Comparison between Perforator Dependent Island Flap and Limberg Flap for Treatment of Pilonidal Sinus

**Ahmed Samy Fawzy, Doaa Omar Refaat, Abd Elhafez
Mohammad Elshewail and Abd-Elrahman M. Metwalli**

General surgery Department, Faculty of Medicine, Zagazig University, Egypt.
Corresponding author: Ahmed Samy Fawzy, Email: ahmed_s_8@yahoo.com

ABSTRACT
Background: The optimal operation for pilonidal sinus disease should be a straightforward one with low complication and recurrence rates. This is accomplished by flap techniques which flatten the natal cleft with an off-midline closure. The aim of this research was to compare two commonly used flap strategies in Zagazig university hospitals in terms of complications, recurrence rates, and patient satisfaction.
Patients and methods: 24 patients with pilonidal sinus disease were split into two categories in this interventional comparative clinical review. The superior gluteal artery perforator based flap was used to close the defect after complete excision of the sinus and its side branches in Group 1 while Group (2): were operated with total excision of the sinus and its side branches followed by closure of the defect using the Limberg flap. Patients were followed up weekly for the first 4 postoperative weeks and after that a visit once a month.
Results:In terms of postoperative wound complications, the gap between our two classes was negligible. Recurrence occurred in none of the patients in group (1) and one-sixth of the patients in group (2), but the disparity was statistically insignificant with a P value of 0.478. In the SGAP community, patient satisfaction with the operation was non-significantly higher.
Conclusion: Both perforator dependent island flap and limberg flap are safe procedures and provide effective treatment for pilonidal sinus disease with low rate of complications and recurrence.
Keywords:Perforator Dependent Island Flap; Limberg Flap; Pilonidal Sinus

INTRODUCTION:
Pilonidal sinus disease (PSD) can range from a single pit to extensive sinus formation and is normally seen in the inergluteal zone. The disorder has an incidence of 26 cases per 100,000 people, with a mean age of onset of 20 years. It mostly affects young males, with a male to female ratio of around 4 to 1 **(1).** Despite old hypotheses that said pilonidal sinus was a congenital disorder, it is now considered an acquired

condition. Keratin plugs, dermopathy, hair remnants in the natal cleft, and foreign body reactions to hair are some of the most common causes**(2).**

Pilonidal sinuses are most often found in the natal cleft, but they have also been identified in other locations such as finger webs (Barber's interdigital pilonidal sinus), the axilla (Pilonidal sinus of the axilla), and the umbilicus (Pilonidal sinus of the umbilicus) **(3).**

While numerous surgical procedures for treating patients with pilonidal sinus have been identified to date, the best cure remains a matter of debate. A commonly recognised procedure that reduces risks and recurrence rates while still providing cosmetically appropriate results and a limited healing time is still unavailable **(4).**

Limberg flap for defect repair after excision of chronic sacrococcygeal pilonidal sinus is a safe and successful procedure **(5)**. Limberg flap, on the other hand, can have some disadvantages and be linked to post-operative complications such as flap necrosis, wound dehiscence, and infection **(6).**

In terms of vascularity, perforator flaps based on perforating arteries, such as the superior gluteal artery perforator (SGAP) flap, outperform random flaps, particularly when closing larger and deeper defects **(7).**

The aim of this study is to compare the efficacy of the superior gluteal artery perforator dependent island flap to the Limberg flap in treating pilonidal sinus disease in Zagazig University hospitals.

Patients and Method:

This study was conducted on 24 patients with pilonidal sinus disease were admitted to the Department of General Surgery at Zagazig University Hospital for conclusive surgical management From September 2019 to March 2020.

The patients were divided into two groups **Group (1):** were operated with total excision of the sinus and its side branches followed by closure of the defect using the superior gluteal artery perforator dependent flap while **Group (2):** were operated with total excision of the sinus and its side branches followed by closure of the defect using the Limberg flap.

Inclusion criteria was patients with primary pilonidal sinus disease with stage iii and iv according to guner staging system and also who with recurrent pilonidal sinus disease (stage r according to guner staging system) not previously treated with flap.

Exclusion criteria was history of extensive sacrococcygeal surgery, history of flap surgery in the sacrococcygeal region, patients who missed follow up visits, pregnant females, patients who refused to participate in the study and patients with acute pilonidal abscess.

