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Comparative Study between Excision with Primary Closure versus Flap Reconstruction in Management of Sacrococcygeal Pilonidal Sinus

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ABSTRACT

Introduction and aim: Pilonidal sinus (PNS) is a common inflammatory condition of the gluteal region. Different methods were introduced for treatment. However, recurrence is still a significant problem after surgery and different approaches were described to lower the recurrence rate. But controversy exist regarding the standard surgical intervention. The current work aimed to compare between excision with off midline primary closure versus Limberg flap procedure in the treatment of sacrococcygeal PNS.

Methodology: Sixty patients with PNS were included and divided into two equal groups, the first for primary midline excision with closure, and the second treated by Limberg flap. Patients were assessed by clinical evaluation and after surgery, the recurrence rate was documented through the first year. In addition, complications rate and times to restore the normal daily activities were documented and compared between groups.

Results: Both groups were comparable regarding all preoperative variables. The operative time was significantly short among group I than group II (31.6± 6.5 vs 51.6± 6.4 minutes). The duration of hospital stay, time to return to work, drainage amount, time to stitch removal, time to walk pain-free and time to painless toilet seat were significantly shorter in group I. However, cosmetic score was significantly higher in group I than group II. Finally, the recurrence rate was significantly higher in group I than group II (20.0% vs 0.0%). The recurrence was significantly associated with hairy skin, positive family history, diabetes mellitus, higher BMI, and history of previous PNS.

Conclusion: Primary midline closure of PNS is superior than the Limberg flap in operative time and times to return to normal daily activities. However, it had a higher recurrence rate. Thus, Limberg flap is advocated for PNS.

Keywords: Inflammation; Gluteal; Recurrence; Limberg.

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INTRODUCTION

Pilonidal sinus is a very common inflammatory disease of gluteal region. Its incidence is 26/100,000 and it usually occurs in working males of between 15 to 30 years of their age [(1)]. The disease itself dates back to 1833 when Herbert Mayo, A British Physiologist, Anatomist and Surgeon described it as a sinus containing hair follicles located in the sacrococcygeal region in a woman [(2)]. The condition is also defined as a common chronic condition usually affecting young adults under 40 years of age. The disease usually occurs in the intergluteal region, although it may occur elsewhere such as the umbilicus and in finger webs in hairdressers [(3)].

The risk factors for the development of the condition include male gender, extensive body hair, young adulthood, family history, local trauma, sedentary lifestyle, poor hygiene, an anatomically deep natal cleft and obesity [(4)]. In addition to hair follicles, cut or shed hairs also had important roles in pathogenesis. Not only the quality and type of the hair are important, but also the place where hair grows. Whether it is located either above or under the skin does not make any difference, but hairs penetrating the skin facilitate the establishment of the infection [(5)].

Clinical presentation ranges from the simple pit to the complex infected type with multiple orifices and purulent or serosanguinous discharge [(6)]. Clinical diagnosis is straightforward varying from acute pilonidal abscess, chronic pilonidal sinus, complicated pilonidal sinus and recurrent pilonidal disease. According to the pathogenesis of the disease, different treatments have been introduced including non-operative management, excisional and incisional procedure and flaps [(7)].

Although different surgical approaches have been used to manage sacrococcygeal pilonidal sinus, none of these approaches eliminate the postoperative morbidity including delayed wound healing, dis comfort and high rate of recurrence, which range between 1% and 43% in different studies [(8)].

The surgical wound may be left to heal by secondary intention. Advocates of this technique state that reduced wound tension facilitate trouble free healing without recurrence if all sinus tracts are fully excised. Alternatively, the wound may be closed to heal by primary intention. Methods can be broadly categorized as midline closure techniques with the wound lying within the natal cleft or other techniques where the wounds placed out with the midline. Advocates of primary closure perceive benefits of faster tissue healing [(9)]. Excision and midline primary closure involve excision of the entire sinus with closure of the wound. This procedure has the advantage of avoiding wound packing. One problem is that the incision tends to be situated in a deep midline cleft where there is tension and also the propensity to accumulate hair. Skin flaps have been described to cover a sacral defect after wide excision; this keeps the scar off the midline and flattens the natal cleft. The techniques available include the cleft closure, Karydakis procedure, local advancement flap (V-Y advancement flap), rotational Limberg flap and gluteus maximus myocutaneous flap [(10)].

