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Comparative Study between Excision of Pilonidal Sinus Via Lay Open Technique Versus Closed Technique and between Karydakis Technique Versus Limberg Technique: Meta Analysis

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Abstract

Background: Pilonidal sinus disease is a chronic inflammation and infection of the sacrococcygeal region, it is a common disease, affecting roughly 26 per 100 000 population, usually appears at age between 15&25 years old and predominantly affects young males. It can cause pain, sepsis, and reduced quality of life and has an impact on the individual's ability to attend work or education. Risk factors for the condition include male gender, young age, obesity, hairiness, deep natal cleft, and poor hygiene.

Aim of Study: To conduct a systematic review and meta-analysis for studies comparing between excision of pilonidal sinus and lay open versus primary closure and between karydakis technique versus limberg technique regarding wound healing. wound complications, and recurrence rate.

Material and Methods: We have performed an electronic search for PubMed, Cochrane library, Google Scholar, resulting in 334 studies filtered for title and abstract resulting in 152 studies eligible for full text search, then second filter was done for full text excluding 128 unrelated studies and 24 studies were obtained, 9 studies compared between lay open and primary closure technique & 15 studies comparing karydakis technique and limberg technique.

Results: Complication rate was 16.41% in lay open group, 22.55% with primary closure group and it was 15.45% with Karydakis flap and about 20% with limberg flap. Recurrence rate was 8.91% after lay open, 6.83% after primary closure, 3.09% after Karydakis flap and 4.89% after limberg flap.

Conclusion: Lay open procedure was associated with shorter operative time and reduced risk of recurrence or complication rate in comparison to primary closure technique, but it take more time for hospital stay and wound healing. Also, Karydakis technique was associated with shorter operative time, shorter hospital stays, lower need to resuture, higher satisfaction with no significant difference regarding complication and recurrence rate. So, it was recommended to use karydakis technique in routine clinical practice.

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Key Words: *Pilonidal sinus – Lay open technique – Closed technique – Karydakis technique – Limberg technique.*

Introduction

PILONIDAL (pilus = hair, nidus = nest) sinus disease is common, affecting roughly 26 per 100 000 population **[1]**. It is rarely seen before puberty or in later life and predominantly affects young males. It can cause pain, sepsis, and reduced quality of life and has an impact on the individual's ability to attend work or education. Risk factors for the condition include male gender, young age, obesity, Mediterranean ethnicity, hairiness, deep natal cleft, and poor hygiene **[2]**.

The exact aetiology of pilonidal sinus disease is unclear; however, it is thought to be related to hormone changes leading to enlargement of hair follicles with resultant blockage in the pilosebaceous glands in the sacrococcygeal area. The movement of the buttock and the shape of the natal cleft facilitate the burial of the barbed shaped hairs into these sinuses, which in turn exacerbates the infection acting as a foreign body **[3]**.

Pilonidal sinus disease can initially present as either an acute abscess or a discharging sinus. Regardless of the disease presentation, the ideal treatment for patients who suffer from pilonidal sinus disease should allow a cure with a rapid recovery period allowing return to normal daily activities, with a low level of associated morbidity **[3]**.

A variety of different surgical techniques have been described for the primary treatment of pilonidal sinus disease, and current practice remains variable and contentious. While some management

options have improved for some patients, the complications of surgery may be worse than the primary disease [3].

When assessing the outcomes of various pilonidal treatment, there are many factors to be considered: Time to complete healing and frequency of unhealed wounds in clinical trials, disease recurrence, number of operations needed to achieve healing, postoperative wound complications, Time to return to work/education and few clinical studies, however, record all these parameters. Inadequate follow-up duration for patients recruited into studies may also underreport the associated complications or recurrence. This clinical review aims to provide an update on the management options to guide clinicians involved in the care of patients who suffer from sacrococcygeal pilonidal sinus disease [3].

Aim of the work:

To conduct a systematic review and meta-analysis for studies comparing between excision of pilonidal sinus and lay open versus closure technique, and between karydakis technique versus limberg technique regarding wound healing. Wound complications, and recurrence rate.

Material and Methods

We prepared this systematic review with a careful following of the Cochrane Handbook for Systematic Reviews of Interventions. We also preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines during the design of our study.

We include studies that met our following inclusion criteria: Studies; which published between 2010 & 2020 in English language only, population: Patients with pilonidal sinus, intervention: Excision of pilonidal sinus, comparator: Lay open or Closure with karydakis technique or limberg technique, and outcome parameters with special emphasis on short term outcome, long term outcome and study design.

Search strategy for identification of studies: An electronic search was conducted till January 2022 using PubMed, Google scholar, Scopus, Web of Science, and Cochrane Library: We used the following keywords; "pilonidal sinus" , "lay open", "karydakis", "limberg", "Wound Closure", "Grafting". We used “OR” and “AND” operators during Literature search.

Method of the review:

Locating and selecting studies: Titles and abstracts of articles identified using the above search strategy were viewed, and articles that appeared to fulfil our study types were retrieved in full, when there was a doubt, a second reviewer assessed the article and consensus were reached.

PRISMA flow chart was produced based on the search results and the inclusion/exclusion criteria as in Fig. (1).

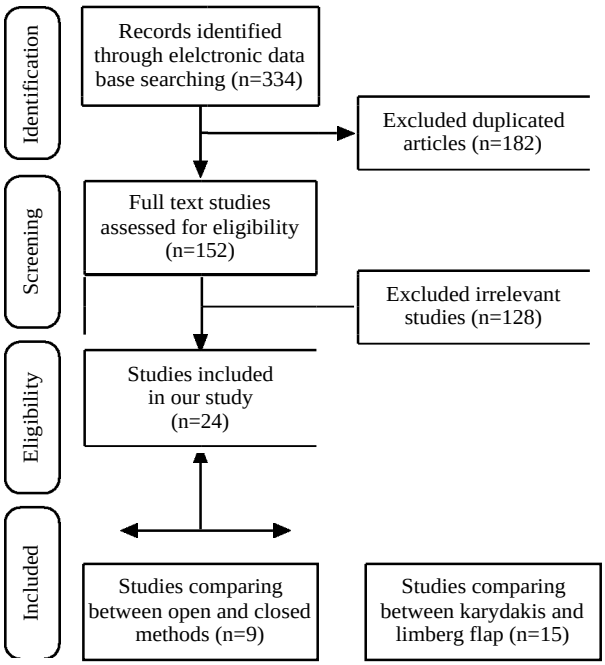

Fig. (1): PRISMA flow chart for inclusion and exclusion criteria.

Data extraction: A standardized extraction form was prepared by MS Excel. Authors independently extracted the following data from each of the included study: (1) Study characteristics; (2) Participants' baseline characteristics; (3) Risk of bias domains; and (4) Endpoint outcomes.

Statistical analysis: Where data were reported consistently across studies for certain outcomes, they were pooled together in quantitative synthesis. Continuous data were pooled as mean difference (MD) and 95% confidence interval, while dichotomous outcomes were pooled as odds ratio (OR) and 95% confidence interval. Review Manager (RevMan, Cochrane Collaboration) version 5.3 was used to pool studies. We used I square value and its p-value to quantify degree of heterogeneity. We used random effect model when I square value is more than 50%.