Detailed history was taken with emphasis on associated medical disorders and previous surgical interventions.Careful general and local examinations were carried out. Pre-operative perforators marking using Duplex ultrasound examination was done using permanent ink markings

Surgical technique:

Superior gluteal artery perforator (SGAP) flap

The superior gluteal artery and its perforators were marked with permanent ink at perforator sites during a Duplex ultrasound test.Methylene blue dye was injected into the sinus orifices to aid in determining the size of the sinus so that it could be completely excised.

Land-marking of related anatomical sites was carried out as follows: the posterior superior iliac spine (PSIS), greater trochanter (GT), coccyx, piriformis muscle (PM) and using handheld Doppler device, the perforators already marked on the skin preoperatively was located before starting the excision of the sinus. Extent of excision and flaps were determined by drawing on the glutei. The pathological area to be excised was mapped on the skin.

The pilonidal sinus was excised down to the presacral fascia, with strong hemostasis. In a supra-fascial plane, the incision was made superiorly and then went down through muscle, subcutaneous fat, and fascia. The flap was then separated from the fascia before the desired perforator was found.

Intra operative locating of the perforator vessel using handheld Doppler device was carried out for better assessment of the perforator vessels supplying the flap. The perforator vessel was slowly dissected and once the vessel is found, the inferior border of the flap was incised and the flap is raised away from the fascia fully to form an island flap. The island flap was then sutured to the surrounding skin and transposed to mask the defect. Donor pages were also shut down. Suction drainage was used in the donor region and under the flap.

Steps of (Limberg flap)

Methylene blue dye was injected into the sinus orifices to aid in determining the size of the sinus so that it could be completely excised. Drawing on the glutei was used to assess the extent of the excision and flaps. On the scalp, the pathological region to be excised was mapped. A rhombus-shaped pattern encircled it, with the long axis in the middle line (ABCD).

The flap was planned so that (DE) was a direct continuation of the line (BD) and was of equal length to the line (BA) to which it was sutured after rotation. (EF) was parallel to (DC) and was of equal length and after rotation it was sutured to (AD).This defined the main flap (CDEF) and the triangular flap (ADE) . The skin and subcutaneous fat within the (ABCD) area were excised down to the deep fascia.

The skin, subcutaneous fat, and fascia overlying the gluteus maximus muscle were all contained in the (CDEF) fold. It was then rotated on a pedicle of (CF) to cover the midline rhomboid defect, and the defect was linearly closed. Deep absorbable sutures were inserted in the subcutaneous tissue and fat over a suction drain, and the skin was then primarily covered.

Follow up:

Patients were followed up weekly for the first 4 postoperative weeks and after that a visit once a month (to check for recurrences and assess their satisfaction with the results). Postoperative complications were reported based on clinical findings with

emphasis on wound infection, wound dehiscence, subcutaneous fluid collections and flap necrosis.

Satisfaction with cosmetic results was determined at the end of the third post-operative month by asking patients to give a score from 1 to 10 (with 10 being the highest and one being the lowest).

Statistical analysis

Data were checked, entered and analyzed by using the software SPSS (Statistical Package for the Social Sciences) version 17.Data were expressed as Mean ± SD for quantitative variables, number and percentage for descriptive variables. Chi-square (X^2) or Fisher exact results and t test were used when appropriate. To compare means of two groups, independent sample t test was used when data is normally distributed. Nonparametric test (Mann Whitney) was used to compare means when data was not normally distributed and to compare medians in categorical data P <0.05 was considered statistically significant. P ≤0.001was considered high statistically significant.

Results:

, there was a male predominance in both groups with (83.3%) in group (1) and (75%) in group (2), the age of patients ranged from 17-39 years with a mean ± SD of (24±6.3) in group (1) while the range was from 18-38 years with a mean ± SD of (26 ±6.6) in group (2) with no significant difference between both groups regarding the demographic data.

There is statistically non-significant difference between the studied groups regarding defect size. Defect size was measured by multiplying the largest two dimensions of the defect and the mean was 95.75 ± 15.422 mm in SGAP group and 84.417 ± 15.6 mm in Limberg flap group. About 57% had flap based on one perforators while remaining 43% based on 2 perforators.Operative time was significantly higher in SGAP group (123.75 ± 16.669 min.) than Limberg flap group (57.167 ± 7.6 min.). There is no statistically significant difference between the studied groups regarding complications as shown in details in