THE AIM OF THE WORK

To compare between excision with off midline primary closure versus Limberg flap procedure in the treatment of sacrococcygeal pilonidal disease as regard recurrence rate, operative data, postoperative pain, postoperative complications and return to daily activity.

PATIENTS AND METHODES

This prospective randomized clinical study was performed on 60 patients with pilonidal sinus disease who were admitted to Al-Azhar University Hospitals General Surgery Departments. Patients were included if they were adults, men or women with symptoms of sacrococcygeal pilonidal sinus. On the other hand, they were excluded if they have abscess formation, with immunodeficiency, had congenital asymptomatic pits, had psychiatric disease disabling surgical intervention and pregnant women. Patients were randomized to one of two equal groups; group-I was treated with excision and off midline primary closure. On the other side, group-II was treated with excision with rhomboid flap (Limberg flap). Randomization was achieved by a computer-generated schedule and the results were sealed into envelopes. The envelopes were drawn and opened by a nurse just before surgery.

For preoperative assessment, all patients were subjected to thorough preoperative evaluation (e.g., detailed history, thorough general & local examination and routine preoperative blood tests (CBC, renal function, liver function, prothrombin time, random blood glucose)). The collected data included age, sex, job and body mass index (BMI). Occupation was defined as the occupation performed during two years prior to diagnosis of pilonidal sinus (PNS). Shower habits of patients was

approximately calculated by the number of baths/weeks. Family history was assessed negative or positive. Moreover, if positive whether it is 1st degree relatives (father, mother, sister, brother or grandmother) or not. Body hair ratio was graded subjectively as described by **Harlak et al.** [11], into hairless, mild hairy and hairy. The complaint (Pain, pruritis, bleeding and\or discharge) and its preoperative duration were recorded. The number of openings and clinical staging were documented.

Surgical procedure:

All the patients were admitted one day before surgery. Operations were performed under spinal or general anesthesia and shaving the intergluteal area was performed. The patients were placed in the prone Jack knife position and wide adhesive taps were used to separate the buttocks. Patients received antibiotics in the form of third generation Cephalosporin before the incision [12]. The surgical procedure in both groups was performed as described by **Tavassoli et al.** [6]. In group-I, the procedure started by probing of the sinus, excision of the wound with removing the sinuses *en bloc* using a vertical elliptical specimen of overlying skin 1 cm away from the sinus reaching the level of the sacrococcygeal fascia. The tissue was resected and hemostasis was completed by electrocautery. Tension was released by a limited sharp dissection above the fascia. Then, a suction drain was inserted from a separate incision. After that, placing deep approximating 0 polyglactin sutures to close the deep fascia as a layer then the skin was approximated with 3/0 polyglactin interrupted subcutaneous sutures and the skin edges were closed with 2/0 Polyprolene interrupted mattress sutures (figures 1 to 3).

In group-II, mapping a rhomboid shaped incision while the patient is standing, the ratio of length to width was 60%. The lesion was excised with each side equal in length. The depth of the rhomboid excision was extended down to the gluteal fascia. Then, rotation of the rhomboid flap from the gluteal fascia to the excised area without tension was done. A suction drain was inserted Subcutaneous tissue was sutured with interrupted 2/0 Polyglactin and the skin was sutured separately with interrupted mattress Polyproline 2/0 sutures Postoperative evaluation; Standard postoperative care, including mobilization and return to normal diet as quickly as possible were done (Figures 4 to 6) .

