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Value of Laser Ablation in Treatment of Non-Branching Perianal Fistula: Systematic Review and Meta-Analysis

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Abstract

Background: Perianal fistula is a common anorectal disease that is associated with a decreased quality of life. Despite the advances made in recent years, the treatment of perianal fistula remains a challenge due the difficulty of maintaining continence while preventing recurrence.

Aim of Study: To do a systematic search and meta-analysis of the available literature to assess the outcome of FiLaC in the treatment of non-branching perianal fistula. The main objective is to learn about the healing rates and complications associated with FiLaC to reach a conclusion about its overall safety and efficacy.

Subjects and Methods: In the current systematic review meta-analysis, a total of 14 studies were included with a total of 809 patients, out of them 11 studies were retrospective, 1 prospective study, 1 cohort study and 1 case series.

Results: Pain post-operative assessed in 5 studies with event rate 9.5% and significant heterogeneity between studies. Success assessed in 14 studies with event rate 52.9% and significant heterogeneity between studies. Failure assessed in 14 studies with event rate 45.955% and significant heterogeneity between studies. Complications assessed in 14 studies with event rate 2.7% and significant heterogeneity between studies.

Data Sources: Medline databases (PubMed, Medscape, Science Direct. EMF-Portal) and all materials available in the Internet till 2022.

Conclusion: FiL aC is a promising, sphincter-saving technique for the treatment of perianal fistula. It has proven efficacy with more than half of the patients achieving complete healing after its primary application. The main advantage of FiL aC is the good safety profile with very few minor complications and almost no negative effects on continence.

Key Words: *Fistula-in-ano – Fistula laser closure – Ligation of intersphincteric fistula tract.*

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Introduction

PERIANAL fistula is a common anorectal disease that is associated with a decreased quality of life **[1,2]**. Despite the advances made in recent years, the treatment of perianal fistula remains a challenge due the difficulty of maintaining continence while preventing recurrence **[3]**.

Effective therapy may lead to faecal incontinence particularly in the treatment of high transphincteric and intersphincteric fistula. Most patients are more interested in preserving continence than in definitive fistula treatment **[4]**.

Their pathophysiological basis is the cryptoglandular hypothesis, according to which an infection of the intersphincteric glands leads to abscess formation, which points to the surface of the perianal skin **[5]**.

While simple perianal fistula can be treated with lay open fistulotomy with healing rates up to 98% **[6]**, complex perianal fistula treatment remains challenging, as perianal fistula may recur, or the patient's continence status may be compromised. In the last 2 decades, the treatment of perianal fistula has progressed from simple fistulotomy to a diversity of intricate sphincter-preserving techniques, this was primarily in response to concerns about the unacceptably high rates of incontinence associated with fistulotomy **[7]**.

Numerous surgical procedures have been introduced for the treatment of perianal fistula including ligation of intersphincteric fistula tract (LIFT), anal advancement flaps, injection of fibrin glue, collagen paste or autologous adipose tissue, fistula plug, video-assisted anal fistula treatment (VAAFT) and fistula laser closure (FiLaC) **[8-10]**.

The FiLaC technique involves the identification of the internal opening, sometimes by the injection of hydrogen peroxide or methylene blue from the external opening, debriding the fistula tract with a curette, closure of the internal opening, insertion of a plastic hollow catheter using a guide-wire, insertion of a disposable laser fibre into the catheter with its tip emerging at the internal orifice, and continuous delivery of laser energy circumferentially within the fistula tract while with drawing it at a rate of 1cm per 3s **[11]**.

The parameters of the laser energy can be regulated depending on the width of the tract **[12]**.

Aim of the work:

The aim of this review is to do a systematic search and meta-analysis of the available literature to assess the outcome of FiLaC in the treatment of non-branching perianal fistula. The main objective is to learn about the healing rates and complications associated with FiLaC to reach a conclusion about its overall safety and efficacy.

Material and Methods

This is a systemic review article on value of laser ablation in treatment of non-branching perianal fistula. A systemic review following PRISMA guidelines was undertaken.

Search Strategy for identification of studies:

The search will be conducted by using the data base PubMed, the Cochrane Central Register of Controlled Trials (CENTRAL), Clinical Trials.gov ., EMBASE, Web of Science, SCOPUS, and Grey Literature Searching, and journals related to the topic by using these keywords: Perianal fistula, fistula laser closure, non-branching perianal fistula, fistula-in-ano.

Locating and selecting studies:

Abstracts of articles identified by using our search strategy will be reviewed, and articles that fulfil the inclusion criteria will be fully retrieved in full data on at least one of the outcome measures must be included in the study. In case of doubt, a second reviewer will assess the article and a consensus will be reached and the process will be presented in a PRISMA flow chart, according to the PRISMA statement.

Data extraction:

Two review authors will independently extract the data from eligible studies using a standardized data extraction form. Any duplicated data studies will be removed.

Statistical considerations:

Outcomes from included trials will combined using The Review Manager Software and manually screened for eligibility to be included. PRISMA flow chart will be produced based on the search inclusion and exclusion criteria. Data will be abstracted from each study in form of a risk estimate and its 95% Confidence Interval (CI). Pooled risk estimate will be obtained by weighing each study by the inverse variance of the effect measure on a logarithmic scale. When a risk estimate and its 95% Confidence Interval were not available from the article, unadjusted values from the published data of the article will be calculated, using SPSS ver. 20.0. This approach to pool the results assumes that the study populations being compared are similar and hence corresponds to a fixed effect analysis. The validity of pooling the risk estimates will be tested (Test of Homogeneity) using a Chi-square test. A violation of this test implies that the studies being grouped differ from one another. In the presence of significant heterogeneity of the effect measure among studies being compared, we will perform a random effect analysis that is based on the method described by Der Simonian and Laird (1986). The random effect analysis accounts for the interstudy variation. Because the test of homogeneity has low power.

