



ELSEVIER

Journal of  
Coloproctology

www.jcol.org.br



## Original Article

**Clinical, functional and morphologic evaluation of patients undergoing lateral sphincterotomy for chronic anal fissure treatment. Identification of factors that can interfere with fecal continence**

Graziela Olivia da Silva Fernandes<sup>a,\*</sup>, Sthela Maria Murad-Regadas<sup>b</sup>,  
Francisco Sérgio Pinheiro Regadas<sup>b</sup>, Lusmar Veras Rodrigues<sup>b</sup>,  
Iris Daiana Dealcanfreitas<sup>c</sup>, Jacyara de Jesus Rosa Pereira<sup>d</sup>, Erico de Carvalho Holanda<sup>e</sup>,  
Francisco Sérgio Pinheiro Regadas Filho<sup>f</sup>

<sup>a</sup> Service of Coloproctology, Hospital Universitário Presidente Dutra, Universidade Federal do Maranhão (UFMA), São Luís, MA, Brazil

<sup>b</sup> Department of Surgery, Universidade Federal do Ceará (UFC), Fortaleza, CE, Brazil

<sup>c</sup> Service of Coloproctology, Hospital Regional do Cariri, Juazeiro do Norte, CE, Brazil

<sup>d</sup> Service of Coloproctology, Hospital Universitário, Universidade Federal do Piauí (UFPI), Teresina, PI, Brazil

<sup>e</sup> Service of Coloproctology, Santa Casa de Misericórdia de Fortaleza, Fortaleza, CE, Brazil

<sup>f</sup> Service of Coloproctology, Hospital São Carlos, Fortaleza, CE, Brazil

## ARTICLE INFO

## Article history:

Received 12 March 2014

Accepted 19 May 2014

Available online 2 July 2014

## Keywords:

Chronic anal fissure

Lateral internal sphincterotomy

Anorectal manometry

Anorectal three-dimensional

ultrasound

## ABSTRACT

**Objective:** Evaluate clinical, functional and morphologic outcomes of lateral sphincterotomy for chronic anal fissure treatment, and correlate the findings with factors that influence in the anal continence.

**Method:** In a prospective study, female patients treated by lateral sphincterotomy for chronic anal fissure were assessed using Wexner's incontinence score and grouped according to score: group I (score = 0) and group 2 (score  $\geq 1$ ) and evaluated with anal manometry and anorectal 3D ultrasonography.

**Results:** Thirty-six womens were included, 33% had vaginal delivery. Seventeen patients were included in group I and 19 in group II. We found no difference in age, parity and mode of delivery between groups. A significant difference with respect to percentage reduction in resting pressures was noted, when comparing group 1 versus group 2. The anal sphincter muscle length was similar in both groups. However, the length and percentage of transected internal anal sphincter was significantly greater in group II.

**Conclusion:** There was a correlation between fecal incontinence symptoms after sphincterotomy with the percentage of resting pressure reduction, length and percentage of transected internal anal sphincter.

© 2014 Sociedade Brasileira de Coloproctologia. Published by Elsevier Editora Ltda.

Este é um artigo Open Access sob a licença de [CC BY-NC-ND](https://creativecommons.org/licenses/by-nc-nd/4.0/)

\* Corresponding author.

E-mail: [grazielafernandes@gmail.com](mailto:grazielafernandes@gmail.com) (G.O.d.S. Fernandes).

<http://dx.doi.org/10.1016/j.jcol.2014.05.006>

2237-9363/© 2014 Sociedade Brasileira de Coloproctologia. Published by Elsevier Editora Ltda.

Este é um artigo Open Access sob a licença de [CC BY-NC-ND](https://creativecommons.org/licenses/by-nc-nd/4.0/)

## Avaliação clínica, funcional e morfológica de pacientes submetidas à esfínterectomia para tratamento da fissura anal. Identificação dos fatores que podem interferir na continência fecal

### R E S U M O

#### Palavras-chave:

Fissura anal crônica  
Esfínterectomia lateral interna  
Manometria anorretal  
Ultrassonografia anorretal  
tridimensional

**Objetivo:** Avaliar os resultados clínicos, funcionais e morfológicos de pacientes submetidas à esfínterectomia para tratamento de fissura anal, correlacionando os resultados com os fatores que podem interferir com a continência fecal.