Publication Bias: We assessed publication bias using Egger test and funnel plot methods.

Results

A total of 334 studies were selected from the aforementioned databases for further screening. We excluded 182 duplicated articles, meta-analysis and systematic review and 128 other articles because of irrelevant topics, the remaining 24 studies were included, 9 studies from them comparing between excision of pilonidal sinus via lay open versus closed technique and 15 studies comparing between karydakis technique and limberg technique.

A- *In comparing between excision of pilonidal sinus via lay open technique versus closed technique:*

9 studies comparing between excision of pilonidal sinus via lay open technique versus closed techniques were included 5 were retrospective studies, 3 were RCTs and one Descriptive cross sectional study as shown in Table (1).

Table (1): Study characteristics.

Author	Type of study
Pfammatter M et al., **[4]**	Retrospective
Ekici U et al., **[5]**	Retrospective
Shakor FN et al., **[6]**	Retrospective
Anandaravi BN et al., **[7]**	Descriptive cross sectional study
Jabbar MS et al., **[8]**	RCT
Borel F et al., **[9]**	Retrospective
Kamran H et al., **[10]**	RCT
Yoldas T et al., **[11]**	Retrospective
Lorant T et al., **[12]**	RCT

743 cases were included with m/f 567/176 and mean age was 24.19 years as shown in Table (2).

Table (2): Patient's characteristics.

Author		Number	Age	m/f
	Lay open	32	15.5	19/13
Pfammatter M et al., **[4]**	Primary closure	24	15.5	17/7
	Lay open	53	25.5	45/8
Ekici U et al., **[5]**	Primary closure	195	23.6	153/42
	Lay open	69	22.96	48/21
Shakor FN et al., **[6]**	Primary closure	50	22.96	35/15
	Lay open	20	23.7	16/4
Anandaravi BN et al., **[7]**	Primary closure	10	23.7	8/2
	Lay open	30	28.43	27/3
Jabbar MS et al., **[8]**	Primary closure	30	27.4	29/1
	Lay open	27	26.6	15/12
Borel F et al., **[9]**	Primary closure	17	25.6	12/5
	Lay open	33	25.3	25/8
Kamran H et al., **[10]**	Primary closure	32	24.1	24/8
	Lay open	30	24.6	26/4
Yoldas T et al., **[11]**	Primary closure	11	24.6	9/2
	Lay open	41	28.5	33/8
Lorant T et al., **[12]**	Primary closure	39	27	28/11

Mean follow-up period was 17.69 months as shows in Table (3).

Table (3): Follow-up.

Author		Follow-up/mn
	Lay open	15.9
Pfammatter M et al., **[4]**	Primary closure	6.3
	Lay open	21.8
Ekici U et al., **[5]**	Primary closure	22.7
	Lay open	17.28
Shakor FN et al., **[6]**	Primary closure	17.28
	Lay open	
Anandaravi BN et al., **[7]**	Primary closure	
	Lay open	
Jabbar MS et al., **[8]**	Primary closure	
	Lay open	9
Borel F et al., **[9]**	Primary closure	7
	Lay open	29.5
Kamran H et al., **[10]**	Primary closure	29.5
	Lay open	23.7
Yoldas T et al., **[11]**	Primary closure	23.7
	Lay open	12
Lorant T et al., **[12]**	Primary closure	12

A total of 147 cases showed complications in form of infection, wound dehiscence, bleeding, scar fissure, chronic pain as shown in Table (4).

4 studies included comparing operative time/ min in Lay open group versus Primary closure group shows significant longer time in Primary closure group versus Lay open group p-value 0.009.

5 studies included comparing hospitalization/ days in Lay open group versus Primary closure group shows significant longer time in Lay open group versus Primary closure group p-value 0.0001.

6 studies included comparing time taken for wound healing/days in Lay open group versus Primary closure group shows significant longer time in Lay open group versus Primary closure group p-value <0.0001.

9 studies included comparing Complications in Lay open group versus Primary closure group shows insignificant higher rate of complications in primary closure group versus lay open group

6 studies included comparing Recurrence in Lay open group versus Primary closure group shows insignificant higher recurrence rate in primary closure group versus lay open group p-value 0.022.

B- *In comparing between karydakis technique versus limberg technique:*

15 studies comparing between excision of pilonidal sinus by Karydakis technique versus Limberg technique were included, 10 studies were RCT, 4 were retrospective studies and 1 Interventional study as shown in Table (10).

Table (4): Complications.

Author		Complication	Infection	Wound dehiscence	Bleeding	Scar fissure	Chronic pain
	Lay open	18	6	7	5		
Pfammatter M et al., **[4]**	Primary closure	19	7	11	1		
	Lay open	5	5	0			
Ekici U et al., **[5]**	Primary closure	36	34	2			
	Lay open	14	3		2	5	4
Shakor FN et al., **[6]**	Primary closure	7	4		1	2	0
	Lay open	1	1				
Anandaravi BN et al., **[7]**	Primary closure	2	2				
	Lay open	6	6				
Jabbar MS et al., **[8]**	Primary closure	5	5				
	Lay open	1		1			
Borel F et al., **[9]**	Primary closure	7		7			
	Lay open	3	1	2			
Kamran H et al., **[10]**	Primary closure	6	3	3			
	Lay open	0					
Yoldas T et al., **[11]**	Primary closure	0					
	Lay open	7	1		6		
Lorant T et al., **[12]**	Primary closure	10	3		7		

Table (5): Meta-analysis for operative time/min.

Study	Lay open	Primary closure	SMD	SE	95% CI
Ekici U et al., **[5]**	34.3±6.4	34.6±7.9	-0.039	0.154	-0.344 - 0.265
Shakor FN et al., **[6]**	11	20	-0.728	0.190	-1.105 - -0.351
Borel F et al., **[9]**	16.4±7	25.5±4	0.000	0.141	-0.278 - 0.278
Kamran H et al., **[10]**	63.5±20.5	74.8±32.5	-0.412	0.248	-0.907 - 0.083
Total (fixed effects)			-0.209	0.086	-0.377 - -0.041
Total (random effects)			-0.272	0.174	-0.614 - 0.069
Test for heterogeneity:					
Q			11.5033		
DF			3		
Significance level			0.009*		
I2 (inconsistency)			73.92%		
95% CI for I2			27.03-90.68		

Q: Total variance for heterogeneity. I^2: Observed variance for heterogeneity.
SMD: Standardized Mean Difference. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (6): Meta-analysis for duration of hospitalization/days.