Evidence of publication bias:

The risk of bias for individual studies will be made according to the PRISMA Statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions. After pooling of collected data from the desired search studies the relative risk of each of intended outcome measures of interest will be calculated and define the safety and efficacy of using laser ablation in treatment of non- branching perianal fistula.

The inclusion criteria of selected articles:

Randomized control trials (RCT), Cohort studies, case control studies and any studies with level evidence 1-4. Type of subject: Patient with non-branching perianal fistula either primary or recurrent. Type of surgery: Fistula Laser Closure. Duration of follow-up: Equal or more than one year. English literature only. Studies between 1/1 2017 and 1/6/2022 describing fistula laser closure and non-branching perianal fistula.

The exclusion criteria of selected articles:

Irrelevance to study non-branching perianal fistula. Nonclinical studies. Case report. Surgical

techniques without reported outcomes. Duplicated articles by the same author unless with longer follow-up studies. Conference abstract. Studies on patients with: Infected perianal fistula or perianal abscess. Incontinent patients. Wide fistula tract (more than 8mm). Cavities and fistula related to malignancy and Crohn's disease.

Statistical analysis of the data:

Data were fed to the computer and analyzed using MedCalc software package version 20.100 Confidence interval (CI) was established at 95% and *p*-values of less than or equal 0.05 were considered statistical significant. Statistical heterogeneity was assessed using I^2 (observed variance for heterogeneity) and Q (Total variance for heterogeneity). Qualitative Data are reported as total Number and number of event.

Results

The literature search revealed 14 published studies on FiLaC after excluding some studies.

Study characteristics:

14 studies were included 11 were retrospective studies, 1 prospective, 1 case series and 1 cohort study as shown in Table (1).

Patient's characteristics:

A total of 809 cases were included with mean age 43.5 years as shown in Table (2).

Diagnosis and follow-up:

Mean follow-up was 21.8 months and regarding site of l superficial (7) esion was Intersphincteric fistula (144), Transsphincteric fistula (448), Suprasphincteric fistula (62), superficial (8), extrasphincteric (1) as shown in Table (3).

Operative outcome:

Number of cases had pain postoperative was 27 cases, mean Length of stay (day) was 1.05, 1 case had urine retention, and success cases was 427, failure in 373 as shown in Table (4).

Complications:

A total of 300 complications were founded in form of infection, hemorrhage, wound healingcomplications, ileus and as regard recurrence founded in 258 as shown in Table (5).

Meta-analysis:

Pain post-operative assessed in 5 studies with event rate 9.5% and significant heterogeneity between studies.

Success assessed in 14 studies with event rate 52.9% and significant heterogeneity between studies.

Failure assessed in 14 studies with event rate 45.955% and significant heterogeneity between studies.

Complications assessed in 14 studies with event rate 2.7% and significant heterogeneity between studies.

Recurrence assessed in 14 studies with event rate 30.672% and significant heterogeneity between studies.

Table (1): Study characteristics.

Author	Type of study
Lalhruaizela **[13]**	Retrospective
Nordholm-Carstensen et al. **[14]**	Retrospective
Brabender et al. **[15]**	Retrospective
Wolicki et al. **[16]**	Retrospective
Isik et al. **[17]**	Retrospective
De Bonnechose et al. **[18]**	Retrospective
Serin et al. **[19]**	Retrospective
De Hous et al. **[20]**	Case series
Stijns et al. **[21]**	Retrospective
Marref et al. **[22]**	Prospective
Terzi et al. **[23]**	Retrospective
Lauretta et al. **[24]**	retrospective
Donmez et al. **[25]**	Retrospective
Wilhelm et al. **[26]**	Cohort

Table (2): Patient's characteristics.

Author	Number	Age	m\f
Lalhruaizela **[13]**	31	38.6	19\12
Nordholm-Carstensen et al. **[14]**	66	40	28\38
Brabender et al. **[15]**	18	41	10\8
Wolicki et al. **[16]**	83	50.01	64\19
Isik et al. **[17]**	100	42	72\28
De Bonnechose et al. **[18]**	100	43	65\35
Serin et al. **[19]**	35	43.9	25\10
De Hous et al. **[20]**	10	50	
Stijns et al. **[21]**	20	45	4\16
Marref et al. **[22]**	69	40	34\35
Terzi et al. **[23]**	103	43	82\21
Lauretta et al. **[24]**	30	52	16\14
Donmez et al. **[25]**	27	35.6	23\54
Wilhelm et al. **[26]**	117	46	82\35

Table (3): Diagnosis and follow-up.