Early postoperative complications (bleeding and urine retention) were noticed. Pain score and early wound infection were recorded. No patient had complete bed rest and oral antibiotics and analgesics were prescribed after patients were discharged. All the patients were recommended to visit the outpatient clinic twice weekly for two weeks then weekly for another two weeks and then every 3 months for 6 months during the follow-up period. During each visit, complete patient assessment took place. Full history was taken and patient was asked about pain, painless walking and toilet setting. Meticulous examination for delayed postoperative complication (e.g., wound infection, wound dehiscence, flap necrosis, flap edema, numbness and hyposthesia) was performed. Drain output and seroma formation were recorded. All patients were advised to walk freely but not to exercise until stitches removal. All the patients were advised to shave the area well around the operative site at least monthly.

The primary outcome was the recurrence while the secondary outcomes included all other parameters (e.g., complications, pain and times to return to normal activities). Follow up of patients for 12 months for recurrence. Recurrence was defined as reappearance of pilonidal sinus at the site of surgery as diagnosed by physical examination by the operating surgeon and a surgical resident. Post-operative pain was assessed on the first, fourth postoperative day and at stitch removal using a visual analogue scale (VAS) from zero (no pain) to 10 (worst pain imaginable). Infection was considered as leakage of purulent secretion through the surgical wound and not only peri- incisional hyperemia. The suction drain was removed when drainage became less than 20 mL per day [6]. Seroma was defined as the formation of non-infected serous fluid collection beneath the flap and diagnosed by clinical examination. Duration of incapacity for work was defined as the date on which patient returned to normal activities including employment and leisure activities time from the date of surgery. Patients were asked to evaluate the cosmetic appearance of the wound by looking at its picture using VAS ranging from 0-10 where 0 means the worst cosmetic outcome and 10 indicates the best cosmetic outcome. A Turkish study used a 0 to 10 visual analogue scale (VAS) scale to assess patient satisfaction [13].

Statistical analysis: The statistical analysis of data was done by SPSS program version 23 (IBM Corp, Bristol, UK). The description of the data was done in the form of mean ± SD for quantitative data, frequency and percentages for qualitative data. For quantitative data, Student's t-test was used to compare between two groups. Chi square and Fisher's exact tests were used to check association of qualitative variables. P value of ≤ 0.05 was considered statistically significant.

Figure (1). Excision with primary off midline closure

Figure (2). Excision with primary off midline closure with skin edgesclosed with 2/0 polyprolene interrupted mattress sutures.

Figure (3): Excision with off midline primary closure after removal of stitches.

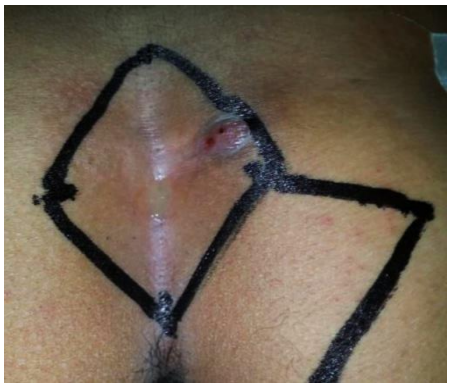

Figure (4): Rhomboid flap marking

Figure (5): Rhomboid shaped incision with each side equal in length.

Figure (6): The Rhomboid flap, 6 months after surgery

RESULTS

Table (1) presented the data about patient demographics and preoperative variables in groups I and II. This showed that, both groups were comparable regarding all preoperative variables (i.e., no significant difference was observed between groups).

The operative time was significantly short among group I than group II (31.6± 6.5 vs 51.6± 6.4 minutes). In addition, the duration of hospital stay, time to return to work, drainage amount, time to stitch removal, time to walk pain-free and time to painless toilet seat were significantly shorter in group I than group II. However, cosmetic score was significantly higher in group I than group II. Finally, the recurrence rate was significantly higher in group I than group II (20.0% vs 0.0%) (Table 2). The recurrence was significantly associated with hairy skin, positive family history, diabetes mellitus, higher BMI, and history of previous PNS (table 3).