Study	Lay open	Primary closure	SMD	SE	95% CI
Pfammatter M et al., **[4]**	15.8±6.3	9±1.6	1.372	0.296	0.778 - 1.966
Ekici U et al., **[5]**	2.2±1.2	2.1±1	0.095	0.154	-0.209 - 0.400
Anandaravi BN et al., **[7]**	4.3±1.7	5.4±2.8	-0.462	0.360	-1.200 - 0.276
Borel F et al., **[9]**	0.5±0.6	0.2±0.4	0.586	0.144	0.302 - 0.870
Kamran H et al., **[10]**	4.74±1.84	3.64±1.52	0.643	0.252	0.140 - 1.146
Total (fixed effects)			0.436	0.089	0.260 - 0.612
Total (random effects)			0.460	0.233	0.003 - 0.918
Test for heterogeneity:					
Q			22.8359		
DF			4		
Significance level			0.0001 *		
I2 (inconsistency)			82.48%		
95% CI for I2			59.82 - 92.36		

Q: Total variance for heterogeneity. I^2: Observed variance for heterogeneity.
SMD: Standardized Mean Difference. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (7): Meta-analysis for time taken for wound healing/days.

Study	Lay open	Primary closure	SMD	SE	95% CI
Pfammatter M et al., **[4]**	20±4.5	21±4.1	-0.228	0.267	-0.763 - 0.308
Shakor FN et al., **[6]**	35±18.7	13±2.7	1.522	0.209	1.107 - 1.936
Anandaravi BN et al., **[7]**	51.65±22.8	14.2±2.9	2.242	0.458	1.303 - 3.181
Borel F et al., **[9]**	59±22	32±17	-1.368	0.157	-1.677 - -1.059
Kamran H et al., **[10]**	20.46±4.5	13.5±2.09	1.950	0.299	1.353 - 2.547
Yoldas T et al., **[11]**	19.5±4.1	17±3.2	0.736	0.441	-0.155 - 1.628
Total (fixed effects)			0.122	0.101	-0.075- 0.320
Total (random effects)			0.791	0.677	-0.539 - 2.121
Test for heterogeneity:					
Q			197.7546		
DF			5		
Significance level			p<0.0001*		
I2 (inconsistency)			97.47%		
95% CI for I2			96.13-98.35		

Q: Total variance for heterogeneity. I^2: Observed variance for heterogeneity.
SMD: Standardized Mean Difference. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (8): Meta-analysis for complications.

Study	Lay open	Primary closure	Relative risk	95% CI
Pfammatter M et al., **[4]**	18/32	19/24	1.250	0.772 - 2.024
Ekici U et al., **[5]**	5/53	36/195	0.511	0.211 - 1.238
Shakor FN et al., **[6]**	14/69	7/50	1.449	0.631 - 3.327
Anandaravi BN et al., **[7]**	1/20	2/10		–
Jabbar MS et al., **[8]**	6/30	5/30	1.200	0.410 - 3.511
Borel F et al., **[9]**	1/27	7/17	7.000	0.877 - 55.859
Kamran H et al., **[10]**	3/33	6/32	1.939	0.530 - 7.101
Yoldas T et al., **[11]**	0/30	0/11		–
Lorant T et al., **[12]**	7/41	10/39	0.666	0.282 - 1.575
Total (fixed effects)	55/335	92/408	1.106	0.803 - 1.523
Total (random effects)			1.116	0.737 - 1.689
Test for heterogeneity:				
Q		8.689		
DF		6		
Significance level		0.1918		
I2 (inconsistency)		30.95%		
95% CI for I2		0.00-70.54		

Q: Total variance for heterogeneity. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).
I^2: Observed variance for heterogeneity.

Table (9): Meta-analysis for recurrence.

Study	Lay open	Primary closure	Relative risk	95% CI
Pfammatter M et al., **[4]**	12/32	3/24	3.000	0.951 - 9.467
Ekici U et al., **[5]**	3/53	5/195	2.208	0.545 - 8.941
Shakor FN et al., **[6]**	2/69	4/50	0.362	0.069- 1.902
Kamran H et al., **[10]**	2/33	7/32	3.394	0.762 - 15.125
Yoldas T et al., **[11]**	3/30	1/11	17.50	2.162 - 141.62
Lorant T et al., **[12]**	1/41	4/39	0.238	0.028- 2.035
Total (fixed effects)	23/258	24/351	1.785	1.040 - 3.063
Total (random effects)			1.863	0.649 - 5.347
Test for heterogeneity:				
Q		13.1025		
DF		5		
Significance level		0.022*		
I2 (inconsistency)		61.84%		
95% CI for I2		6.98-84.35		

Q: Total variance for heterogeneity. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).
I^2: Observed variance for heterogeneity.

Table (10): Study characteristics.

Author	Type of study
Mohamed Abd-Elfattah A et al., **[13]**	Interventional study
Destek S et al., **[14]**	Retrospective
Ekici U et al., **[5]**	Retrospective
El Hadidi A et al., **[15]**	RCT
Alvandipour M et al., **[16]**	RCT
Erkent M et al., **[17]**	Retrospective
Kartal A et al., **[18]**	Retrospective
Ahmed Z et al., **[19]**	RCT
Kohla SM et al., **[20]**	RCT
Bali .I et al., **[21]**	RCT
Tokac M et al., **[22]**	RCT
Bessa SS., **[23]**	RCT
Karaca T et al., **[24]**	RCT
Ates M et al., **[25]**	RCT
Can MF et al., **[26]**	RCT

A total of 2251 cases were included in both groups with mean age 26.14 years and m/f 1578/623 as shown in Table (11).

Mean symptoms durations was 10.3 months as mentioned in Table (12).

Meta analysis:

Regarding Operative time/min, 11 studies showing the mean Operative time/min in both groups with significant higher in Limberg techniquevs Karydakis technique p-value <0.0001, I^2 (inconsistency) 92.54%, 95% CI for I^2 88.60-95.11.

Regarding hospital stay/day, 7 studies showing the mean hospital stay/day in both groups with significant higher in Limberg techniquevs Karydakis technique p-value <0.0001, I^2 (inconsistency) 94.29%, 95% CI for I^2 90.56-96.54.

Complication:

4 studies showing the occurrence of hematoma in both groups with insignificant differences in Limberg techniquevs Karydakis technique p-value 0.8236, I^2 (inconsistency) 0.0%, 95% CI for I^2 0.00-82.71.

10 studies showing the occurrence of seroma in both groups with insignificant differences in Limberg techniquevs Karydakis technique p-value 0.6136, I^2 (inconsistency) 0.0%, 95% CI for I^2 0.00-70.73.

12 studies showing the occurrence of Wound disruption in both groups with insignificant differences in Limberg techniquevs Karydakis technique p-value 0.1711, I^2 (inconsistency) 27.90%, 95% CI for I^2 0.00-63.51.

3 studies showing the Need to resuture in both groups with insignificant higher in Limberg techniquevs Karydakis technique p-value 0.0390, I^2 (inconsistency) 69.17%, 95% CI for I^2 0.00-91.02.

Table (11): Patient's characteristics.