Author	Diagnosis	Follow-up (mn)
Lalhruaizela **[13]**	Intersphincteric fistula (21), Transsphincteric fistula (9), Suprasphincteric fistula (1)	24
Nordholm-Carstensen et al. **[14]**	Intersphincteric fistula (2), Transsphincteric fistula (61), Suprasphincteric fistula (5)	19
Brabender et al. **[15]**	Transphinctric (14), intersphincteric (5), suprasphincteric (1), superficial (1)	29
Wolicki et al. **[16]**		45.1
Isik et al. **[17]**	Intersphincteric fistula (10), Transsphincteric fistula (82), Suprasphincteric fistula (8)	48
De Bonnechose et al. **[18]**	Transphicteric (87), suprasphincteric (13)	13.6
Serin et al. **[19]**	Intersphincteric fistula (21), Transsphincteric fistula (12), Suprasphincteric fistula (2)	11
De Hous et al. **[20]**	Transphicteric (12), suprasphincteric (3)	9
Stijns et al. **[21]**	Transsphincteric (14), Intersphincteric (6)	10
Marref et al. **[22]**	Intersphincteric fistula (2), Transsphincteric fistula (55), Suprasphincteric fistula (11)	6.3
Terzi et al. **[23]**	Intersphincteric fistula (56), Transsphincteric fistula (29), Suprasphincteric fistula (11), superficial (7)	28
Lauretta et al. **[24]**	Transphincteric (30)	11.3
Donmez et al. **[25]**	Intersphincteric fistula (14), Transsphincteric fistula (7), Suprasphincteric fistula (5), Extrasphincteric (1)	22
Wilhelm et al. **[26]**	Intersphincteric fistula (7), Transsphincteric fistula (36), Suprasphincteric fistula (2)	30

Table (4): Operative outcome.

Author	Pain post-operative	Length of stay (day)	Urinary retention	Success	Failure
Lalhruaizela **[13]**	3	1	1	21	10
Nordholm-Carstensen et al. **[14]**				30	36
Brabender et al. **[15]**	8			4	14
Wolicki et al. **[16]**	11			62	22
Isik et al. **[17]**				62	38
De Bonnechose et al. **[18]**				41	59
Serin et al. **[19]**				15	20
De Hous et al. **[20]**				7	3
Stijns et al. **[21]**				4	16
Marref et al. **[22]**				31	28
Terzi et al. **[23]**				41	62
Lauretta et al. **[24]**	4			10	20
Donmez et al. **[25]**	1	1.1		24	3
Wilhelm et al. **[26]**				75	42

Table (5): Complications.

Author	Compl-ications	Hemorrhage	Infection	Wound healing complications	Bowel movement (postoperative day)	Obstructive ileus	Recurrence
Lalhruaizela **[13]**	14	7	3		1		3
Nordholm-Carstensen et al. **[14]**	5		1				4
Brabender et al. **[15]**	17		3				14
Wolicki et al. **[16]**	42	7		14			21
Isik et al. **[17]**	38						38
De Bonnechose et al. **[18]**	51						51
Serin et al. **[19]**	2		1				1
De Hous et al. **[20]**	3						3
Stijns et al. **[21]**	5		2			1	2
Marref et al. **[22]**	28						28
Terzi et al. **[23]**	28						28
Lauretta et al. **[24]**	21	1					20
Donmez et al. **[25]**	3						3
Wilhelm et al. **[26]**	42						42

Table (6): Meta-analysis for pain post-operative.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Lalhruaizela **[13]**	31	3	9.677	2.042 to 25.754
Brabender et al. **[15]**	18	8	44.444	21.530 to 69.243
Wolicki et al. **[16]**	83	11	13.253	6.806 to 22.477
Terzi et al. **[23]**	103	4	3.883	1.068 to 9.645
Lauretta et al. **[24]**	30	1	3.333	0.0844 to 17.217
Total (fixed effects)			9.599	6.362 to 13.755
Total (random effects)			12.26	4.445 to 23.240
Test for heterogeneity:				
Q			20.4888	
DF			4	
Significance level			0.0004*	
I^2 (inconsistency)			80.48 %	
95% CI for I^2			54.21 to 91.68	

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

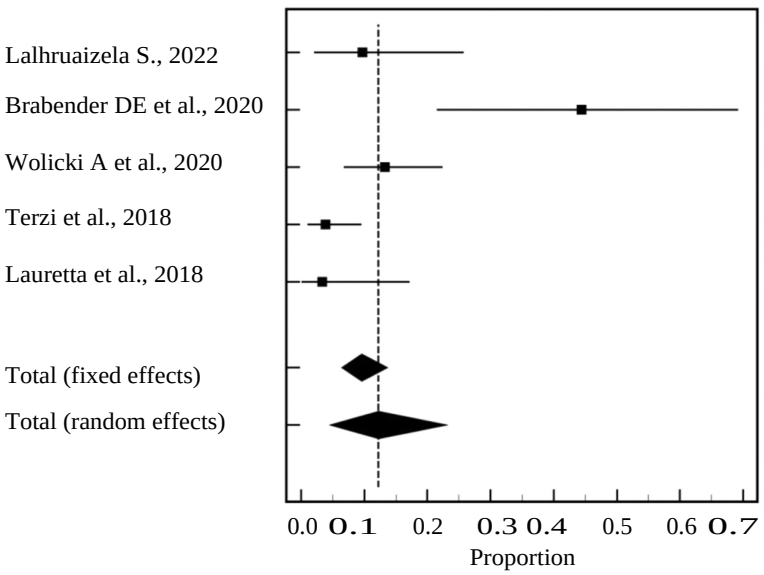

Fig. (1): Forest plot for pain post-operative.

