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COMPARATIVE STUDY BETWEEN TAILORED AND LIMITED LATERAL SPHINCTEROTOMY IN TREATMENT OF CHRONIC ANAL FISSURE: A COMPUTERIZED ANAL VECTOR MANOMETRIC ANALYSIS

By

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***Objective:** This study was designed to: detect the characteristic anal manometric pattern in patients with chronic anal fissure, compare prospectively the changes in anal function following tailored sphincterotomy according to the height of the fissure versus limited sphincterotomy to the distal fourth of the sphincter length.*

***Patients & methods:** A pre-operative computer-generated anal vector manometric studies were performed for sixty patients suffering from anal fissure and twenty controls. Anal manometry was repeated one week and five weeks following each type of sphincterotomies.*

***Results:** Forty-one patients had high RAP (68.33%) while 19 patients had normal RAP (31.66%). Contrary to the controls, RAP-1 cm in patients with chronic fissure was significantly higher than global RAP ($p=0.00358$) with a significantly higher posterior pressure in the distal 1 cm of the anal canal. No significant difference between mean RAP-1 cm of normotensives and hypertensives. TLS resulted in postoperative hypotonia which was more evident in females and normotensive patients (mean RAP = 57.00±7.75cm H2O, 48.60±9.08 cm H2O respectively). On the other hand, no evident hypotonia could be demonstrated following LLS. Normotensive patients have significantly shorter FACL than hypertensive patients (3±0.5, 3.51±0.43, $p=0.00013$). Neither TLS nor LLS resulted in a significant change in the FACL. The width of high pressure segment as a percent of FACL was significantly less in normotensive patients (20.57±7.23 %) than in hypertensive patients (29.44±11.11%) ($P=0.002378$). Normotensive fissure patients have a significantly more distally located HMRP than hypertensive patients (0.82±0.21, 1.24±0.46, $p=0.000326$). Two patients (6.66%)had persistent fissure after TLS, while three patients (10%) required further treatment following LLs, two for persistent fissure and one for recurrent fissure six months post-operatively.*

***Conclusions:** Elevation in the mean resting anal pressure is attributed to distal hypertonia secondary to presence of the fissure. Anal physiology was significantly more preserved following LLS than after TLS with absence of post-operative hypotonia. The rate of imperfect control using limited technique is compared favorably with the tailored sphincterotomy. Moreover, the success rate of LLS was closely approximate to that of TLS.*

Keywords: [Fissure, manometry, pathophysiology, sphincter]

Abbreviations:

TLS: Tailored lateral sphincterotomy.
LLS: Limited lateral sphincterotomy.
RAP: Resting anal pressure.
MSP: Maximum squeeze pressure.
FACL: Functional anal canal length.
VSI: Vector symmetry index.
ACHPS: Anal canal highest pressure segment.

HMRP: Highest mean resting pressure.
EAS: External anal sphincter.
IAS: Internal anal sphincter.
D1: Distance from anal verge to the point of HMRP.
D2: Distance from the HMRP to the proximal border of the anal canal

INTRODUCTION

Anal fissures are commonly encountered by general and colorectal surgeons. Range of anal manometry techniques have been performed in patients with anal fissure, often with conflicting results. In the last decade, a number of refinements in manometric technology have occurred. Use of computer helps to standardize performance and generate accurate longitudinal and cross-sectional pressure profiles of the anal pressure, as well as more familiar numeric values for pressure and functional anal canal length.

Lateral internal anal sphincterotomy has been widely accepted as the treatment of choice for chronic anal fissures. [1-6] However, the traditional division of the internal sphincter up to the dentate line is sometimes followed by impaired continence, [7] particularly in females with short anal canal. [8-11]

Pharmacological techniques of inducing reversible chemical sphinctrotomy have failed to gain wide acceptance, as their use is associated with considerable problems with patient compliance, healing rates and side effects. [12]

Tailored lateral sphincterotomy, described by Littlejohn and Newstead[13] as adjusting the sphincterotomy height to the length of the fissure, produces clinically significant reduction in incontinence rates and has recognized unquoted conservative practice of many surgeons. However, it does not solve the problem of long fissure in a short anal canal with variation in the length of fissure

Computer-generated longitudinal pressure profiles reveal a relative hypertonia at the distal one-centimeter of the anal canal in patients with anal fissure. [14] Refinements in manometric technology have promoted us to suggest a relation between the vertical height of sphincter division and the functional anal canal length by limiting sphincterotmy height to the distal fourth of the sphincter length, thus considering the functional anal canal length in the recruitment of a sphincterotomy (careful selection based on the FACL).