Author		No.	Age	m/f
Mohamed Abd-Elfattah A et al., **[13]**	Karydakis technique	10		
	Limberg technique	10		
Destek S et al., **[14]**	Karydakis technique	53	29.1	10/43
	Limberg technique	51	28.3	12/39
Ekici U et al., **[5]**	Karydakis technique	81	23.1	57/24
	Limberg technique	114	24.1	96/18
El Hadidi A et al., **[15]**	Karydakis technique	60	22	57/3
	Limberg technique	60	22	58/2
Alvandipour M et al., **[16]**	Karydakis technique	37	25.89	16/21
	Limberg technique	27	34.19	18/9
Erkent M et al., **[17]**	Karydakis technique	128	24	107/21
	Limberg technique	300	27	251/49
Kartal A et al., **[18]**	Karydakis technique	232	26.39	42/190
	Limberg technique	131	26.31	25/106
Ahmed Z et al., **[19]**	Karydakis technique	75	33.6	62/13
	Limberg technique	75	32.2	65/10
Kohla SM et al., **[20]**	Karydakis technique	15		
	Limberg technique	15		
Bali .I et al., **[21]**	Karydakis technique	34	23.5	32/2
	Limberg technique	37	25	32/5
Tokac M et al., **[22]**	Karydakis technique	45	28.35	39/6
	Limberg technique	46	29.28	40/6
Bessa SS., **[23]**	Karydakis technique	60	23	54/6
	Limberg technique	60	23	58/2
Karaca T et al., **[24]**	Karydakis technique	35	26.9	20/15
	Limberg technique	46	28.5	44/2
Ates M et al., **[25]**	Karydakis technique	135	24.45	123/12
	Limberg technique	134	25.5	117/17
Can MF et al., **[26]**	Karydakis technique	68	22	67/1
	Limberg technique	77	22	76/1

Table (12): Duration of symptoms.

Author		duration of symptoms/ mn
Mohamed Abd-Elfattah A et al., **[13]**	Karydakis technique	
	Limberg technique	
Destek S et al., **[14]**	Karydakis technique	8
	Limberg technique	6
Ekici U et al., **[5]**	Karydakis technique	
	Limberg technique	
El Hadidi A et al., **[15]**	Karydakis technique	
	Limberg technique	
Alvandipour M et al., **[16]**	Karydakis technique	11.5
	Limberg technique	9
Erkent M et al., **[17]**	Karydakis technique	
	Limberg technique	
Kartal A et al., **[18]**	Karydakis technique	
	Limberg technique	
Ahmed Z et al., **[19]**	Karydakis technique	
	Limberg technique	
Kohla SM et al., **[20]**	Karydakis technique	
	Limberg technique	
Bali .I et al., **[21]**	Karydakis technique	12.66
	Limberg technique	14.32
Tokac M et al., **[22]**	Karydakis technique	9
	Limberg technique	9
Bessa SS., **[23]**	Karydakis technique	12
	Limberg technique	12
Karaca T et al., **[24]**	Karydakis technique	
	Limberg technique	
Ates M et al., **[25]**	Karydakis technique	
	Limberg technique	
Can MF et al., **[26]**	Karydakis technique	
	Limberg technique	

12 studies showing the Wound infection in both groups with insignificant differences in Limberg techniquevs Karydakis technique p-value 0.3285, I2 (inconsistency) 11.88%, 95% CI for I^2 0.00-51.57.

Regarding satisfaction: 6 studies showing the satisfaction in both groups with significant higher in Karydakis techniquevs Limberg technique p-value 0.0087, I^2 (inconsistency) 67.58%, 95% CI for I^2 23.05 to 86.34.

Regarding recurrence: 6 studies showing the recurrence in both groups with insignificant differences in Karydakis techniquevs Limberg technique p-value 0.9247, I^2 (inconsistency) 0.0%, 95% CI for I^2 0.00-10.89.

Table (13): Meta-analysis for operative time/min.

Study	Karydakis technique	Limberg technique	SMD	SE	95% CI	*t*	*p*
Mohamed Abd-Elfattah A et al., **[13]**	41.7 (4.22)	51.5 (4.17)	2.237	0.555	1.070 - 3.404		
Destek S et al., **[14]**	45.0 (11.7)	54.0 (12.9)	0.726	0.201	0.327 - 1.125		
Ekici U et al., **[5]**	33.7 (8.4)	34.6 (7.9)	0.111	0.145	-0.175 - 0.396		
Alvandipour M et al., **[16]**	23.03 (6.06)	29.15 (7.69)	0.89	0.262	0.366 - 1.414		
Kartal A et al., **[18]**	46.85(10.46)	54.31 (6.41)	0.808	0.113	0.586 - 1.031		
Kohla SM et al., **[20]**	37.73(12.98)	61.6 (11.1)	1.923	0.433	1.035 - 2.811		
Tokac M et al., **[22]**	42.9 (6.2)	44.5 (6.6)	0.248	0.209	-0.167 - 0.662		
Bessa SS., **[23]**	33.0 (4.9)	52.0 (5.8)	3.516	0.291	2.941 - 4.092		
Karaca T et al., **[24]**	33.5 (15.7)	45.3 (11.3)	0.881	0.207	0.471 - 1.292		
Ates M et al., **[25]**	42.32 (8.64)	50.14 (6.96)	0.994	0.129	0.740 - 1.247		
Can MF et al., **[26]**	40.4 (2.5)	52.8 (16)	1.046	0.177	0.697 - 1.395		
Total (fixed effects)			0.858	0.0556	0.749 - 0.967	15.449	<0.001 *
Total (random effects)			1.142	0.216	0.718 - 1.566	5.285	<0.001 *
Test for heterogeneity:							
Q			133.9738				
DF			10				
Significance level			<0.0001 *				
I2 (inconsistency)			92.54%				
95% CI for I2			88.60-95.11				

Q: Total variance for heterogeneity. I^2: Observed variance for heterogeneity.
SMD: Standardized Mean Difference. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (14): Meta-analysis for hospital stay/day.

Study	Karydakis technique	Limberg technique	SMD	SE	95% CI	*t*	*p*
Ekici U et al., **[5]**	1.9 (1.1)	2.1 (1.0)	0.191	0.145	-0.095- 0.477		
Alvandipour M et al., **[16]**	1.41 (0.49)	1.48 (0.5)	0.14	0.25	-0.361 - 0.640		
Kartal A et al., **[18]**	2.1 (0.73)	3.31 (0.87)	1.542	0.123	1.299 - 1.784		
Ahmed Z et al., **[19]**	2.93 (0.66)	3.97 (0.71)	1.51	0.184	1.145 - 1.874		
Tokac M et al., **[22]**	1.03 (0.17)	1.06 (0.3)	0.122	0.208	-0.292 - 0.535		
Ates M et al., **[25]**	3.43 (0.94)	3.8 (1.19)	0.344	0.123	0.103 - 0.585		
Can MF et al., **[26]**	4.8 (2.6)	5.5 (2.0)	0.303	0.166	-0.026- 0.632		
Total (fixed effects)			0.682	0.0593	0.565 - 0.798	11.50	<0.001 *
Total (random effects)			0.6	0.254	0.102 - 1.098	2.363	0.018*
Test for heterogeneity:							
Q			105.0396				
DF			6				
Significance level			<0.0001 *				
I2 (inconsistency)			94.29%				
95% CI for I2			90.56-96.54				