Time off work was significantly higher in SGAP group (16.583 ± 1.564 day) than Limberg flap group (14.417 ±   1.929 day) . There is statistically non-significant difference between the studied groups regarding patient satisfaction (non-significantly higher in SGAP group). There is statistically non-significant difference between the studied groups regarding recurrence. None of the patients from SGAP group had recurrent sinus versus one sixth of those underwent Limberg flap operation yet with statistically non-significant difference.
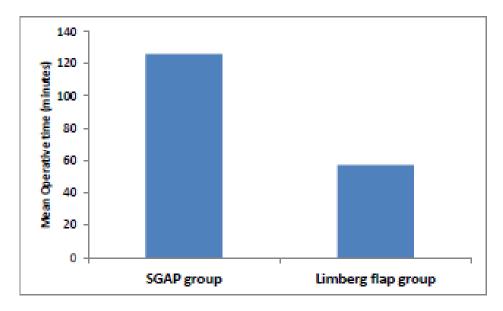
Fig. (1): Simple bar chart showing operative time among the studied groups
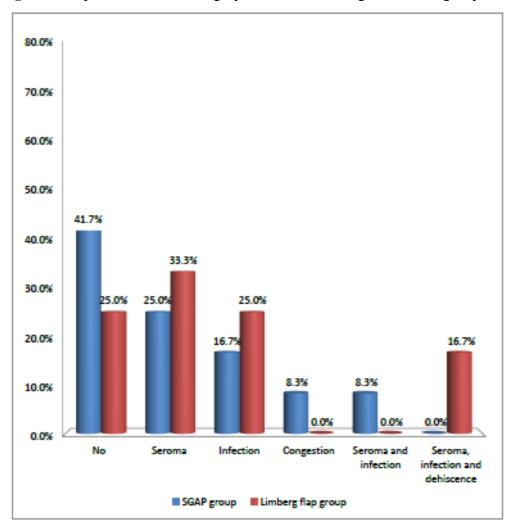

Fig. (2): Combined bar chart showing comparison between the studied groups regarding occurrence of postoperative complications.
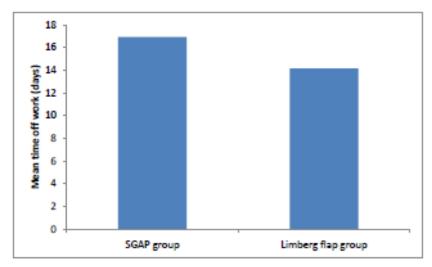
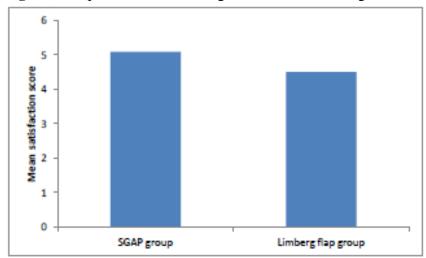**Fig. (3):** Simple bar chart showing time off work among the studied groups

Fig. (4): Simple bar chart showing mean satisfaction score among the studied groups
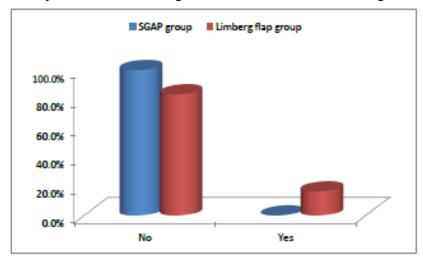

Fig. (5): Combined bar chart showing comparison between the studied groups regarding occurrence of recurrence

Discussion:

Despite almost two centuries passing since this disease was first noted, no standard management for pilonidal disease exists, but numerous methods of treatment are available. All treatment options are weighed against the optimal one which should fulfill low cost, fast recovery, minimal time off work as well as a low complication and recurrence rate with a satisfactory cosmetic result **(8).**

Thus, flap techniques are used to prevent recurrence on the midline by removing the cavity in the natal cleft and shifting the incisions from the midline, **(9)**.

Along with these lines, the aim of this study is to assess the effectiveness of the SGAP and limberg flaps in the treatment of pilonidal sinus disease and compare them regarding operative time, cosmetic satisfaction, post-operative complications and recurrence rate.

In this study, there was a male predominance in both groups, the age of patients ranged from 17-39 years with a mean ± SD of (24±6.3) in group (1) while the range was from 18-38 years with a mean ± SD of (26 ±6.6) in group (2) with no significant difference between both groups regarding the demographic data.

This previous findings were similar to that of **Ekici and his co-workers, 2019 (4)** who studied the management of 303 patients with pilonidal disease with a mean age of (24 ±6.7) and a male predominance of 80.5%. **Ahmed et al. in 2017 (10)** studied on 150 patients with pilonidal sinus with an age mean of (32.9) and a male predominance of 84.6%. **Tokac et al. in 2015 (9)** also on their study on 91 paients reported an average age of 28 and male predominance of 86.8%.