Table (7): Meta-analysis for success.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Lalhruaizela **[13]**	31	21	67.742	48.627 to 83.318
Nordholm-Carstensen et al. **[14]**	66	30	45.455	33.144 to 58.186
Brabender et al. **[15]**	18	4	22.222	6.409 to 47.637
Wolicki et al. **[16]**	83	62	74.699	63.961 to 83.606
Isik et al. **[17]**	100	62	62.000	51.746 to 71.523
De Bonnechose et al. **[18]**	100	41	41.000	31.262 to 51.286
Serin et al. **[19]**	35	15	42.857	26.323 to 60.647
De Hous et al. **[20]**	10	7	70.000	34.755 to 93.326
Stijns et al. **[21]**	20	4	20.000	5.733 to 43.661
Marref et al. **[22]**	69	31	44.928	32.923 to 57.381
Terzi et al. **[23]**	103	41	39.806	30.289 to 49.924
Lauretta et al. **[24]**	30	10	33.333	17.287 to 52.812
Donmez et al. **[25]**	27	24	88.889	70.841 to 97.647
Wilhelm et al. **[26]**	117	75	64.103	54.712 to 72.760
Total (fixed effects)			52.965	49.489 to 56.420
Total (random effects)			51.684	42.487 to 60.824
Test for heterogeneity:				
Q			86.436	
DF			13	
Significance level			<0.0001	
I^2 (inconsistency)			84.96%	
95% CI for I^2			76.28 to 90.46	

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

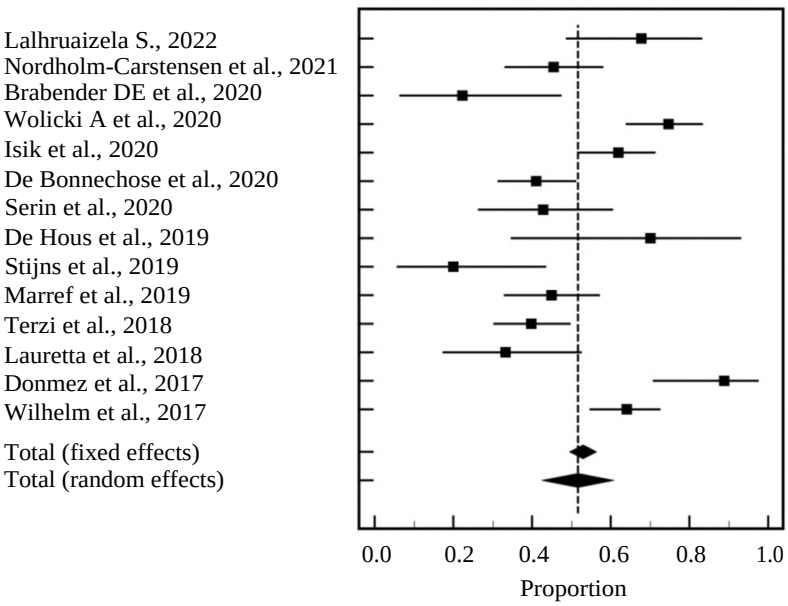

Fig. (2): Forest plot for success.

Table (8): Meta-analysis for failure.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Lalhruaizela **[13]**	31	10	32.258	16.682 to 51.373
Nordholm-Carstensen et al. **[14]**	66	36	54.545	41.814 to 66.856
Brabender et al. **[15]**	18	14	77.778	52.363 to 93.591
Wolicki et al. **[16]**	83	22	26.506	17.415 to 37.336
Isik et al. **[17]**	100	38	38.000	28.477 to 48.254
De Bonnechose et al. **[18]**	100	59	59.000	48.714 to 68.738
Serin et al. **[19]**	35	20	57.143	39.353 to 73.677
De Hous et al. **[20]**	10	3	30.000	6.674 to 65.245
Stijns et al. **[21]**	20	16	80.000	56.339 to 94.267
Marref et al. **[22]**	69	28	40.58	28.913 to 53.081
Terzi et al. **[23]**	103	62	60.194	50.076 to 69.711
Lauretta et al. **[24]**	30	20	66.667	47.188 to 82.713
Donmez et al. **[25]**	27	3	11.111	2.353 to 29.159
Wilhelm et al. **[26]**	117	42	35.897	27.240 to 45.288
Total (fixed effects)			45.955	42.509 to 49.430
Total (random effects)			47.289	38.326 to 56.341
Test for heterogeneity:				
Q			83.4181	
DF			13	
Significance level			<0.0001*	
I^2 (inconsistency)			84.42%	
95% CI for I^2			75.31 to 90.16	

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

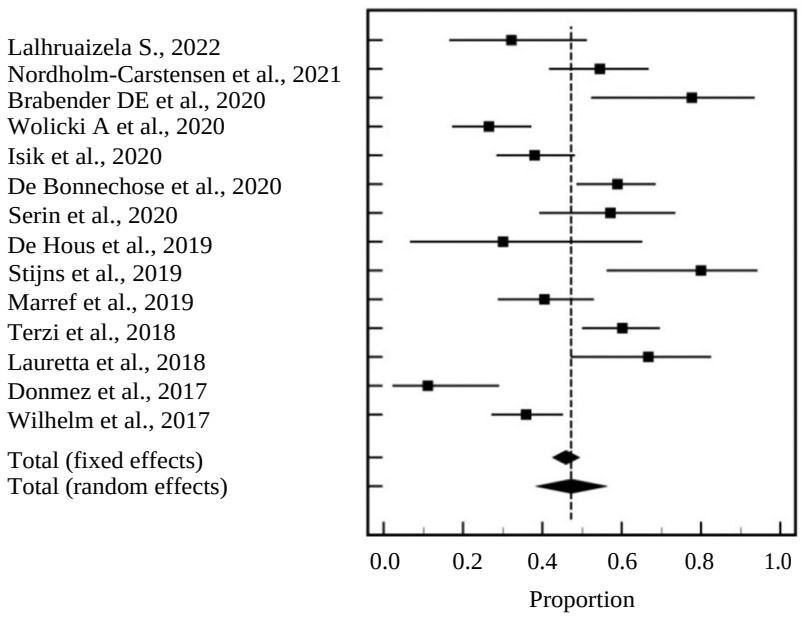

Fig. (3): Forest plot for failure.