Q: Total variance for heterogeneity. I^2: Observed variance for heterogeneity.
SMD: Standardized Mean Difference. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (15): Meta-analysis for hematoma.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
Destek S et al., **[14]**	1/53	1/51	1.039	0.067- 16.176		
Alvandipour M et al., **[16]**	0/37	0/27	-			
Bali İ et al., **[21]**	3/34	8/37	2.450	0.707 - 8.489		
Ates M et al., **[25]**	1/135	3/134	3.022	0.318 - 28.692		
Total (fixed effects)	5/259	12/249	2.291	0.842 - 6.229	1.624	0.104
Total (random effects)	5/259	12/249	2.276	0.828 - 6.256	1.594	0.111
Test for heterogeneity:						
Q			0.3881			
DF			2			
Significance level			0.8236			
I2 (inconsistency)			0.00%			
95% CI for I2			0.00 - 82.71			

Q : Total variance for heterogeneity.
RR: Relative risk.
I2 : Observed variance for heterogeneity.
CI : Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (16): Meta-analysis for seroma.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
Destek S et al., **[14]**	4/53	3/51	0.779	0.183 - 3.312		
Ekici U et al., **[5]**	6/81	8/114	0.947	0.342 - 2.626		
Erkent M et al., **[17]**	8/128	28/300	1.493	0.700 - 3.187		
Kartal A et al., **[18]**	10/232	13/131	2.302	1.039 - 5.104		
Ates M et al., **[25]**	2/135	3/134	1.511	0.257 - 8.900		
El Hadidi A et al., **[15]**	1/60	1/60	1.000	0.064- 15.622		
Alvandipour M et al., **[16]**	13/37	3/27	0.316	0.010- 1.002		
Bali .I et al., **[21]**	4/34	3/37	0.689	0.166 - 2.859		
Bessa SS., **[23]**	3/60	0/60	0.143	0.008- 2.707		
Can MF et al., **[26]**	1/68	3/77	2.649	0.282 - 24.876		
Total (fixed effects)	52/888	65/991	1.469	0.949 - 2.275	1.724	0.085
Total (random effects)	52/888	65/991	1.475	0.946 - 2.300	1.717	0.086
Test for heterogeneity:						
Q			2.6749			
DF			4			
Significance level			0.6136			
I2 (inconsistency)			0.00%			
95% CI for I2			0.00-70.73			

Q : Total variance for heterogeneity.
RR: Relative risk.
I2 : Observed variance for heterogeneity.
CI : Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (17): Meta-analysis for Wound disruption.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
Destek S et al., **[14]**	2/53	1/51	0.520	0.049- 5.556		
Ekici U et al., **[5]**	2/81	0/114	0.143	0.007- 2.932		
El Hadidi A et al., **[15]**	2/60	1/60	0.500	0.0466 - 5.368		
Alvandipour M et al., **[16]**	1/37	0/27	0.452	0.019- 10.697		
Erkent M et al., **[17]**	3/128	23/300	3.271	1.000 - 10.701		
Kartal A et al., **[18]**	19/232	28/131	2.610	1.518 - 4.486		
Ahmed Z et al., **[19]**	2/15	4/15	2.000	0.429 - 9.321		
Kohla SM et al., **[20]**	2/34	1/37	0.459	0.0436 - 4.841		
Bali .I et al., **[21]**	6/60	11/60	1.833	0.725 - 4.638		
Tokac M et al., **[22]**	4/43	0/61	0.079	0.0044- 1.428		
Bessa SS., **[23]**	8/135	14/134	1.763	0.765 - 4.064		
Karaca T et al., **[24]**	3/68	3/77	0.883	0.184 - 4.231		
Total (fixed effects)	54/946	86/1067	1.632	1.181 - 2.255	2.969	0.003
Total (random effects)	54/946	86/1067	1.475	0.915 - 2.379	1.594	0.111
Test for heterogeneity:						
Q			15.2558			
DF			11			
Significance level			0.1711			
I2 (inconsistency)			27.90%			
95% CI for I2			0.00 - 63.51			

Q : Total variance for heterogeneity.
RR: Relative risk.
I2 : Observed variance for heterogeneity.
CI : Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (18): Meta-analysis for Need to resuture.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
Bessa SS., **[23]**	0/60	9/60	19.00	1.131 - 319.28		
Ates M et al., **[25]**	1/135	4/134	4.030	0.456 - 35.588		
Can MF et al., **[26]**	4/68	2/77	0.442	0.084- 2.336		
Total (fixed effects)	5/263	15/271	2.679	1.042 - 6.891	2.045	0.041*
Total (random effects)	5/263	15/271	2.642	0.273 - 25.581	0.839	0.402
Test for heterogeneity:						
Q			6.4869			
DF			2			
Significance level			0.0390*			
I2 (inconsistency)			69.17%			
95% CI for I2			0.00 - 91.02			

Q : Total variance for heterogeneity.
RR: Relative risk.
I2 : Observed variance for heterogeneity.
CI : Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (19): Meta-analysis for Wound infection.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
Destek S et al., **[14]**	2/53	1/51	0.52	0.049- 5.556		
Ekici U et al., **[5]**	11/81	23/114	1.486	0.768 - 2.873		
El Hadidi A et al., **[15]**	2/60	1/60	0.5	0.047- 5.368		
Alvandipour M et al., **[16]**	3/37	1/27	0.457	0.050- 4.156		
Erkent M et al., **[17]**	2/128	8/300	1.707	0.367 - 7.926		
Kartal A et al., **[18]**	12/232	18/131	2.656	1.321 - 5.341		
Bali .I et al., **[21]**	8/34	4/37	0.459	0.152 - 1.389		
Tokac M et al., **[22]**	3/45	3/46	0.978	0.208 - 4.594		
Bessa SS., **[23]**	2/60	3/60	1.5	0.260 - 8.659		
Karaca T et al., **[24]**	2/43	0/61	0.142	0.007- 2.885		
Ates M et al., **[25]**	4/135	8/134	2.015	0.621 - 6.533		
Can MF et al., **[26]**	3/68	4/77	1.177	0.273 - 5.075		
Total (fixed effects)	54/976	74/1098	1.328	0.952 - 1.851	1.671	0.095
Total (random effects)	54/976	74/1098	1.301	0.876 - 1.930	1.304	0.192
Test for heterogeneity:						
Q			12.4824			
DF			11			
Significance level			0.3285			
I2 (inconsistency)			11.88%			
95% CI for I2			0.00-51.57			

Q : Total variance for heterogeneity.
RR: Relative risk.
I2 : Observed variance for heterogeneity.
CI : Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (20): Meta-analysis for satisfaction.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
El Hadidi A et al., **[15]**	57/60	56/60	0.982	0.899 - 1.074		
Kohla SM et al., **[20]**	12/15	10/15	0.833	0.538 - 1.292		
Tokac M et al., **[22]**	43/45	44/46	1.001	0.917 - 1.093		
Bessa SS., **[23]**	58/60	43/60	0.741	0.628 - 0.875		
Karaca T et al., **[24]**	27/43	46/61	1.201	0.916 - 1.575		
Can MF et al., **[26]**	60/68	71/77	1.045	0.938 - 1.165		
Total (fixed effects)	257/291	270/319	0.967	0.908 - 1.030	1.040	0.298
Total (random effects)	257/291	257/319	0.966	0.872 - 1.070	0.660	0.509
Test for heterogeneity:						
Q			15.4237			
DF			5			
Significance level			0.0087*			
I2 (inconsistency)			67.58%			
95% CI for I2			23.05 to 86.34			

Q : Total variance for heterogeneity.
RR: Relative risk.
I2 : Observed variance for heterogeneity.
CI : Confidence interval (LL: Lower limit -UL: Upper Limit).