In this computerized vector manometric study we prospectively: 1- analyzed anal functions in patients with chronic anal fissure, 2- compared changes in the anal manometric parameters after tailored versus limited sphincterotomy in treatment of chronic anal fissure.

PATIENTS AND METHODS

A prospective study of sixty patients suffering from chronic fissure-in-ano admitted, in the period from April 1997 to May 1999, to the Unit of Colon and Rectal Surgery, Alexandria Main University Hospital.

An informed consent was obtained from each patient. The study protocol was registered and approved by the committee of Postgraduate Studies and Medical Research, Faculty of Medicine, University of Alexandria. Patients with inflammatory bowel disease or previous history of anorectal disease were excluded from the study.

The study included 20 volunteers as controls. Volunteers with anal or gastrointestinal disease were excluded.

Anal Manometry: A water-perfuse catheter (Sandhill Vectrogram Catheter: part number AGS- 108) has 8 side holes oriented at 45° to one another and arranged in two rows. The catheter was perfused using pneumohydrolic pump (Mui Scientific Mississauga, Canada). Using station pull- out technique, the catheter was pulled out 0.5 cm each time according to the standard marks on the catheter. Pressures were recorded using Smart Lab (Sandhill Scientific, Inc., Denver, Colorado) with pressure amplifiers. The data were analyzed by Anal graph® computer software (Sandhill Scientific, Inc., Denver, Colorado) was used for digitally created 3-D Vectrogram and automatically produced numeric reports of: Resting Anal Pressures (RAP), Maximum Squeeze Pressure (MSP), Functional Anal Canal Length (FACL), Anal Canal Highest Pressure Segment (ACHPS) and Vector Symmetry Index (VSI).

After the manometric procedure, the patients were randomly allocated into two equal groups using the sealed envelope technique. Group (TLS) for tailored lateral sphincterotomy and group (LLS) for limited lateral sphincterotomy.

The pre-operative manometric procedure was repeated one week and five weeks following surgery.

Operative procedures: The patient was placed in the lithotomy position. Both procedures were done under general anesthesia without muscle relaxation. After careful assessment of the anal canal length and the fissure height, a Ferguson-Hill retractor was introduced into the anal canal. The intersphincteric groove is identified and a number 11 blade was introduced through the peri-anal skin at the mid-lateral aspect of the anus (3 O'clock). It is pushed cephalad with the flat of the blade sandwiched between the internal sphincter and the external sphincter. The cutting surface was redirected medially, the internal sphincteric muscle was divided on a supporting left index finger inside the anal canal. As the scalpel cuts through the internal sphincter there was a characteristic 'gritty' sensation, and with completion of the division there was a sudden 'give' indicating that the blade cut all the fibers. In tailored lateral sphincterotomy, internal sphincter division was tailored exactly to the height of the fissure, [13] while in limited sphincterotomy it was limited to its distal fourth. Therefore, careful measurement of the sphincter length is an essential step in LLS to determine the appropriate vertical height of sphincter division. After division of the sphincter, completeness of the sphincterotomy may be assessed after withdrawal of the knife by a firm lateral pressure with the finger.This would rupture any residual internal sphincter fibers. Pressure was applied to the site of the wound for 5 minutes to secure haemostasis.The stab wound was left open to allow drainage. [15] A large associated sentinel tag was excised.

The vertical height of sphincter division was significantly higher in TLS (range 1.2-1.5 cm, mean= 1.39±0.174) than in LLS (0.75±1.2cm, mean=0.9±0.172) ($p<0.001$).

Data analysis and statistical methods:

Comparison between groups was made using an unpaired t-test. Three-way ANOVA was used to compare data before, one week and five weeks following each procedure with the effect of sex and anal tone was entered simultaneously and their interactions have been suppressed.