Table (9): Meta-analysis for Complications.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Lalhruaizela **[13]**	31	11	35.484	19.227 to 54.630
Nordholm-Carstensen et al. **[14]**	66	1	1.515	0.0384 to 8.155
Brabender et al. **[15]**	18	3	16.667	3.579 to 41.418
Wolicki et al. **[16]**	83	21	25.301	16.394 to 36.039
Isik et al. **[17]**	100	0	0.000	0.000 to 3.622
De Bonnechose et al. **[18]**	100	0	0.000	0.000 to 3.622
Serin et al. **[19]**	35	1	2.857	0.0723 to 14.917
De Hous et al. **[20]**	10	0	0.000	0.000 to 30.850
Stijns et al. **[21]**	20	3	15.000	3.207 to 37.893
Marref et al. **[22]**	69	0	0.000	0.000 to 5.206
Terzi et al. **[23]**	103	0	0.000	0.000 to 3.518
Lauretta et al. **[24]**	30	2	6.667	0.818 to 22.074
Donmez et al. **[25]**	27	0	0.000	0.000 to 12.770
Wilhelm et al. **[26]**	117	0	0.000	0.000 to 3.104
Total (fixed effects)			2.769	1.759 to 4.134
Total (random effects)			4.719	1.284 to 10.159
Test for heterogeneity:				
Q			114.1117	
DF			13	
Significance level			<0.0001*	
I^2 (inconsistency)			88.61%	
95% CI for I^2			82.64 to 92.52	

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

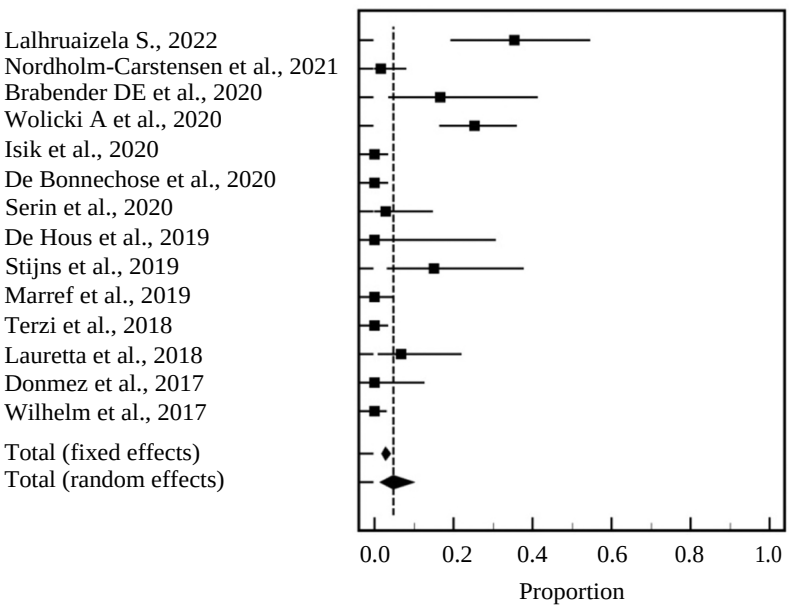

Fig. (4): Forest plot for Complications.

Table (10): Meta-analysis for Recurrence.

Study	Total number	Event	Event rate (%) (Proportion)	95% CI of rate (%)
Lalhruaizela **[13]**	31	3	9.677	2.042 to 25.754
Nordholm-Carstensen et al. **[14]**	66	4	6.061	1.676 to 14.797
Brabender et al. **[15]**	18	14	77.778	52.363 to 93.591
Wolicki et al. **[16]**	83	21	25.301	16.394 to 36.039
Isik et al. **[17]**	100	38	38.000	28.477 to 48.254
De Bonnechose et al. **[18]**	100	51	51.000	40.804 to 61.136
Serin et al. **[19]**	35	1	2.857	0.0723 to 14.917
De Hous et al. **[20]**	10	3	30.000	6.674 to 65.245
Stijns et al. **[21]**	20	2	10.000	1.235 to 31.698
Marref et al. **[22]**	69	28	40.58	28.913 to 53.081
Terzi et al. **[23]**	103	28	27.184	18.884 to 36.840
Lauretta et al. **[24]**	30	20	66.667	47.188 to 82.713
Donmez et al. **[25]**	27	3	11.111	2.353 to 29.159
Wilhelm et al. **[26]**	117	42	35.897	27.240 to 45.288
Total (fixed effects)			30.672	27.534 to 33.948
Total (random effects)			29.146	19.623 to 39.700
Test for heterogeneity:				
Q			127.8808	
DF			13	
Significance level			<0.0001 *	
I^2 (inconsistency)			89.83%	
95% CI for I^2			84.72 to 93.24	