Table (21): Meta-analysis for recurrence.

Study	Karydakis technique	Limberg technique	RR	95% CI	Z	*p*
Mohamed Abd-Elfattah A et al., **[13]**	1/10	1/10	1	0.072- 13.868		
Destek S et al., **[14]**	4/53	3/51	0.779	0.183 - 3.312		
Ekici U et al., **[5]**	2/81	3/114	1.066	0.182 - 6.235		
El Hadidi A et al., **[15]**	0/60	0/60		-		
Alvandipour M et al., **[16]**	1/37	0/27	0.452	0.019- 10.697		
Erkent M et al., **[17]**	5/128	24/300	2.048	0.799 - 5.248		
Kartal A et al., **[18]**	5/232	5/131	1.771	0.522 - 6.004		
Kohla SM et al., **[20]**	1/15	1/15	1.000	0.069- 14.554		
Bali .I et al., **[21]**	0/34	0/37		-		
Tokac M et al., **[22]**	2/45	3/46	1.467	0.257 - 8.372		
Bessa SS., **[23]**	1/60	2/60	2.000	0.186 - 21.474		
Karaca T et al., **[24]**	2/43	0/61	0.142	0.007- 2.885		
Ates M et al., **[25]**	4/135	9/134	2.267	0.715 - 7.183		
Can MF et al., **[26]**	3/68	4/77	1.177	0.273 - 5.075		
Total (fixed effects)	31/1001	55/1123	1.414	0.911 - 2.194	1.545	0.122
Total (random effects)	31/1001	55/1123	1.435	0.910 - 2.263	1.554	0.120
Test for heterogeneity:						
Q			5.1305			
DF			11			
Significance level			0.9247			
I2 (inconsistency)			0.00%			
95% CI for I2			0.00-10.89			

Q : Total variance for heterogeneity. I^2 : Observed variance for heterogeneity.
RR: Relative risk. CI: Confidence interval (LL: Lower limit -UL: Upper Limit).

Discussion

In this meta-analysis, 9 studies included comparing between excision of pilonidal sinus via lay open technique versus closed techniques were included 5 were retrospective studies (4;5; 6; 9; 11), 3 were RCTs (8; 10; 12) and one Descriptive cross-sectional study **[7]**.

The total number of the studied cases were 743 cases with male to female ratio 567/176 and mean age was 24.19 years. Mean follow-up period was 17.69 months with longest follow-up of 29.5 months by Kamran et al., **[10]**. 335 cases was operated by lay open technique versus 408 cases by primary closure technique.

The present meta-analysis also compared the outcome of karydakis technique versus limberg technique. 15 studies (5; 13-26) were included, 10 studies were RCT, 4 were retrospective studies and 1 Interventional study. A total of 2251 cases were included in both groups with mean age 26.14 years and m/f 1578/623. The Mean symptoms durations was 10.3 months. 1068 cases undergo karydakis technique versus 1183 undergo limberg technique.

A- *In comparing between open and primary closure technique regarding:*

1- Time taken for wound healing/days showed that 6 studies **[4,6,7,9-11]** included comparing time taken for wound healing/days in lay open group versus Primary closure group shows significant longer time in lay open group (34.268 ± 12.767) versus Primary closure group (18.449 ±5.33 1) *p*-value <0.0001. Out of these 6 studies 2 studies **[4,9]** have reported that Primary closure group take longer time for healing than lay open group. The differences in healing time may be due to the differences in cases comorbidities (such as DM and HTN) and intraoperative complications.

In agreement with our findings, the meta-analysis by McCallum et al., **[27]** included 18 trials (n=1573). 12 trials compared open healing with primary closure. The study reported that wounds heal more quickly after primary closure than after open healing but at the expense of increased risk of recurrence.

2- As regard Operative time/min, 4 studies **[5,6,9,10]** included comparing operative time/min in Lay open group versus Primary closure group shows significant longer time in Primary closure group (38.725± 11.1) versus Lay open group (31.3 ± 8.475) *p*-value 0.009.

All the studies **[5,6,9,10]** reported that significantly longer time in Primary closure group in comparison to Lay open group.

The shortest operative time was reported by Shakor et al., **[6]** (about 11 minute for lay open

group & 20 minute for primary closure group) however the longest operative time was reported by Kamran et al., [10] (63.5±20.5min for lay open group & 74.8±32.5 min for primary closure group).

3- As regard hospitalization/days, 5 studies [4,5,7,9,10] included comparing hospitalization/days in Lay open group versus Primary closure group shows significant longer time in Lay open group (5.508±2.328) versus Primary closure group (4.068 ±1.464) p-value 0.0001.

The majority of studies, Pfammatter et al., [4]; Ekici et al., [5]; Borel et al., [9]; Kamran et al., [10] reported that lay open group takes longer hospitalization period in comparison to Primary closure group. However, the study by Anandaravi et al., [7] reported that Primary closure group takes longer hospital stay in comparison to lay open group.

The shortest hospital stay was reported by Borel et al., [9] (0.5±0.6 day for lay open group & 0.2 ±0.4 day for primary closure group) however the longest hospital stay was reported by Pfammatter et al., [4] (15.8±6.3 day for lay open group & 9 ± 1.6 day for primary closure group).

However, in contrast to our results the meta-analysis by McCallum et al., [27] reported that Pooling of trials that compared open healing with midline closure showed no statistically significant difference in hospital stay.

4- Regarding rate of Complications, 9 studies [4-12] included comparing Complications in Lay open group versus Primary closure group. A total of 147 cases showed complications in form of infection, wound dehiscence, bleeding, scar fissure and chronic pain, with total complication rate of 19.7%, 55 cases from lay open group (16.4179%) and 92 cases from primary closure group (22.549%) with insignificant differences between the two groups regarding rate of complications.

The study by Pfammatter et al., [4] reported the highest rate of complications however Yoldas et al., [11] reported no any post operative complications.

The current study was supported by the results of the meta-analysis by McCallum et al., [27] who reported that Infection rates were marginally higher after open healing; however, this was not statistically significant. Of seven trials reporting data on 688 patients, the rate of complications did not differ. Five of these trials (433 participants) compared open healing with midline closure; no significant difference was found in rate of postoperative complications.

5- Regarding Recurrence rate, 6 studies [4-6, 10-12] included comparing Recurrence in Lay open group versus Primary closure group, totally recurrence occur in 47 cases, 23 of them from lay open group (8.914%) and 24 from primary closure group (6.837%), one of this studies [4] was performed on children complaining from pilonidal sinus and it show significant higher recurrence rate with lay open group (37.5%) versus primary closure group (12.5%), but the total results of the others studies show insignificant higher recurrence rate in primary closure group (6.42%) versus lay open group (4.86%) p-value 0.022.