RESULTS

This study was carried out on 60 patients with chronic anal fissure with mean age 26.72±9.37 (range, 18-52) years. Eighteen patients were males with mean age 22.72±2.99(range, 20-28) years and 42 were females with mean age 28.43±10.62 (range, 18-52) years. The difference in age between males and females was significant ($p=0.0294$). The control group was comparable to the studied group as regard the mean age (25.62 ± 8.77, range, 20-30) years and sex distribution (females 60% and males 40%)

Group LS included 24 females and 6 males, while group TLS included 18 females and 12 males. There was no difference in age between the two groups (mean LS=26.93±7.84, mean TLS= 26.5±10.82, $p=0.859$).

Distribution of fissures: posterior fissure was found in 40 patients (66.66%), combined anterior and posterior fissures were found in 14 patients (23.33%) and anterior fissure was found in 6 patients (10%). Anterior fissures alone or combined anterior and posterior were exclusively found in female patients, while posterior fissures were found almost equally in males and females (18/40 and 22/40 respectively).

All the patients were followed up for five weeks. The time required for healing of fissures following TLS ranged between 2-4 weeks with a mean of 3.6 + 0.6 weeks, while following LLS it ranged between 3-4 weeks with a mean of 3.78 + 0.43 weeks ($t = 1.001$, $p = 0.15$). Two patients (6.66%)had persistent fissure after TLS were treated by 0.2 percent glyceryl trinitrate. Three patients (10%) required further treatment following LLs, two for persistent fissure and one for reccurrent fissure six months post-operatively. Redo of LLS on the right side was required in two patients and 0.2 percent glyceryl trinitrate application was sufficient in the third patient. Soiling and imperfect control of flatus were reported by two patients (6.66%) following TLS while no patient complained of any degree of continence disorder after LLS.

Manometric Results:

1. Resting anal pressure (RAP):

Preoperative RAP ranged from 61 to 138cm H_2O with a significant higher mean (90.41 ± 17.64cm H_2O) if compared to the control group (64.9±11.90 cm H_2O, range 50-79). Forty-one patients had high RAP (68.33%) while 19 patients had normal RAP (31.66%). The mean RAP of patients in LS group was 90.93±0.48 cm H2O and in TLS group was 89.9±14.62 cm H_2O with no difference between groups ($p=0.8228$). The LS group included 20 patients with hypertonic anal canal (66.66%) and 10 patients had normotonic anal canal (33.33%). The TLS group included 21 patients with hypertonic anal canal (70%) and 9 patients had normotonic anal canal (30%).

The mean RAP was significantly lower in female patients (86.79±17.62 cm H_2O) than that in male patients (98.89±14.95 cm H2O) ($p=0.013$). There was no difference in age between normotensive (26.21± 5.09 years) and hypertensive patients (26.95±10.85 years) ($p=0.7785$).

Both tailored and limited lateral sphincterotomies resulted in reduction of the RAP one and five weeks after surgery with marginal insignificant increase over time. The

percent of reduction in the RAP was significantly more after TLS than LLS (34.73±15.60, 12.48±13.95, p=0.0000003). The reduction in RAP was nearly constant after TLS, regardless the type of patients (36.85±15.04% in hypertensives, 30.48±16.62% in normotensives, 37.25±6.07% in males, 34.10±17.23% in females) (Fig. 1). TLS resulted in hypotonia, which was more evident in female patients and normotensive patients (mean RAP = 57.00±7.75cm H_2O, 48.60±9.08 cm H_2O respectively). On the other hand LLS resulted in variable percentage of reduction in the RAP that was more in male patients and hypertensive patients (21.49±13.48%, 15.97±14.79%) than in female patients and normotensive patients (6.47±10.90%, 4.34±7.24%) (Fig. 1).

No evident hypotonia could be demonstrated after LLS. Five weeks after LLS, the mean RAP of females was 72.80±11.68 cm H_2O and of normotensives was 70.33±5.29 cm H_2O.

2. Resting anal pressure at 1 cm from the anal verge (RAP-1cm):

The mean resting pressure at 1 cm from the anal verge in patients with chronic anal fissure was significantly higher (101.06±21.39) than in control group (54.04±22.95) [p<0.0001]. RAP-1 cm in patients with chronic fissure was significantly higher than global RAP (p=0.00358), while it was less than the global RAP in control group with no significant difference (p=0.2005).