In our study, the operative time was significantly shorter with the Limberg flap operation with a (mean ± SD) of (57.16 ± 7.6) minutes than it was with the SGAP flap procedure where it ranged from 100 to 155 minutes with a (mean ± SD) of (123.75 ± 16.6) minutes denoting a highly significant difference (P value<0.001).

Basterzi and his co-workers in 2008 (11) estimated a mean operative time of 107.4 ± 14.56 minutes, while **Acaturk et al. in 2010 (7)** performed the SGAP flap on 15 patients with the operative time ranging from 35-60 minutes with an average of 45 minutes and this significantly shorter operative time was explained by the less dissection as they did not need to identify the perforators intra operatively as they raised the flap at 45º to the vertical axis of the defect which allowed mobilization of the flap once the flap is freed from the surrounding structures.

The Limberg flap operative time is in agreement with the previous study by **Singh et al. in 2017 (5)** that found the mean operative time was 50 minutes with a range of 30 to 80 minutes.

Regarding post-operative wound complications, in group (1) three of the patients were presented with seroma while in group (2) four cases had seroma that was treated conservatively while two patients of group (1) and three patients of group (2) developed wound infection that was treated by intravenous broad spectrum antibiotics and local antibiotics spray.

In group (1), one patient developed flap congestion that improved spontaneously after applying nitroglycerin patch and one other flap complicated with wound

infection over seroma and was treated accordingly by antibiotics and evacuation of the underlying infected seroma.

While in group (2), two patients encountered partial wound dehiscence after having infected seroma under the flap and that was treated by delayed primary closure after evacuation of the infected seroma, systemic antibiotic treatment and repeated dressing.

Overall, there was statistically non-significant difference between the studied groups regarding complications.

Many authors in the literature have discussed the limberg flap with its complications, **Bali et al. in 2015 (12)** on their study on 37 patients found wound infection rate of 11%, seroma in 8% and wound dehiscence of 3% of the cases.

Bessa in 2013 (13), on his study of 60 patients with the limberg flap found post-operative complications in 14 cases, with wound infection rate of 5% and wound dehiscence rate of 18%.

Madhusudhan and his coworkers in 2017 (6) conducted a retrospective study on 13 patients who underwent limberg flap procedure. Seroma was found in 2 patients (14.4%) and flap necrosis was found in 2 cases (15.4%).

These results go in line with our study, in which we did not encounter any vascularity related complications such as flap necrosis.

When discussing the recurrence rate we found a recurrence in two of the

12 patients (16.7%) of the Limebrg flap over a follow up period of 6 months, however, no recurrence was found in group (1) that were treated by SGAP flap. The relatively high recurrence rate in group (2) may be attributed to the small study group.

Many authors in the literature have discussed the recurrence rate after Limberg flap. **Ekici et al., in 2019 (4)** found a recurrence rate of 2.6% (3 of 114 patients). **Boshnaq et al., in 2018 (14)** had a recurrence rate of 2% (2 of the 26 patients). **In 2017, Madhusudhan and his coworkers (6)** had a recurrence rate of 7.7% (1 of 12 patients). **Arslan et al. in 2014 (15)** found recurrence rates in the limberg flap group of 6.3%. In **Ates and his colleagues, 2011 (16)** study, recurrence was observed in 9 patients (6.9%), within 3 to 10 months, of the limberg group.

In contrary, **Acaturk et al. in 2010 (7)** had no recurrence in their study of fifteen patients.

Basterzi et al. in 2008 (11) also had no recurrence out of the 10 patients he treated using the SGAP flap over a follow-up period ranged from 4 to 11 months, they also claimed that the SGAP flap has low recurrence rate due to the effectiveness of the flap in obliterating and flattening the intergluteal sulcus thus preventing possible midline recurrence.

Finally, regarding patient satisfaction, group (1) achieved a mean ± SD (5.083 ± 0.9) and range (3-6), in comparison to group (2) that achieved a mean ± SD (4.5 ± 1.624) and range (2-6). There was statistically non-significant difference between the studied groups.

In group (1) there were five patients who gave a score of satisfaction of   6 out of 10 and would advice other patients to perform this type of surgery while in group

(2) four patients gave a score of 6 out of 10 for the cosmetic and would recommend Limberg flap for others.

In **Ates and his colleagues, 2011 (16)** study, the VAS score for satisfaction with the cosmetic appearance of the scars in the Karydakis group was (7.08 ± 1.75) , whereas it was (3.16 ± 1.40) in the Limberg group.