Table (1): Patients demographics and preoperative data among study groups

Variable		Group I	Group II	P value
Age in years		25.06±7.4	23.8±5.9	> 0.05
Gender (male/female)		25/5	27/3	> 0.05
BMI (kg/m2)		27.4± 3.9	26.5± 4.4	> 0.05
Body hair ratio	Hairless	7(23.3%)	7(23.3%)	>0.05
	Mild hairy	14(46.6%)	11(36.6%)	
	Hairy	9(30%)	12(40%)	
Baths/week	< 3 /week	20(66.6%)	24(80%)	> 0.05
	>=3/week	10(33.3%)	6(20%)	
Family history	Positive	5(16.6%)	4(13.3%)	> 0.05
	Negative	25(83.3%)	26(86.6%)	
Comorbidities	Diabetics	7(23.3%)	3(10%)	> 0.05
	Smokers	16(53.3%)	18(60%)	> 0.05
Sitting hours/day	>=6 hours	19(63.3%)	25(83.3%)	> 0.05
	<6 hours	11(36.6%)	5(16.6%)	
Preoperative duration of PNS (months)		16.1±5.2	14.1±4.4	>0.05
Clinical presentation	Discharge	25(83.3%)	22(73.3%)	> 0.05
	Pain	7(23.3%)	9(30%)	> 0.05
	Pruritis	12(40%)	13(43.3%)	> 0.05
	Bleeding	1(3.3%)	1(3.3%)	> 0.05
Number of pits		1.6±0.7	1.4±0.5	> 0.05
Previous abscess		6(20%)	7(23.3%)	> 0.05
Stage of PNS	I	4(13.3%)	5(16.6%)	> 0.05
	II	11(36.6%)	13(43.3%)	
	III	7(23.3%)	6(20%)	
	IV	1(3.3%)	1(3.3%)	
	R	7(23.3%)	5(16.6%)	

Table (2): Operative and postoperative data among study groups

Variable		Group I	Group II	P value
Operative time (min)		31.6± 6.5	51.6± 6.4	*<0.001**
Hospital stay (days)		1.2±0.6	1.5± 0.6	0.06
Time to return to work (days)		17 ± 3.3	20± 2.5	*<0.01**
Immediate postoperative Complications	Urine retention	1 (3.3)	3(10)	>0.05
	Bleeding	0 (0.0%)	1 (3.3)	>0.05
Delayed complications	Wound infection	6(20%)	1(3.3%)	>0.05
	Flap edema	3(10%)	2(6.6%)	>0.05
	Wound dehiscence	2(6.6%)	1(3.3%)	>0.05
	Numbness and hyposthesia	2(6.6%)	5(16.6%)	>0.05
	Total wound complications	13(43.3%)	9(30%)	>0.05
Postoperative pain score	First PO day	6.6±1	6.9± 0.7	>0.05
	Fourth PO day	2.7±0.9	3.1±1.1	>0.05
	At stitch removal	1.5±0.5	1.5±0.7	>0.05
Drainage amount (CC)		637± 182.6	815± 169.2	*<0.001**
Time for drain removal (days)		15.6 ±3.4	17.5 ±5.5	>0.05
Time for stitch removal (days)		12.6 ±2.2	14.4 ±2.1	*<0.01**
Time to walk pain-free (days)		4.7 ±2.4	6.2 ±1.3	*<0.01**
Painless toilet seat		6 ±1	8.5 ±1.8	*<0.001**
Final scar	Fine linear	27(45%)	25(41.6%)	>0.05
	Ugly scar	3(5%)	5(16.6%)	
Cosmetic satisfaction score		7.8±1.2	5.4±1.5	*<0.001**
Recurrence		6 (20%)	0 (0.0%)	*<0.05**