The mean RAP-1 cm was significantly higher in LS group (110.22±18.4) than in TLS group (91.9±20.47) [p=0.000573]. There was an insignificant difference in RAP-1 cm neither between female (99.76±21.71) and male patients (104.08±20.92) [p=0.478082], nor between normotensive (104.97±15.15) and hypertensive (99.25± 23.69) [p=0.339643).

The percent of reduction in the RAP-1 cm was significantly more after TLS than LLS (41.56±14.51%, 17.62±27.25%, p=0.0000794). Although, both procedures resulted in more reduction in the RAP-1 cm than the global RAP, the difference was not significant (p= 0.08443, p= 0.361327) (Fig. 1).

There was no significant difference in the RAP-1 cm 5 weeks after each procedure (63.88±16.72, 73.01±11.47, p=0.056203). Similarly, no significant difference between mean RAP-1 cm of normotensives and hypertensives after TLS (56.88±10.83, 67.38±18.23, p=0.105899) and after LLS (75.67±19.62, 70.80±15.47, p=0.472482) (Fig. 1)

3. Cross-sectional profile at 1 cm from the anal verge:

The pressure cross-sections were rather symmetrical in control group with no significant difference between anterior and posterior pressure domains (p=0.552983) In patients with chronic fissure; there was a significantly higher posterior pressure in the distal 1 cm of the anal canal (p=0.00000017) (Table 1).

The distribution of pressures, being higher posteriorly, was similar in females, males, LS, TLS groups, normotensive and hypertensive groups with no difference existed between subgroups (Table 1).

There was equal percent of reduction in the anterior and posterior pressure domains after TLS (40.07±17.27%, 41.58±16.81%) while LLS resulted in more reduction in the posterior pressure (19.87±19.67%) than in the anterior pressure (1.30±68.55%)

4. Functional Anal Canal Length (FACL):

The functional anal canal length was similar in patients and controls (3.35±0.51, 3.55±0.64, p=0.15414). FACL was significantly longer in TLS group than in LS group (3.6±0.50, 3.1±0.38, p=<0.0001). No significant difference was found in FACL between female and male patients (3.30±0.53, 3.47±0.44, p=0.2242) while normotensive patients have significantly shorter FACL than hypertensive patients (3±0.5, 3.51±0.43, p=0.00013). Neither TLS nor LLS resulted in a significant change in the FACL

5. Width of the High Pressure Segment (HPS):

In both patients and controls, the width of the high-pressure segment (the part of the FACL where pressures are higher than 50% of RAP) was measured in centimeter and as a percent of total FACL. No significant difference in width of HPS could be elicited between patients and controls (0.89±0.38, 0.90±0.52, p=0.93801). Width of HPS was comparable in LS and TLS groups (0.93±0.37, 0.85±0.40, p=0.401036) and no difference existed between males and females (0.85±0.41, 1±0.30, p=0.150478). Normotensive fissure patients have a significantly shorter width of HPS than the hypertensive patients (0.61± 0.21, 1.02±0.37, p=0.0000238). The width of high-pressure segment as a percent of FACL was significantly less in normotensive patients (20.57±7.23 %) than in hypertensive patients (29.44±11.11%) (P=0.002378).

There was no significant change in the width of HPS following TLS or LLS. LLS resulted in a significant increase in width of HPS as a percent of FACL (38.33±65.71%) if compared to TLS (3.74±48.00%). (Table 2) The increase in the width of HPS/FACL% following LLS was significantly more in normotensive (pre-op=15.27±2.08%, post-

op=28.89±6.67%) than in hypertensive patients (pre-op=26.53±9.24%, post-op=27.29±8.45%) (P=0.000778)

6. Highest Mean Resting Pressure (HMRP):

For comparison, the distance from the anal verge to the point of the HMRP (D1), the distance from the HMRP to the proximal border of the anal canal (D2) and D1/D2 ratio were performed for both patients and controls.

The HMRP was more distally located in patients than in controls because D1/D2 ratio was significantly higher in controls than in patients (1.33±1.45,1.10±0.44, p=0.022356). No difference in D1/D2 ratio between male and female patients (1.05±0.46, 1.16±0.42, p=0.346166) and it was comparable in LS and TLS groups (1.10±0.49, 1.11±0.30, p=0.979055). Normotensive fissure patients have a significantly more distally located HMRP than hypertensive patients (0.82±0.21, 1.24±0.46, p=0.000326).