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

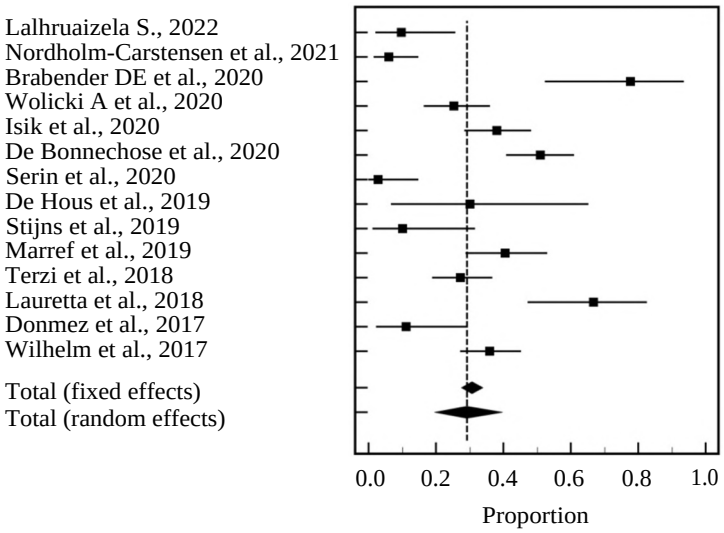

Fig. (5): Forest plot for Recurrence.

Discussion

Anal fistula is a sequela of the abscess ulceration or incision drainage that occurs around the anus and rectum, which is manifested as the formation of abnormal channels connecting the anal canal and rectum with the skin around the anus. There are 20,000 to 25,000 newly confirmed cases in the USA each year **[27]**. A statistical analysis based on a large population database in the UK showed that the incidence of anal fistula is 1.69 cases per 10,000 individuals **[28]**. This was also evidenced by other relevant studies **[29]**.

Patients with anal fistula are mainly adults between 30 and 40 years old, and the incidence rate of this condition in men is higher than that in women **[30]**. In addition to severely affecting the quality of life of patients, anal fistula has also a negative impact on the psychological state of patients who often suffer from depression or anxiety symptoms. In general, anal fistula cannot be cured

without therapeutic intervention. Surgical therapy is the main method used to treat anal fistula. The best treatment criterion is to eradicate the infected lesion, ensure sufficient drainage, and promote the closure of the fistula, while minimizing damage to the anal sphincter **[31]**. The integrity of the internal anal sphincter (IAS) and external anal sphincter (EAS) is the most important guarantee for keeping normal anal function of patients.

While simple fistula-in-ano (FIA) can be treated with lay open fistulotomy with healing rates up to 98% **[32]**, complex FIA treatment remains challenging, as FIA may recur or the patient's continence status may be compromised. In the last 2 decades, the treatment of FIA has progressed from simple fistulotomy to a diversity of intricate sphincter-preserving techniques, this was primarily in response to concerns about the unacceptably high rates of incontinence associated with fistulotomy **[33]**. Numerous surgical procedures have been introduced for the treatment of complex FIA including ligation of intersphincteric fistula tract (LIFT), anal advancement flaps, injection of fibrin glue, collagen paste or autologous adipose tissue, fistula plug, video-assisted anal fistula treatment (VAAFT) and fistula laser closure (FiLaC) **[34,35]**.

FiLaC is a novel procedure initially described by Wilhelm et al., in 2011 **[36]**. It uses a radially emitting laser probe, which destroys the fistulous track epithelium with simultaneous obliteration of the remaining fistula tract through a shrinkage effect.

Since the introduction of FiLaC, several investigators have considered its use as a definitive treatment for FIA. However, variable outcomes were reported.

The aim of this review is to do a systematic search and meta-analysis of the available literature to assess the outcome of FiLaC in the treatment of non-branching perianal fistula. The main objective is to learn about the healing rates and complications associated with FiLaC to reach a conclusion about its overall safety and efficacy.

In the current systematic review meta-analysis, a total of 14 studies **[37-50]** were included with a total of 809 patients, out of them 11 studies were retrospective **[37-43,45,47-49]**, 1 prospective study **[46]**, 1 cohort study **[50]** and 1 case series **[44]**.

The mean age of the studied patients was 42.8 years with majority of males 68.5%.

In agreement with the current study Elfeki et al., **[51]** performed a systematic review and meta-analysis aimed to assess the safety and efficacy of the FiLaC procedure including 7 studies with a total of 454 patients, (67.4% were males). The median age of the patients was 43 (range 18-83) years.

Regarding diagnosis and follow-up, the current systematic review and meta-analysis showed that the mean 21.8 months and regarding site of fistula, we revealed that the most common affected site was Trans- sphincteric fistula in (448/829) 54% followed by Inter- sphincteric fistula in (144/829) 17% and Supra-sphincteric fistula in (62) 7.4%.

This comes in agreement with the systematic review and meta-analysis by Elfeki et al., **[51]** who revealed that the majority were trans sphincteric in 314 (69.16%) patients, intersphincteric in 95 (20.93%) patients, supra/extrasphincteric in 38 (8.37%) patients, and only superficial in 7 (1.54%) patients.

Also, the systematic review and meta-analysis by Frountzas et al., **[52]** aimed to present the efficacy and the safety of FiLaCTM in the management of anal fistula disease, the meta-analysis included 8 studies were included that recruited 476 patients, in this study there were 314 (66%) fistulas were transsphincteric, 105 (22%) patients had an intersphincteric fistula and 43 (9%) patients had suprasphincteric fistulas.

Regarding operative outcome, the current study showed that there were 27 cases have postoperative pain as reported by 5 studies **[37,39,40,47,48]**, the meta-analysis showed that the event rate 9.5% and significant heterogeneity between studies.