Table (3): Analysis of factors associated with recurrence

Variable		No recurrence (n=54)	Recurrence (n=6)	P value
Body hair	Clean	14 (25.9%)	0 (0.0%)	*0.04**
	Mild hairy	24 (44.4%)	1 (16.7%)	
	Hairy	16 (29.6%)	5 (83.3%)	
Baths/week	< 3 /week	40 (74.1%)	4(66.7%)	>0.05
	>=3/week	14(25.9%)	2 (33.3%)	
Family history	Positive	6 (11.1%)	3 (50.0%)	*0.03**
	Negative	48 (88.9%)	3 (50.0%)	
comorbidities	DM	6 (11.1%)	4 (66.7%)	*0.005**
	Smoking	29 (53.7%)	5 (83.3%)	>0.05
BMI category	18.5 to <25	19 (35.2%)	1 (16.7%)	*0.01**
	25 to <30	28 (51.9%)	1 (16.7%)	
	30- 35	7 (13.0%)	4 (66.7%)	
Daily sitting	> = 6 hours per day	38 (70.4%)	6 (100.0%)	>0.05
	<6 hours per day	16 (29.6%)	0 (0.0%)	
History of previous PNS		8 (14.8%)	4 (66.7%)	*0.01**
Preoperative duration		15.4±4.7	12± 3.8	0.09
Number of pits		1.5±0.6	1.6±0.7	>0.05

DISCUSSION

A long list of surgeries has been described for management of PNS, which itself reflects the need for a safe and efficient surgical method for this entity. Recurrence is the main problem associated with all techniques described. **Gandhi *et al.*** [14] reported recurrence rate of 21.4% to 100% for incision and drainage, compared to 5.5%–33% for excision and lay open, 8% for marsupialization, 3.3%–11% for Z-plasty. Flap techniques have been associated with lower complication and recurrence rates. Complete excision of the sinus is widely practiced, but controversy remains about what to do with the wound after excision [15]. It is postulated that the disease is correlated with male sex hormones, therefore, it is a young male disease that mainly occurs in the second and third decade of life [16]. Nevertheless, some studies have shown age more than 40 years [17].

PNS is higher in males, age group 15 to 30 years and BMI >25 kg\m^2 and these results agree with Farrell and Murphy [18]. **Shah *et al.*** [19] supported this fact as 63.3% of their patients were <30 years of age, and 86.7% of the patients were males. Weight had its unique importance in the development of pilonidal sinus disease. Forty patients in the current study were overweight with BMI more than 25 kg/m^2 (66.6%). Many different authors have proved the role of the weight and the local hair distribution in the occurrence of PNS in their studies [20,21].

Other studies support higher frequency of PNS occurrence in males that was assumed by other international and national studies reporting [22, 23].

In this work, the average preoperative duration of PNS was 15 months. **Shah *et al.*** [19] reported that, the duration of PNS before presentation was less than one year in 60% of the cases.

The most common clinical presentation was discharge, that is in line with **Topgül *et al.*** [24] while the commonest stage in this study was stage 2 as in **Guner *et al.*** [25] study.

Primary repair group had shorter operative time and less blood loss, as reported by **Muzi *et al.*** [26] due to small defect and minimal dissection. In the **Tavassoli *et al.*** [6] study, the mean operation time was (29.2) minutes in the flap group and (23.7) minutes in the primary repair group (P=0.34)". **Galal Elshazly and Said** [27] demonstrated operative time of (40.6) minutes in the primary closure group, and (55.2) minutes in the Limberg flap group.

In our study, no significant difference between the two groups regarding postoperative complications. In a study by **Cihan *et al.*** [28], higher rate of infection and wound dehiscence was reported in primary off midline repair group. Oral antibiotics and daily dressing were used to manage wound infection. There are different reports on the rate of wound infection from 0 to 8% depending on several factors such as drain placement and BMI [29]. Interestingly, there was no association between infection and type of operations [30,31].

In a study by **Kafadar** [32], flap necrosis was not encountered. He thought that this may have resulted from the fact that the flap pedicle was not kept short while turning flap.

The more dissection in flap group patients resulted in a higher rate of hyposthesia (16.6%) while it was (6.6%) in the primary off midline repair group (p>0.05). These results agree with **Youssef *et al.*** [33] as hyposthesia was recorded in (10%) of Limberg group and (3.3 %) in the primary repair group. This also comparable with the studies conducted by **Akin *et al.*** [34] **and Søndenaa *et al.*** [35] who reported hyposthesia in (8.9%) and (9.5%) of their patients, respectively.

Wound healing, was defined as stitch removal time. Compared with the study of **Tocchi *et al.*** [30] that showed (10.3) days for wound healing in the primary repair group. **el-Khadrawy *et al.*** [36] reported (11) days for the wound healing in the Limberg flap group. **Katsoulis *et al.*** [17] performed a study with Limberg's flap procedure and they found wound complication rate was 16%.