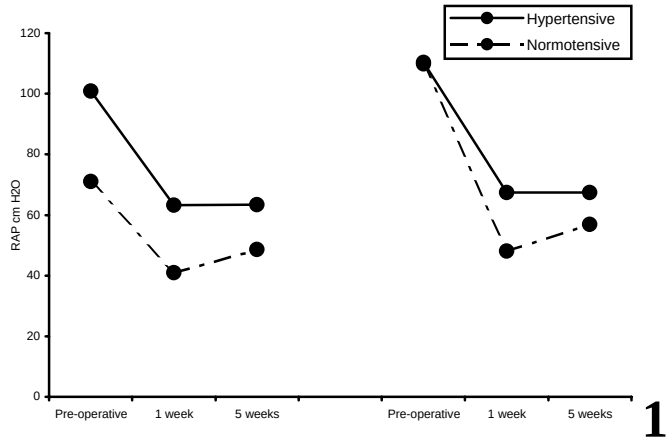
There was no significant increase in D1/D2 ratio following both TLS and LLS (Table 2). Among each group, no significant difference in D1/D2 ratio of hypertensive patients if compared to normotensive patients following TLS (p=0.155755), while LLS resulted in a significant increase in D1/D2 ratio of normotensive patients if compared to hypertensive patients (p=0.034164) with relocation of HMRP more proximally in the anal canal.

7-Vector Symmetry Index (VSI):

VSI was developed as a hypothetical parameter to describe the magnitude of all eight individual data points to form a perfect (i.e. symmetric) circle.

In spite of difference in cross-section pressure distribution there was no significant difference in VSI values between patients and controls (0.66±0.16, 0.69±0.13, p=0.55727) and between the studied subgroups (Table1).

There was no significant change in VSI values following either TLS or LLS (Table 2).



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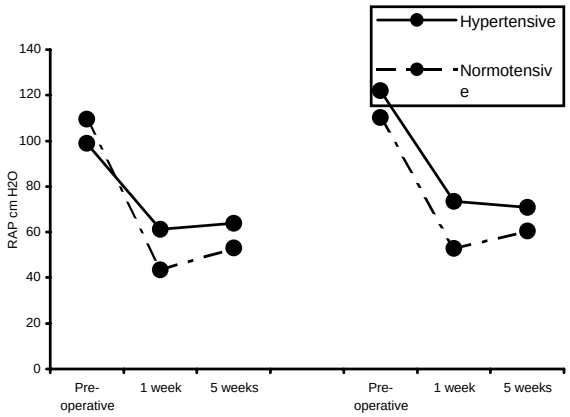

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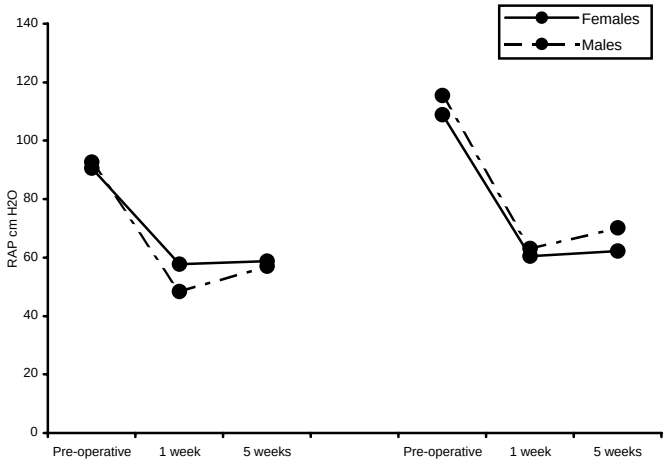

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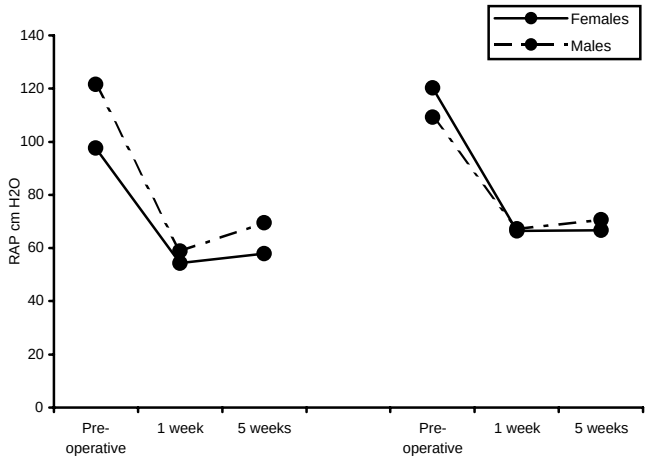