However, **in 2011 Muller et al. (17)** showed that cosmetic outcome after Limberg flap, despite being an issue for some patients, was largely accepted by the majority of their seventy patients. The low incidence of wound complications and recurrence rate contributed to high patients' satisfaction.

Conclusion

Both procedures are successful for pilonidal sinus disease management, with low infection rates, lower recurrence rates, and the ability to be done safely as day-case surgery. However, because of its lower prevalence of vascularity-related complications and lower recurrence rates considering its comparatively longer operating duration, the SGAP flap can be used instead of the Limberg flap for treating extensive sacrococcygeal pilonidal disease with broad defect.

Conflict of Interest: No conflict of interest.

4- References:
1. Tezel E. A new classification according to navicular area concept for sacrococcygeal pilonidal disease. Colorectal Dis. 2007;9(6):575-576.
2. Meinero P, Mori L, Gasloli G. Endoscopic pilonidal sinus treatment (E.P.Si.T.). Tech Coloproctol. 2014;18(4):389-392.
3. O'Neill AC, Purcell EM, Regan PJ. Interdigital pilonidal sinus of the foot. Foot (Edinb). 2009;19(4):227-228.
4. Ekici U, Kanlıöz M, Ferhatoğlu MF, Kartal A. A comparative analysis of four different surgical methods for treatment of sacrococcygeal pilonidal sinus. Asian J Surg. 2019;42(10):907-913.
5. Singh PK., GohilRK., and Saxena, N. Limberg flap procedure for sacrococcygeal pilonidal sinus: a prospective study. IntSurg J., 2017;4(7):2238-2242.
6. Madhusudhan A., Swamy MD, Arif M. Pilonidal sinus-limberg versus karidakisflap our experience at SIMS, Shivamogga. IntSurg J., 2017;4(11):3641-3645.
7. Acartürk TO, ParsakCK, Sakman G, Demircan O. Superior gluteal artery perforator flap in the reconstruction of pilonidal sinus. J PlastReconstrAesthet Surg. 2010;63(1):133-139.
8. Jemma K. Porrett, Liesel J. Porrett, Yik-Hong Ho, and Warren M. Rozen (2019): Pilonidal Sinus—Plenty of Literature yet Lack of Direction: A Pooled Analysis. IntSurg, 103(9-10), 443-451.
9. Tokac, M., Dumlu, E. G., Aydin, M. S., Yalcın, A., &Kilic, M. (2015): Comparison of modified Limberg flap and Karydakis flap operations in

pilonidal sinus surgery: prospective randomized study. International Surgery, 100(5), 870-877.

10. Ahmed Z., Shahid M., Malik MS., Hussain S. Comparison of Karydakis technique with Limberg flap procedure for sacrococcygeal pilonidal sinus disease in terms of hospital stay and work loss. PAFMJ. 2017;67(1);141-44.

11. Başterzi Y, Canbaz H, Aksoy A, Sar A, Türkmenoğlu MO, Cağlkülekçi M. Reconstruction of extensive pilonidal sinus defects with the use of S-GAP flaps. Ann Plast Surg. 2008;61(2):197-200.

12. Bali İ, Aziret M, Sözen S, et al. Effectiveness of Limberg and Karydakis flap in recurrent pilonidal sinus disease. Clinics (Sao Paulo). 2015;70(5):350-355.

13. Bessa SS. Comparison of short-term results between the modified Karydakis flap and the modified Limberg flap in the management of pilonidal sinus disease: a randomized controlled study. Dis Colon Rectum. 2013;56(4):491-498.

14. Boshnaq M, PhanYC, Martini I, Harilingam M, Akhtar M, Tsavellas G. Limberg flap in management of pilonidal sinus disease: systematic review and a local experience. ActaChir Belg. 2018;118(2):78-84.

15. ArslanK, Said Kokcam S, Koksal H, Turan E, Atay A, Dogru O. Which flap method should be preferred for the treatment of pilonidal sinus? A prospective randomized study. Tech Coloproctol. 2014;18(1):29-37.

16. Ates M, Dirican A, Sarac M, Aslan A, Colak C. Short and long-term results of the Karydakis flap versus the Limberg flap for treating pilonidal sinus disease: a prospective randomized study. Am J Surg. 2011;202(5):568-573.

17. Müller K, Marti L, Tarantino I, Jayne DG, Wolff K, HetzerFH. Prospective analysis of cosmesis, morbidity, and patient satisfaction following Limberg flap for the treatment of sacrococcygeal pilonidal sinus. Dis Colon Rectum. 2011;54(4):487-494.