**Método:** Foram avaliadas prospectivamente pacientes do sexo feminino submetidas à esfínterectomia lateral interna devido à presença de fissura anal crônica utilizando o escore de incontinência de Wexner e distribuídas em dois grupos. Grupo 1 – Escore igual a zero e Grupo 2 – maior ou igual a 1. As pacientes foram submetidas à avaliação funcional e anatômica do canal anal utilizando manometria anorretal e ultrassonografia tridimensional anorretal.

**Resultados:** Das 36 pacientes incluídas, 33% tinham história de parto vaginal. Dezesete pacientes foram incluídas no Grupo 1 e 19 no Grupo 2. Não houve diferença quanto à idade, paridade e tipo de parto entre grupos. Houve diferença significativa em relação ao percentual de redução na pressão de repouso quando comparado o grupo 1 com grupo 2. Não houve diferença no comprimento da musculatura esfínteriana entre grupos. No entanto, o comprimento e o percentual de esfínter anal interno seccionado foram significativamente maiores no grupo 2.

**Conclusão:** Há correlação entre os sintomas de incontinência fecal pós esfínterectomia com o percentual de redução das pressões de repouso, tamanho e percentual do esfínter anal interno seccionado.

© 2014 Sociedade Brasileira de Coloproctologia. Publicado por Elsevier Editora Ltda.

Este é um artigo Open Access sob a licença de [CC BY-NC-ND](#)

## Introduction

Among those benign diseases involving the anal canal, anal fissure is a common occurrence in proctologic practice, corresponding to 10% of visits to colorectal units.<sup>1</sup> The initial approach in the treatment of anal fissures is conservative, aiming to reduce the anal resting pressure by lowering the sphincter tonus and improving the blood supply at the site of the fissure, thus promoting healing.<sup>2</sup> Patients with chronic anal fissure are advised to drink fluids and fiber supplements, as well as using stool bulk-forming agents, emollient laxatives, analgesics, and to make use of topical anesthetics and warm sitz baths.<sup>3,4</sup>

On failure of medical treatment with persistence of symptoms, surgical treatment should be offered.<sup>3</sup> Open or closed lateral sphincterotomy is considered the gold standard for the treatment of chronic fissures.<sup>2,3</sup> This procedure results in decreased anal canal pressures, leading to improved perfusion, decreased pain and ulcer healing.<sup>5,6</sup> However, when inducing a sustained reduction in anal resting pressure, a mild, but permanent, incontinence may result.<sup>7-11</sup> According to a systematic review of surgical studies conducted by Nelson, the overall risk of a continence disturbance after the surgery is approximately 10%, but can reach up to 35%.<sup>12</sup>

New imaging methods have enabled the realization of detailed anatomic studies of the anal canal and of the arrangement of sphincter muscles, resulting in an increased interest in using these methods to obtain a complete evaluation of patients with dysfunctions, aiming an adequate therapeutic choice.<sup>13,14</sup> This study aims to evaluate the clinical, functional

and morphological outcomes of patients undergoing sphincterotomy for treatment of anal fissure, correlating the results with those factors that can interfere with fecal continence.

## Method

From February 2011 to May 2013, we evaluated female patients with a mean age of 42.35 (21-55) years old who underwent sphincterotomy due to chronic anal fissure and with anal sphincter hypertonia proven with anorectal manometry from the Department of Coloproctology, Hospital Universitário Walter Cantídio, Universidade Federal do Ceará (HUWC-UFC). The study was approved by the Ethics Committee in Research of the Hospital.