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Figure Legends:

(1) Change in mean resting anal pressure (MRAP) and resting pressure at 1 cm from anal verge (RAP –1cm) in normotensive vs. hypertensive patients,
(2) Change in anterior and posterior pressures in normotensive vs. hypertensive patients,
(3) Change in MRAP and RAP – 1cm in female vs. male patients and
(4) Change in anterior and posterior pressures in female vs. male pateints.

Table (1): ***Anal manometric parameters of the studied subgroups (mean ± SD)***

	Patients	Controls	p	TLS group	LLS group	p	Female Patients	Male Patients	p	Normotensive Patients	Hypertensive Patients	P
n	60	20	-	30	30	-						
Age	26.72±9.37	26.72±9.37		26.93±7.84	26.5±10.82	0.859656	28.42±10.62	22.72±2.99	0.029414*	26.21± 5.09	26.95 ±10.85	0.778531
Male:Female	18-42	18-42	-	6:24	12:18	-	-	-	-	4 :15	14:27	-
RAP(cmH_2O)	90.42±17.65	64.90±11.90	<0.0001*	90.93±20.48	89.9±14.62	0.822783	86.79±17.62	98.89±14.95	0.013596*	72.26± 6.36	98.83±14.56	<0.00001*
RAP 1 cm from A.V. (cmH_2O)	101.06±21.39	54.04±22.95	<0.0001*	110.22±18.4	91.9±20.47	0.000573*	99.76±21.71	104.08±20.92	0.478082	104.97±15.15	99.25± 23.69	0.339643
Anterior Domain (cmH_2O)	87.53±28.45	50.78±28.29	<0.0001*	102.45±21.5	72.6±26.89	<0.0001*	84.95±28.94	93.53±27.13	0.288568	98.09±26.04	82.63±28.49	0.04932*
Posterior Domain (cmH_2O)	114.6±24.79	57.30±19.09	<0.0001*	118±21.28	111.2±27.81	0.291866	114.58±26.02	114.64±22.36	0.993733	111.84± 28.94	115.88±22.89	0.56187
FACL (cm)	3.35±0.51	3.55±0.64	0.15414	3.1±0.38	3.6±0.50	<0.0001*	86.79±17.62	98.89±14.95	0.013596*	3± 0.5	3.51± 0.43	0.00013*
Width of HPZ (cm)	0.89±0.38	0.90±0.52	0.93801	0.93±0.37	0.85±0.40	0.401036	3.30±0.53	3.47±0.44	0.224277	0.61± 0.21	1.02±0.37	2.38E-05
Width of HPZ/FACL %	26.63±10.81	25.69±13.10	0.74690	30.11±11.19	23.15±9.36	0.011356*	0.85±0.41	1±0.30	0.150478	20.57±7.23	29.44±11.11	0.002378*
D1 (cm)	1.72±0.51	1.60±0.88	0.46077	1.53±0.39	1.9±0.55	0.004199*	25.67±11.65	28.88±8.41	0.295717	1.34±0.37	1.89±0.47	<0.0001*
D2 (cm)	1.63±0.29	1.95±0.90	0.01609*	1.57±0.31	1.7±0.25	0.07384	1.68±0.55	1.81±0.39	0.378778	1.66± 0.24	1.62± 0.31	0.658096
D1/D2 ratio	1.10±0.44	1.33±1.45	0.022356*	1.05±0.46	1.16±0.42	0.346166	1.10±0.49	1.11±0.30	0.979055	0.82±0.21	1.24±0.46	0.000326*
VSI	0.66±0.16	0.69±0.13	0.55727	0.69±0.17	0.63±0.14	0.123769	1.62±0.31	1.67±0.24	0.563317	0.61± 0.09	0.69± 0.17	0.082319