Regarding success cases there were 427 successes. The meta-analysis showed that the success assessed in 14 studies **[37-50]** with event rate 52.9% and significant heterogeneity between studies.

Regarding failure it was reported in 382 failure, according to the meta-analysis it was assessed in 14 studies **[37-50]** with event rate 45.955% and significant heterogeneity between studies.

The maximum success rate (88.8%) was reported by Donmez et al., **[25]** followed by Wolicki et al., **[16]** with a rate of (74.7). The least success rate was (22.2%) as reported by Brabender et al., **[15]**.

This was comparable with the systematic review and meta-analysis by Elfeki et al., **[51]** how revealed that the weighed mean rate of primary healing was 67.3% and the overall success when FiLaC was reused was 69.7%.

Also, the systematic review and meta-analysis by Frountzas et al., [52] revealed that the pooled success rate of the technique was 63% (95% CI 50%-75%).

Moreover, another systematic review and meta-analysis by Cao et al., [53] aimed to evaluate the efficacy and safety of FiLaC in perianal fistula, including 6 studies, the primary healing rate in this meta-analysis (68%, 95% CI 53%-84%).

Currently, there is some discrepancy regarding the definitions of healing and failure of anal fistula surgery. Healing may be defined as complete post-operative healing of both the fistula openings as well as the surgical incision (if present). On the other hand, non-healing is usually defined as persistence of discharge through the opening of the fistula or the associated surgical wound and recurrence is defined as reappearance of the fistula after complete healing. It might be a difficult task to differentiate between persistence and recurrence. Since these definitions were heterogeneous across the studies in this review, we have decided to simply categorize non-healing and recurrence as failure of the procedure.

According to the available literature, the failure rate could be attributed to several factors. Undetected secondary tracts and various calibers of the fistula lumen are key factors which may hinder the sealing effect of laser fiber due to failure to adhere to the lining epithelium of the tract [54]. Both factors are theoretically more frequent in longer and advanced types of fistula. In addition, another limitation of FiLaC is being a blind technique when compared to video-assisted anal fistula treatment (VAAFT) in which fulguration of the track is done under vision [34].

Another factor that may explain failure after FiLaC is the management of the internal opening, which Wilhelm et al., [36] considered to be a principal factor for persistent/recurrent disease. The FiLaC technique could be performed as a standalone procedure or according to Wilhelm with the closure of the internal opening. However, there was no significant difference when internal opening closure was performed. Additionally, the advocates of the LIFT technique reported that just the interrupting the fistula tract without closing the internal opening was enough to get a 70% or higher healing rate [55]. Furthermore, Lauretta et al., assumed that fashioning a flap might cause additional unnecessary morbidity [56].

Ozturk and Gulcu, [57] recommended certain precautions to achieve the best results: curetting the track with a thin plastic brush to remove any debris and to allow blood to accumulate which seems to be important for the laser's sealing effect and the laser energy should be applied just when the diode tip enters the internal opening and turned off before the tip reaches the external opening. Successful application can be recognized by a thickened fistula track.

Another factor which may improve the results is seton application prior to FiLaC [58]. This was considered fundamental to facilitate the drainage of any associated abscess and promotes fibrosis, which makes the fistula tract more homogenous and mature for FiLaC. Furthermore, the application of the laser fiber into the fistula track is easier when the seton is already in situ.

Regarding complications, the pooled results showed that there was a total of 300 complications were founded in form of infection, hemorrhage, wound healing complications and ileus.

According to meta-analysis complications assessed in 14 studies [37-50] with event rate 2.7% and significant heterogeneity between studies.

The maximum complication rate was (94.4%) as reported Brabender et al., [15] followed by (66.6%) as reported by Lauretta et al., [24]. The minimum complication rate was (5.7%) as reported by Serin et al., [19].

However, Elfeki et al., [51] revealed that 25 (5.50%) patients developed complications after FiLaC. All of them were minor complications (grade I/II on Clavien-Dindo scale) and were managed without surgical intervention. Temporary pain which occurred postoperatively in 11 patients was the most common complication followed by abscess in 5 patients and bleeding in 4 patients. The weighted mean rate of complication was 4.0% (95% CI 1-7%, I^2=75.27, p<0.001).

Also, Frountzas et al., [52] revealed that the complication rate after FiLaCTM ranged from 0% to 24% and the net pooled rate after proportional metaanalysis (random effect) was 8% (95% CI 1%-18%). There was marked statistical heterogeneity (I^2=88.87%; Table 4). The most common complications after FiLaCTM were pain and discomfort that were reported by 17 patients, five patients had minor bleeding, two patients presented with a fever and one patient had a late abscess.

Regarding recurrence rate the present study showed that recurrence was happened in 258

(27.8%). The maximum recurrence rate was (93.3%) as reported by Lauretta et al., **[24]**. However, the minimum recurrence rate was (2.5%) as reported by Wilhelm et al., **[26]**.

The meta-analysis showed that recurrence assessed in 14 studies **[37-50]** with event rate 30.672% and significant heterogeneity between studies.

This was lower than the systematic review and meta-analysis by Elfeki et al., **[51]** revealed that 158 (34.8%) patients showed non-healing / recurrence with a weighted mean primary failure rate of 32.7% (95% CI 16.6-48.7%, I^2=94.2%, p< 0.001). Re-FiLaC was performed in 19 patients, and 8 (42.1 %) of them achieved healing. The weighted mean of the overall healing rate after primary and secondary FiLaC was 69.7% (95% CI 54.4-85.0%, I^2=93.9, p<0.001).