Akca *et al.* [37] study conducted in 102 cases showed that (2.9%) patients developed seroma, two (1.96%) had wound dehiscence, and one patient had suppurative wound infection. **Mentes *et al.*** [29] analyzed 353 patients' Limberg flap procedure for pilonidal sinus and revealed no neither wound dehiscence nor flap necrosis in any case. Total wound complications were reported in 22 patients (36.6%). 13 patients (43.3%) of the primary off midline repair group and 9 cases (30%) of the Limberg group. With the Limberg flap technique, internal flap cleft can be flattened and tissue can be approximated without tension. **El-khadrawy *et al.*** [36] operated on 40 patients and had superficial necrosis at the tip of the flap in four patients (10%) which may be due to the design of the long flap or fault technique.

Hospital stay in our study has no significant difference it was (1.2) days in the primary off midline closure group and (1.5) days in the Limberg flap group. In a study by **Youssef *et al.*** [33], hospital stay was (1.8) days in the primary repair group and (3.8) days in the Limberg flap group (p<0.05). **Singh *et al.*** [38] noticed longer hospital stay with Limberg flap method. **Tocchi *et al.*** [30] reported that "return to work was (11.7) days in the primary repair group and there was no significant difference in the type of operations. In our study, returning to work was significantly sooner in the primary off midline repair group (17) days for the primary repair group and (20) days for the Limberg flap groups (P=0.0002). In contrast to **Tavassoli *et al.*** [6], it was (8.22) days for the primary repair group and (12.9) days for the flap groups. In contrast, **Ersoy *et al.*** [39] stated that "there was no difference in the time required to return to work between the Limberg flap and primary closure". On the other hand, **Akin *et al.*** [34] demonstrated that "the Limberg flap method was more advantageous compared to excision and primary closure with respect to hospitalization period and time required to return to work".

First pain-free toilet sitting was another factor that had been evaluated in patients. **Mahdy** [40] reported that the first toilet sitting was earlier in the Limberg flap group. In a study by **Akin *et al.*** [34]**.** The first toilet sitting was (16) days. **Tavassoli et al.** [6] reported that, the first toilet sitting was (6.9) days for the flap group and (10) days for the primary closure group (P =0.02). However, in our study it was (6) days for the primary off midline closure group and (8.5) days for the Limberg flap group which is significantly different (P= 0.0001), it may be attributed to larger wound and stitch line or patient fears.

In his retrospective study with 260 cases **Muzi *et al.*** [26] compared the primary closure and the Limberg flap, and stated that postoperative pain was lower in the primary closure group, which is compared to the current work. **Tavassoli *et al.*** [6] reported that, "the first day postoperative pain score was (6.4) in the primary repair group and (4.7) in the flap group (P=0.08)". The primary off midline repair group pain score on the fourth day was (2.7) versus (3.1) in the flap group in our study. The same findings were reported by **Akca *et al.*** [37]**. Muzi *et al.*** [26] compared the Limberg flap and primary closure and stated that "postoperative pain was lower in the excision and primary closure". At the time of stitch removal, it was (1.5) in both groups with no significant difference. **Kafadar** [32] suggested that, although in Limberg flap technique incision is larger and intact tissue is used as a flap, pain was not different from patients with primary suture technique.

Closed suction drain was placed in many studies, before the primary closure or under the flap, so that the complications were prevented by avoiding potential space formation as well as seroma and hematoma [28,39-41]. However, some authors have suggested that "the use of drains is unnecessary because hematoma and seroma can be prevented through a meticulous and patient hemostasis". These authors also reported that the drain use increases the pain killers need, also the risk for wound infection and prolongs the hospitalization period [29, 42].