*Statistically significant ($p < 0.05$)

Table (2): ***Comparison of anal manometric parameters of tailored versus limited lateral sphincterotomy (preoperative, 1 week & 5 weeks after surgery)***

	Tailored Lateral Sphinctrotomy Group N=30			*% difference after 5 weeks*	*Limited Lateral Sphinctotomy Group N=30*			*% difference after 5 weeks*	*3 ways ANOVA*	
	Pre-operative	1 week	5 weeks		Pre-operative	1 week	5 weeks		F	p
RAP(cmH_2O)	90.93±20.48	55.87±18.47	58.47±16.04	34.73±15.60	89.9±14.62	63.14±16.63	72.17±15.63	12.48±13.95	7.745	0.0001*
RAP 1 cm from A.V. (cmH_2O)	110.22±18.4	60.94±18.12	63.88±16.72	41.56±14.51	91.9±20.47	63.01±18.16	73.01±11.47	17.62±27.25	5.730	0.002*
Anterior Domain (cmH_2O)	102.45±21.5	55.23±20.10	60.25±16.99	40.07±17.27	72.6±26.89	53.88±20.51	63.19±15.43	1.30±68.55	4.473	0.007*
Posterior Domain (cmH_2O)	118±21.28	66.65±17.96	67.50±17.62	41.58±16.81	111.2±27.81	72.14±18.91	82.83±13.24	19.87±19.67	4.277	0.009*
FACL (cm)	3.1±0.38	3.10±0.70	3.03±0.66	1.90±19.12	3.6±0.50	3.10±0.82	3.17±0.77	5.65±15.03	5.464	0.002*
Width of HPZ (cm)	0.93±0.37	0.83±0.36	0.83±0.30	0.00±45.91	0.85±0.40	0.69±0.29	0.64±0.23	16.67±21.44	7.511	0.0001*
Width of HPZ/FACL %	30.11±11.19	26.72±8.74	27.23±6.78	-3.74±48.00	23.15±9.36	28.47±7.94	26.88±9.15	-38.33±65.71	3.136	0.033*
D1 (cm)	1.53±0.39	1.50±0.49	1.63±0.51	-11.67±40.45	1.9±0.55	1.56±0.61	1.61±0.40	3.67±25.96	2.522	0.0858641
D2 (cm)	1.57±0.31	1.63±0.57	1.40±0.50	7.78±34.94	1.7±0.25	1.56±0.61	1.56±0.57	1.67±35.92	0.5874	0.5068165
D1/D2 ratio	1.05±0.46	1.08±0.65	1.30±0.61	43.63±85.29	1.16±0.42	1.15±0.61	1.18±0.47	13.08±54.14	1.425	0.1029514
VSI	0.69±0.17	0.65±0.12	0.63±0.14	-16.29±121.76	0.63±0.14	0.62±0.10	0.69±0.12	-8.01±29.17	0.232	0.7185660

*Statistically significant ($p < 0.05$)

DISCUSSION

Our findings of significantly higher resting anal pressure in patients with anal fissure compared with controls are in accordance with the observations of others [17-21]. In our series, 31.66% of patients with anal fissure had normal RAP and this does not agree with the concept of global increase of RAP in patients with anal fissure. [14] Resting pressure at 1 cm from the anal verge in patients with chronic anal fissure was significantly higher than in controls. A similar finding was reported by Williams et al.[14] RAP at 1 cm from the anal verge in patients with chronic fissure was significantly higher than global RAP (p=0.00358) The HMRP was more distally located in patients than in controls. This is inconsistent with the findings of Mc Narmara et al [22] and Keck et al [23] that hypertonia affects the entire anal canal. Our finding of significant distal hypertonia in both hypertensive and normotensive patients could be explained by local spasm or reflex spasm in response to presence of anal fissure. Thus, elevation in the mean resting anal pressure is attributed to distal hypertonia secondary to presence of the fissure.

Anterior pressures were reported to be higher than the posterior pressures in the distal anal canal in both patients and controls. [10,23] Taylor et al [10] suggested that deficient posterior pressure in the distal canal might provide less mucosal support in this region and predispose to the development of fissures. Our pressure cross-sections were rather symmetrical in control group with no significant difference between anterior and posterior pressure domains (p=0.552983), while in patients with chronic fissure; there was a significantly higher posterior pressure in the distal 1 cm of the anal canal (p=0.00000017). Our data could not defend the deficient mucosal support as an underlying etiologic factor. [10] In this respect, we agree with Farouk et al that fissures are primarily traumatic. [24] We suggest that what prevents chronic fissures from healing is the local high tone which may contribute to poor perfusion.