The patients underwent a complete clinical and proctologic evaluation and underwent anorectal manometry. Initially, they were clinically treated, including with hygiene and diet guidelines, stool bulk-forming agents and topic nitrates for 12 weeks. Those who remained symptomatic were referred for surgical treatment. After preoperative tests and a standard flexible sigmoidoscopy, an open lateral internal sphincterotomy was performed by a group of 3 surgeons with expertise in colorectal surgery, with a previously standardized technique, with transection of the internal anal sphincter extending up to the apex of the fissure.

The patients were weekly followed at the coloproctology outpatient clinic, HUWC-UFC, until complete healing of the wound and absence of symptoms. Four months after wound healing, the patients were evaluated for anal continence by an examiner who did not take part of the surgical procedure

using the Wexner incontinence score,<sup>15</sup> being divided into two groups: group I – patients with incontinence score equal to zero, and group II – patients with score greater than or equal to 1. Then, they were subjected to functional and anatomical evaluation of the anal canal using anorectal manometry and anorectal tridimensional ultrasonography (3DUS), respectively.

Nineteen healthy female volunteers without proctologic or colorectal diseases, without previous proctologic surgery and without prior pelvic surgery, from the coloproctology outpatient clinic, HUWC, were also included for anatomical evaluation of the anal canal.

Patients older than 55 years, obese, diabetic, suffering from acquired immunodeficiency syndrome, with complaints of urinary or fecal incontinence, women with associated benign and malignant anorectal diseases or with previous colorectal or proctologic surgery were excluded from the study. Women without prior electromanometry, without evidence of anal hypertonia, and those with prior anal sphincter injury proven by imaging studies were also excluded.

### Anorectal manometry

The equipment used to perform anorectal electromanometry was Medtronic<sup>®</sup> hydro-pneumatic electromanometer, composed of an eight-channel radial catheter. The examination was performed by a staggered manual removal technique at intervals of one centimeter, starting 6.0 cm cranial to the anal border (AB) by the same examiner. The parameters evaluated in this study included mean resting pressure ( $P_{rest}$ ) and maximal voluntary pressure (MVP).

### Anorectal three-dimensional ultrasonography (3DUS)

All participants underwent rectal enema 2 hours before the examination. A Pro-Focus ultrasound equipment with transducer with 360°, type 2052, with a frequency of 9–16 MHz and focal length ranging from 2.8 to 6.2 cm (B-K Medical, Herley, Denmark) was used. This transducer performs image acquisition automatically in the proximal-distal direction in a segment of 6.0 cm for 50 s.

A sequence of numerous parallel transaxial images is acquired, resulting in a volumetric image scanned into a cube, enabling an analysis on multiple planes. In all tests, a frequency of 16 MHz and focal distance of 3.0 cm was used.<sup>16,17</sup>

A scan was performed with the aim to assess the complete anatomy of the anal canal. All examinations were performed by a single investigator and evaluated by two coloproctologists experienced in this method.

The acquired images were analyzed in multiple planes.

The evaluated parameters included measurements (cm) of sphincter muscle performed on sagittal and coronal planes (Fig. 1): length of the external anal sphincter (EAS), length of gap (corresponding to the area of the anterior quadrant without striated muscle – between the proximal border of EAS and the proximal border of the puborectalis (PR), length of external anal sphincter-puborectalis (posterior) complex (EAS-PR), length of intact contralateral internal anal sphincter (IAS), length of remaining IAS, length of IAS and percentage of transected IAS during the operative procedure.

Incontinence scores were correlated with age, parity, resting and maximal voluntary pressures quantified with anorectal manometry, and ultrasound anatomical measurements of sphincter muscle.

The anatomical measurements of the anal canal obtained by anorectal ultrasonography were compared between patients who underwent sphincterotomy and female volunteers.

The intraclass correlation coefficient was evaluated to compare ultrasound measurements between two examiners experienced in 3D Ultrasound both for patients who underwent sphincterotomy and for voluntary women.