In line with current results, **Singh *et al.*** [38] claimed that drain amount is more with the flap group most probably due to more tissue handling and mobilization in Limberg flap method than

in primary excision method. In few patients, there was accidental drain removal on the first postoperative day that resulted in seroma formation. They also claimed that a seroma is a collection of fluid that builds up under the surface of skin. The cause of seroma formation is tissue disruption or tissue removal. To prevent seroma formation, vacuum suction tube drain must be placed in all patients. Seroma managed by external drainage or aspiration to prevent infection, abscess formation, delayed wound healing, wound dehiscence, and flap necrosis.

In our study, time for drain removal in the Limberg flap group is (17.5) days and in the primary off midline closure group was (15.6) days with no significant difference. **Youssef *et al.*** [33] reported that time for drain removal in the Limberg flap group was (4.5) days and in the primary closure group (10.2) days (P=<0.01).

Cosmetic satisfaction according to VAS scoring system was significantly higher in the primary off midline closure group compared to the Limberg flap group. **Topgül** [43] reported that cosmetic satisfaction was higher in the primary repair group. On the other hand, **Can *et al.*** [44] reported a high rate of satisfaction with flaps procedure similar to the study of **Nursal *et al.*** [45]. In **Karaca *et al.*** [46], patients who had primary closure after excision were more satisfied in terms of aesthetic outlook.

Recurrence is the most important factor between patients and surgeons. Because of its emotional and socio-economic effects, the ideal procedure should have lower recurrence rates. Recurrences most commonly occur in the first year [29]. According to **Søndenaa *et al.*** [35], chronic inflammatory process is responsible for recurrences. Wound infection delays wound healing and causes recurrences. **Aydede *et al.*** [47] reported no significant recurrence rate. On the other hand, in the study of **Akca *et al.*** [37] recurrence rate was lower in the Limberg flap group than the primary repair group.3.2% patients had recurrences at the end of the follow up period in Limberg flap group.

In the current study, recurrence was reported in six patients (20%) of the primary off midline closure group and in no patient in the Limberg flap group. Insufficient hygiene at the intergluteal sulcus was noticed in the recurrent cases [48]. As many studies showed, elimination of the preventable risk factors is important for preventing recurrence in addition to the good surgical technique. Therefore, we advised patients in our study regarding the importance of local hygiene. **Bascom** [50] stated that "Postoperative recurrences, like the original sinus, develop in the midline and as the natal cleft becomes deeper, an anaerobic medium is created, resulting in an increased anaerobic bacterial content. Furthermore, the vacuum effect created between the heavy buttocks sucks the anaerobic bacteria, hair, and debris into the subcutaneous fat tissue which are available in the primary closure". **Singh *et al.*** [38] believed that the successful results after flap reconstructions stem from the fact that the deep midline is eliminated; Flattening of natal cleft is achieved when the midline is lateralized or flattened, recurrences are less likely to occur than after the primary closure.

On analysis the risk factors in the recurrent cases of PNS, it shows that hairy persons, previous history of PNS, positive family history and diabetes had significant impact as regard the recurrence rate. The Limberg flap technique has become the most preferred and appropriate surgical procedure because it`s simplicity, production of minimal discomfort; minimum wound care required; and low recurrence rate and postoperative complication rate [49]. **Mentes *et al.*** [29] conclude that quick healing time, short hospital stay, early return to daily life, low complication and recurrence rate are the important advantages of the Limberg flap procedure. **Daphan *et al.*** [50] assumed that The Limberg flap procedure is an easy and effective technique. Patient comfort, quick healing time, early return to full activity, and low complication and recurrence rates are the important advantages of this procedure. **Ertan *et al.*** [13] reported on 100 consecutive cases and observed shorter hospital stay, earlier healing, shorter time of work, lower ratios of complications, and lower pain perception, are the main advantages of Limberg flap.

Conclusion: Limberg flap technique had proved effective in treatment of sacrococcygeal pilonidal sinus disease, attaining significant lower recurrence rate than excision with primary closure. On the other hand, primary off midline closure achieved much shorter operative time, hospital stay and return to work. Both techniques had similar complication rate with better cosmetic result on favor of primary off midline closure. Hirsute body nature, diabetes mellitus, positive family history and previous pilonidal sinus surgery were recognized as significant risk factors for recurrence.

Conflict of interest disclosure: None to disclosed.

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