Our meta-analysis was supported by the meta-analysis by Berthier et al., [28] who demonstrated the Superiority of flap repair vs direct closure or lay open in pilonidal sinus treatment. The meta-analysis demonstrated a lower risk of recurrence, a shorter duration of incapacity to work, a lower risk of wound infections, a lower risk of skin wound complications, and a shorter duration of hospitalisation in favour of flap vs direct closure. A shorter time to complete wound healing, ashorter duration of incapacity to work and insignificant difference regarding rate of recurrence for flap vs the laying open technique were observed.

Also, the meta-analysis by McCallum et al., [27] reported that Pooling of eight trials that compared open healing with midline closure showed a statistically significant lower recurrence rate with open healing.

B- *Comparing between karydakis technique and limberg technique regarding:*

1- Operative time/min showed that 11 studies [5,13,14,16,18,20,22-26] showing the mean Operative time/min in both groups with significant higher in Limberg technique (48.17 ±8.8) vs Karydakis technique (39.19±8.34) p-value <0.0001, I^2 (inconsistency) 92.54%, 95% CI for I^2 88.60-95.11.

In agreement with our results the meta-analysis by Gavriilidis & Bota [29] which aimed to compare differences in outcomes between these 2 flap-based techniques (Karydakis vs. Limberg) included 9 studies with a total of 1421 patient, of whom 773 (54.4%) underwent Limberg and 648 (45.6%) underwent Karydakis flap reconstruction and reported that Operative time was shorter by 7 minutes in the Karydakis group than in the Limberg group (mean difference 7.00min, 95% confidence interval [CI] 0.53 to 13.48).

However, the meta-analysis by Prassas et al., [30] which included Eight RCTs were identified

comparing Karydakis flap (KF) (n=554) to Limberg flap transposition (LF) (n=567). The mean operative time ranged from 33.5 to 50.9min in the KF group and from 44.5 to 53.5min in the LF group, with all studies favoring the KF arm. No data pooling was possible due to a high study inhomogeneity (I^2=97%).

2- As regard Hospital stay/day, 7 studies **[5, 16,18,19,22,25,26]** showing the mean hospital stay/day in both groups with significant higher in Limberg technique (3.03±0.94) vs Karydakis technique (2.514±0.956) p-value<0.0001, I^2 (inconsistency) 94.29%, 95% CI for I^2 90.56-96.54.

However, the meta-analysis by Prassas et al. [30]reported that No differences of the length of stay were detectable between the two study groups (SMD=–0.06; 95% CI [–0.35, 0.23]; p=0.69; 4 studies; I^2=73%).

Also, the meta-analysis by Gavriilidis & Bota **[29]** reported that for all other outcomes (wound infection/dehiscence, hematoma, recurrence, length of hospital stay and patient satisfaction), no significant differences were found between the 2 procedures.

One more recent meta-analysis by Emile et al. [31]aimed to review the outcome of randomized trials that compared Karydakis procedure (KP) and Limberg flap (LF). Fifteen randomized controlled trials (1943 patients) were included. There was no significant difference in the median hospital stay after both procedures (2.36 days after KP versus 2.24 days after LF) with a weighted mean difference of –0.144 (95%CI: –0.43 to 0.14, I^2=93.2%, p=0.33).

3- *As regard complication rate:*

3a- Wound infection, 12 studies **[5,14-18,20, 21,23-26]** showing the Wound infection in both groups with insignificant differences in Karydakis technique (5.53%) vs Limberg technique (6.739%) p-value 0.3285, I^2 (inconsistency) 11.88%, 95% CI for I^2 0.00-51.57.

In agreement with the present study, the meta-analysis by Gavriilidis & Bota **[29]** reported that as regard wound infection/dehiscence, no significant differences were found between the 2 procedures.

Also, in line with the present study Prassas et al., **[30]** reported that the meta-analytical data of the two methods showed comparable results regarding wound infection (OR=1.27; 95% CI [0.79, 2.05]; p=0.33; 8 studies; I^2=18%).

However, Emile et al., **[31]** reported that Karydakis technique had higher odds of wound infection (OR=1.87, 95%CI: 1.15-3.04, p=0.011).

3b- As regard Hematoma, 4 studies **[14,16,21,25]** showing the occurrence of hematoma in both groups with insignificant differences in Limberg technique (4.819%) vs Karydakis technique (1.93%) p-value 0.8236, I^2 (inconsistency) 0.0%, 95% CI for I^2 0.00-82.71.

In agreement with our results the meta-analysis by Gavriilidis & Bota **[29]** reported that there was no significant difference between Limbergvs Karydakis techniques as regard hematoma.

Also, the meta-analysis by Emile et al., **[31]** reported that there was no significant difference between LimbergvsKarydakis techniques as regard hematoma formation (OR=0.63, 95%CI: 0.3-1.31, I^2=0, p=0.22).

3c- Regarding seroma, 10 studies **[5,14-18,21, 23,25,26]** showing the occurrence of seroma in both groups with insignificant differences in Limberg technique (6.559%) vs Karydakis technique (5.855%) p-value=0.6136, I^2 (inconsistency) 0.0%, 95% CI for I^2 0.00-70.73.

The present study can be supported by Gavriilidis & Bota **[29]** who reported that the seroma formation rate was significantly higher in the Karydakis cohort (odds ratio [OR] 0.36, 95% CI 0.24 to 0.56); however, after excluding studies with a high risk of bias, the sensitivity analysis showed no significant differences in seroma formation rate between the 2 techniques (OR 0.76, 95% CI 0.31 to 1.85).

However, the meta-analysis by Prassas et al., **[30]** reported that Limberg technique was associated with a lower rate of post-operative seroma (OR = 2.03; 95% CI [1.15, 3.59]; p=0.01; 7 studies; I^2=0%).

Also, the meta-analysis by Emile et al., **[31]** reported that Karydakis technique was associated with higher rates of seroma than Limberg technique (OR=2.33, 95%CI: 1.39-3.9, p=0.001).

Furthermore, the meta-analysis by Bi et al., **[32]** in which a total of 39 studies and 5,061 patients were identified and the most common surgical intervention was the Limberg flap. The study reported that Limberg technique was associated with a relatively low seroma rate in comparison to Karydakis technique.

3d- Regarding the Wound disruption, 12 studies **[5,14-18,20-21,23-26]** showing the occurrence of Wound disruption in both groups with insignificant differences in Limberg technique (8.05%) vs Karydakis technique (5.708%) p-value 0. 1711, I^2 (inconsistency) 27.90%, 95% CI for I^2 0.00-63.51.

In agreement with the present study Prassas et al., **[30]** reported that the issue of wound disruption was addressed in seven studies. The meta-analysis of these results failed to show any differences between the two groups (OR=1.05; 95% CI [0.43, 2.57]; p=0.91; 7 studies; I^2=56%).