Moreover, Elfeki et al., **[51]** reported that Clinical confounders for failure of the FiLaC were investigated using the random-effects meta-regression model and revealed that factors associated with failure were age (SE=–1.03, 95% CI (–2.06-0.01), p=0.046), IBD (SE=0.29, 95% CI (–0.1–0.49), p=0.003) and supra / extrasphincteric fistula (SE=0.30, 95% CI (0.07-0.54), p=0.010). On the other hand, previous fistula surgery and laser power laser failed to reach statistical significance.

This review has a number of limitations related to the available literature. Despite the fair quality of the included studies, all the studies were retrospective cohorts with relatively small sample sizes. Furthermore, the high statistical heterogeneity detected between the studies was a key limitation while considering the outcomes. This highlights the importance of future randomized controlled trials with longterm follow-up comparing the FiLaC to other sphincter-preserving techniques to reach a solid conclusion.

Conclusion:

In conclusion; FiLaC is a promising, sphincter-saving technique for the treatment of non-branching perianal fistula. It has proven efficacy with more than half of the patients achieving complete healing after its primary application. The main advantage of FiLaC is the good safety profile with very few minor complications and almost no negative effects on continence. These promising results should place FiLaC in the surgical armamentarium for perianal fistula treatment.

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قيمة الاستئصال بالليزر فى علاج الناسور الشرجى غير المتفرع : دراسة منهجية وتحليل بعدى

الناسور الشرجى هو مرض شائع يرتبط بالتأثير السلبى على جودة الحياة. وعلى الرغم من التقدم الذى تم إحرازه فى السنوات الأخيرة، إلا أن علاج الناسور الشرجى لا يزال يمثل تحدياً صعباً نظراً لصعوبة علاجه وذلك من خلال الحفاظ على قدرة المريض على التحكم فى البراز مع منع الإصابة المتكررة بالمرض.

فى بعض الأحيان قد يؤدى العلاج الفعال للناسور إلى سلس البراز خاصة فى علاج الناسور العالى المتداخل مع العضلات العاصرة الارادية يهتم معظم المرضى بالحفاظ على التحكم فى البراز أكثر من أهتمامهم بالعلاج النهائى للناسور.

والأساس المرضى المتعارف عليه للناسور هو فرضية التهاب الغدد جار الشرجية الخفية، مما قد يؤدى إلى تكوين خراج، قد يظهر على سطح الجلد حول الشرج.

فى حين يمكن علاج الناسور الشرجى البسيط من خلال بضع الناسور المفتوح بمعدلات شفاء تصل إلى ٩٨٪، إلا أن علاج الناسور لا يزال يمثل تحدياً، حيث قد تتكرر الإصابة به، أو قد تتعرض حالة التحكم فى البراز فى المريض للخطر من خلال الرصابة بسلس البراز. فى العقدين الماضيين، تطور علاج الناسور الشرجى من بضع الناسور البسيط إلى مجموعة متنو عة من تقنيات الحفاظ على العضلة العاصرة، وكانت استجابة للمخاوف المتعلقة بالمعدلات المرتفعة غير المقبولة لسلس البراز المرتبط ببضع الناسور فى المقام الأول.

تم إدخال العديد من الإجراءات الجراحية لعلاج الناسور الشرجى بما فى ذلك ربط قناة الناسور بين العضلة العاصرة (LIFT)، ورفوف متقدمة للشرج، وحقن غراء الفيبرين، ومعجون الكولاجين أو الأنسجة الدهنية الذاتية، وسدادة الناسور، وعلاج الناسور الشرجى بمساعدة الفيديو (VAAFT)، إغلاق الناسور بالليزر (FiLaC).

تتضمن تقنية تحديد الفتحة الداخلية، أحياناً عن طريق حقن بيرو كسيد الهيدروجين أو صبغة الميثيلين الأزرق من الفتحة الخارجية، وتنظيف مجرى الناسور بالكحت، و إغلاق الفتحة الداخلية، إدخال قسطرة بلاستيكية مجوفة باستخدام سلك توجيه، وإدخال ألياف ليزر يمكن التخلص منها فى القسطرة مع ظهور طرفها عند الفتحة الداخلية، والتوصيل المستمر لطاقة الليزر (عادة بطول موجة ١٤٧٠ نانو متر و ١٣ واط) بشكل محيطى داخل قناة الناسور عند سحبه بمعدل ١ سم لكل ٣ ثوان ، يمكن تنظيم معلمات طاقة الليزر اعتماداً على عرض الناسور.

ومنذ بدأ استخدام هذه التقنية اعتبرها البعض العلاج الأساسى للناسور الشرجى على الرغم من تفاوت نتائجها.

هدف هذه الدراسة هو تقديم دراسة منهجية لتحديد نتائج استخدام تقنية الليزر فى علاج الناسور الشرجى غير المتفرع والتعرف على معدلات الشفاء والمضاعفات المرتبطة باستخدام تقنية الليزر للتوصل إلى نتيجة بشأن سلامتها وفعاليتها.

فى التحليل للمراجعة المنهجية الحالية، تم تضمين ما مجموعة ١٤ دراسة مع ما مجموعة ٨٠٩ مرضى، من بينهم ١١ دراسة كانت بأثر رجعى، ودراسة استباقية واحدة، ودراسة أترابية واحدة، وسلسلة حالة واحدة.