On the basis of our data, patients with chronic anal fissure can be classified into hypertensive group, with longer FACL, wider high pressure segment of higher percentage of the FACL and more proximally located, and normotensive group with a dramatically different pressure profile, with shorter FACL, narrower high pressure segment of lower percent of the FACL and more distally located. To our Knowledge, this concept has not been previously published

Traditional lateral sphincterotomy is accompanied by a 50 percent reduction in anal resting pressures. [24] In females, it was demonstrated to be more extensive than intended [8-11] In this study, tailored lateral sphincterotomy is accompanied by a mean of 34.73 % reduction in the resting anal pressure, that is constant regardless the type of patient, with evident hypotonia in females and normotonic patients. LLS resulted in variable percentage of reduction in the RAP (4.34-21.49%) that was more in males and hypertensives than in females and normotensive patients. Absence of hypotonia and continence disorders following limited sphincterotomy is not only related to less division of the sphincter but also to proportionality of the height of sphincter division to the functional anal canal length.

Tailored and limited sphincterotomies create a significant reduction in RAP-1cm, which may be the source of global reduction in the mean resting anal pressure. The RAP-1cm with its cross sectional pressure distribution returned to normal values regardless the type of sphincterotomy. Therefore, to assess accurately the effect of a sphinctertomy, we would consider it important to know which level in anal canal the pressure to be measured.

Measurement of the distance from the anal verge to HMRP in relation to the distance from the HMRP to the proximal end of the anal canal (D1/D2 ratio) represents another way to quantitatively assess anal sphincter function. In agreement with other authors, [16,25] the HMRP was midway in the anal canal in normal controls. The HMRP was more distally located in patients than in controls. Both TLS and LLS relocated the HMRP more proximally. Moreover, normotensive fissure patients have a significantly more distally located HMRP than hypertensive patients This higher gradient of pressure between proximal and distal anal canal in normotensive patients has been corrected by TLS on the expense of the mean RAP. Nevertheless, LLS equally corrected the higher-pressure gradient with ultimate normotonia.

Parallel to the post-operative reduction in both mean RAP and RAP-1cm, there was increase in the width of the high-pressure segment in relation to FACL. Actually a new HPS has been formed following sphincterotomy, which is wider and of lower intensity (amplitude) than the pre-operative HPS.

Vector symmetry index has been used by many authors to diagnose (assess) sphincter defects. Williams et al [14] could demonstrate an increased asymmetry due to segmental manometric defect as a result of lateral sphincterotomy. Although, the reduction of the RAP is the result of manometric defect in the segment in which sphincterotomy was performed, in this study, there was no significant postoperative changes in the vector symmetry index. This observation may suggest a considerable limitation of VSI in detection of sphincter defects. The commercially available software measures the VSI as a mean of serial measurements by the station pull-out technique. Along the entire anal canal, we consider it of importance to measure the segmental VSI to demonstrate a sphincter defect.

When compared with traditional lateral sphincterotomy, tailored sphincterotomy has a comparable success rate but less incidence of continence disorders. [13] The rate of imperfect control using limited technique is compared favorably with the tailored sphincterotomy. Moreover, the success rate of LLS closely approximates that of TLS.

Reports on lateral sphincterotomy have shown increase incontinence rates with long-term follow-up. [26] A long-term longitudinal study, comparing limited sphincterotomy with tailored sphincter division, should be performed with special emphasis on the recurrence and incontinence rates.

CONCLUSION

Patients with anal fissure have longitudinal and radial pressure asymmetry with prominent distal hypertonia. In addition, there are two types of patient with dramatically different pressure profile, hypertensive anal canal with long FACL and normotensive anal canal with short FACL. Limited sphincterotomy technique is a rational modification of traditional sphincterotomy that is based on the sphincter length. Anal physiology was significantly more preserved following LLS than after TLS with absence of post-operative hypotonia and continence disorders. The success rate of LLS closely approximate that of TLS

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