3e-As regard Need to resuture 3 studies **[23,25,26]** showing the Need to resuture in both groups with insignificant higher in Limberg technique (5.53%) vs Karydakis technique (1.9%) p-value 0.0390, I^2 (inconsistency) 69.17%, 95% CI for I^2 0.00-91.02.

In contrast the study by Can et al., **[26]** reported that need to resuture was higher in Karydakis technique (5.88%) in comparison to Limberg technique (2.59%).

4- As regard Satisfaction, 6 studies **[15,20,22, 23,24,26]** showing the satisfaction in both groups with insignificant higher in Karydakis technique (88.31%) vs Limberg technique (84.64%) p-value 0.0087, I2 (inconsistency) 67.58%, 95% CI for I^2 23.05 to 86.34.

This was in agreement with the meta-analysis by Emile et al., **[31]** who reported that Karydakis technique have a higher satisfaction score than Limberg technique (WMD=2.81, 95%CI: 0.65-3.77, p=0.01).

However, in contrast the meta-analysis by Gavriilidis & Bota **[29]** reported that as regard satisfaction, no significant differences were found between the 2 procedures. The differences in results may be due to the differences in inclusion criteria.

regarding to complication rate totally there were 402 cases show complication in form of wound infection, wound disruption, hematoma, seroma formation or subcutaneous fluid collection with insignificant higher rate of complication with limberg technique by 237 cases (21.29%) vskarydakis technique by 165 cases (16.65%).

5- As regard Recurrence, 14 studies **[5,13-18, 20-26]** showing that a total of 86 cases recomplain from pilonidal sinus in both groups, 31 cases after karydakis technique and the other 55 cases after limberg technique with insignificant difference in Karydakis technique (3.09%) vs Limberg technique (4.89%) p-value 0.9247, I^2 (inconsistency) 0.0%, 95% CI for I^2 0.00-10.89.

In agreement with the present study, the meta-analysis by Gavriilidis & Bota **[29]** reported that as regard recurrence, no significant differences were found between the 2 procedures.

Also, in agreement with the present study the meta-analysis Prassas et al., **[30]** by reported that there was no significant difference noted between Karydakis technique and Limberg technique with regard to the primary outcome variable, recurrence rate (OR=1.07; 95% CI [0.59-1.92]; p=0.83; 7 studies; I^2=40%).

Also, our results were supported by the meta-analysis by Emile et al., **[31]** who revealed that Persistence or recurrence of pilonidal sinus disease was recorded in 39 (4.4%) patients after Karydakis procedure and in 33 (3.7%) patients after Limberg flap. After exclusion of two studies with follow-up shorter than 6 months, there was no significant difference between the two groups in the odds of persistence/recurrence of pilonidal sinusdisease postoperatively (OR=1.22, 95%CI: 0.76-1.95, p=I^2=0, p=0.41).

However, the meta-analysis by Ray et al., **[33]** concluded that Limberg technique seems to have clinical advantage over Karydakis and Bascom procedure in terms of reduced recurrence rate following surgical excision of pilonidal sinus. Although, this advantage was clinically persisted on subgroup analysis but failed to achieve statistical significance.

Conclusion:

Lay open procedure was associated with shorter operative time and reduced risk of recurrence or complication rate in comparison to primary closure technique, but it take more time for hospital stay and wound healing. Also, Karydakis technique was associated with shorter operative time, shorter hospital stays, lower need to resuture, higher satisfaction with no significant difference regarding complication and recurrence rate. So, it was recommended to use karydakis technique in routine clinical practice.

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مقارنة منهجية وتحليل بعدى لما تم نشره من أبحاث مقارنة استئصال الناصور العصعصى وترك مكانه مفتوحاً مقابل اغلاق مكانه وبين استئصال الناصور عن طريق طريقة كيريداكس مقابل طريقة ليمبيرج

المقدمة : أن مرض الناصور العصعصي هو التهاب وعدوى مزمنة فى المنطقة العجزى العصعصية وهو مرض شائع حيث أنه يصيب حوالى ٢٦ شخص لكل ١٠٠٠٠٠ شخص وغالباً ما يصيب شباب الذكور فى الفئة العمرية بين ١٥&٢٥ سنة. ويسبب ألم وعدوى بكتيرية للمريض وهذا قد يؤثر على حياة المريض اليومية ويعيقه عن الذهاب إلى مكان عمله أو دراسته. وتتعدد عوامل الخطورة لهذا المرض ومنها الجنس الذكرى وسن الشباب والسمنة والجسم المشعر وسوء النظافة الشخصية والجلوس لفترات طويلة.

الهدف من هذه الرسالة : هو إجراء مراجعة منهجية وتحليل بعدى للدراسات التى تقارن بين استئصال الناصور العصعصى وتركه مفتوحاً مقابل اغلاقه وبين تقنية كيريداكس وتقنية ليمبيرج بخصوص التئام الجروح. مضاعفات الجروح ومعدل تكرار حدوث الناصور بعد العملية.

طرق البحث : لقد قمنا بعمل بحث الكترونى فى المواقع الآتية (PubMed, Cochrane library, Google Scholar) مستخدمين الكلمات (ناصور عصعصى & تركه مفتوحاً & اغلاق الناصور & كيريداكس & ليمبيرج) وتم إيجاد ٣٣٤ بحثاً ثم تم عمل ترشيح لكل من العنوان والملخص ونتج عن ذلك ١٥٢ بحثاً مؤهلين للترشيح الثانى للنص كاملاً وبعد عمل الترشيح الثانى ثم استبعاد ١٢٨ بحثاً غير متعلق بدراستنا وتم عمل دراستنا على ٢٤ بحث ٩ منهم كانت بتقارن بين استئصال الناصور وترك مكانه مفتوحاً أو اغلاق مكانه و١٥ بحث كانت بتقارن بين استئصال الناصور عن طريق تقنية كيريداكس أو بتقنية ليمبيرج.

النتائج : كان العدد الكلى للحالات ٢٢٩٤ حالة منهم ٣٣٥ حالة تم لهم عمل استئصال الناصور وترك مكانه مفتوحاً و ٤٠٨ تم اغلاق مكانه و ١٠٦٨ تم عمل طريقة كيريداكس لهم و ١١٨٣ طريقة ليمبيرج. و كانت نسبة الذكور إلى الاناث ٧٩٩/٢١٤٥ و ٥٠ حالة لم يذكر جنسهم. وكان معدل حدوث المضاعفات ١٦.٤١٪ مع الطريقة المفتوحة و ٢٢.٥٥٪ مع طريقة الاغلاق و١٥.٤٥٪ مع طريقة كيريداكس و ٢٠٪ مع طريقة ليمبيرج. بينما كان معدل حدوث الناصور مرة أخرى بعد عمل الطريقة المفتوحة ٨.٩١٪ وبعد الطريقة المغلقة ٦.٨٣٪ وبعد طريقة كيريداكس ٣.٠٩٪ وبعد طريقة ليمبيرج ٤.٨٩٪.

الخلاصة : يينصح بعمل استئصال للناصور وترك مكانه مفتوحاً أفضل من أغلاقه كما أنه يفضل عمل طريقة كيريداكس أفضل من طريقة ليمبيرج.