revealed pain free ambulation and hospital stay in both the groups were statistically non-

significant, whereas Akin Calisir & İlhan Ece et al in their study found a significantly low operative time in KIPF group compared to LF and no statistical significance in hospital stay in both the groups.<sup>[9,10]</sup> Mina Alvandipour et al. in their single-blinded randomized trial of KF and LF in the management of PSD revealed no statistical significance in hospital stay in both the procedure whereas the operative time was low in Karydakís group.<sup>[11]</sup> İlhan Bali et al in their study of surgical management of recurrent PSD revealed KF group has low mean operative time, hospital stay and day-to-pain-free ambulation compared to LF.<sup>[12]</sup> Similarly, Sabahattin Destek et al in their study about KF and LF revealed low operative time in KF with no difference in hospital stay post-procedure.<sup>[13]</sup> KF being relatively simple has less operative time but the wound closure may be under significant tension resulting in more complications. KIPF has proven to be a superior technique with better outcomes and a low complication rate as revealed by the present study. In this study, although there is no statistical significance in post-op complications, 03 patients developed flap necrosis [Table 2]. 01 in KF and 02 patients in the LF group managed with healing by secondary intention and SSG cover respectively. 04 patients in the KF group continued to be symptomatic even after 03 months of follow-up with scar tenderness compared to KIPF and LF which is statistically significant [Table 3].

The fundamental of flap surgery is the intact vascular supply to the flap, which prevents flap necrosis and hastens wound healing. In KF there is some degree of tension in the wound which results in wound dehiscence. In LF there is massive tissue mobilization & it relies on axial supply, whereas in KIPF there are multiple perforators supplying the flap, and minimal tissue dissection is required, enhancing tension-free closure and thus there is minimal chance of wound dehiscence and seroma formation which further enhances early recovery and

early return to work. Tension on the wound line may disrupt the normal wound healing process and may lead to the formation of hypertrophic scar. The study revealed that KIPF has low hospital stay and early pain-free ambulation with good scar characteristics. Though there is no statistical significance observed in early post-op complication, the results clearly show that KIPF is a better surgical technique for managing PSD as it has a low complication rate compared to KF and LF, has early recovery, reducing morbidity that is associated with other procedures as well as cost benefits, resulting in early return to work and patient satisfaction.

## CONCLUSION

The study revealed no statistical significance in terms of early post-op complications; however, KIPF has low hospital stay and early pain-free ambulation with good scar characteristics and can be beneficial in the management of PSD with better patient satisfaction.

**Limitation:** The study was conducted in a small subset of patients with a defined geographical location with limited resources. The results have to be validated in a large sample size & general population with long-term follow-up. Till then PSD will continue to be a challenge to general surgery practice.

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