Statistical analyzes were performed using GraphPad Prism 5.0 and SPSS version 17 for Windows<sup>®</sup> programs. The data evaluation included descriptive statistical methods (mean, standard deviation, median, interquartile range). Regarding the analytical methods, we applied the Student's *t*-test, one-way ANOVA and Fisher's chi-squared test.  $p < 0.05$  was the value used for statistical significance.

ICC (intraclass correlation coefficient) was also used to compare ultrasonographic anatomical measurements between examiners with a confidence interval of 95%, and reliability was classified according to the Altman classification system ( $<0.20$  = poor;  $0.1-0.40$  = reasonable;  $0.41-0.60$  = moderate;  $0.61-0.80$  = good;  $0.81-1.00$  = very good).<sup>18</sup>

## Results

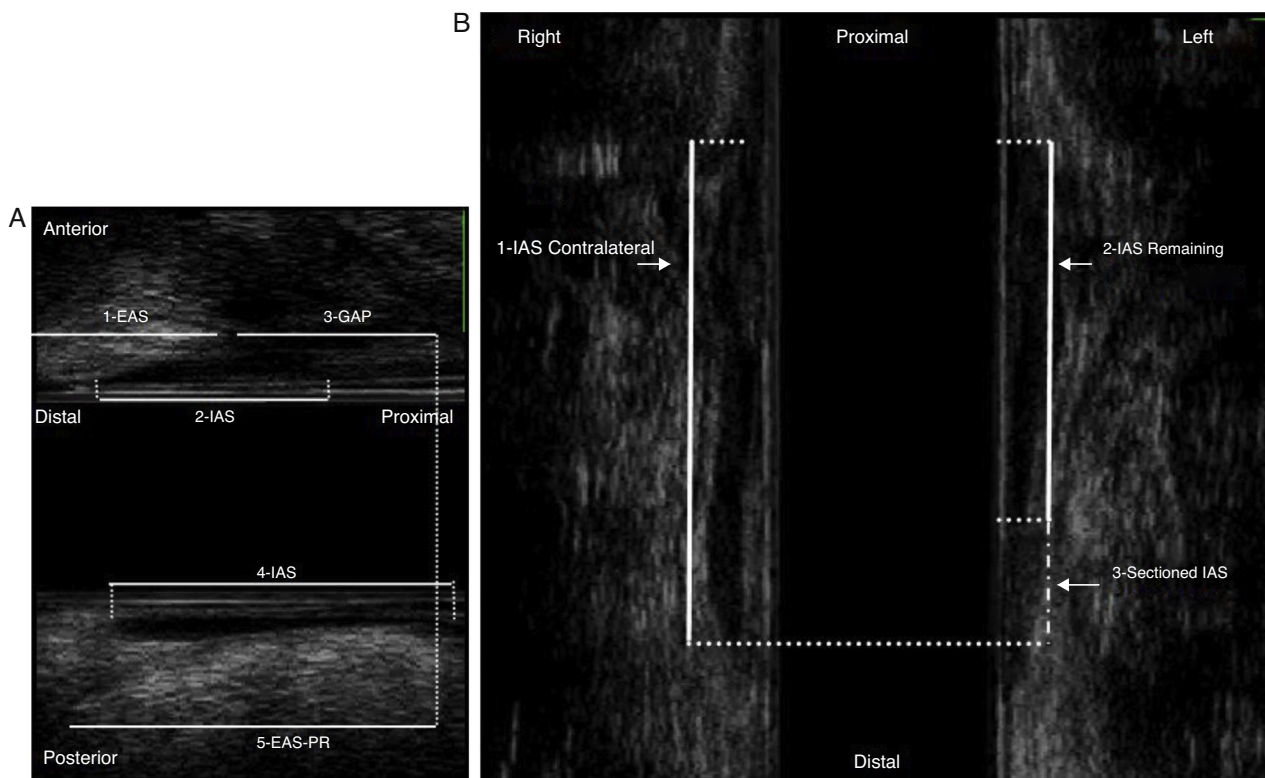
Thirty-six patients who underwent sphincterotomy for the treatment of chronic anal fissure were included in this study. No postoperative complications were observed, and healing of wounds between 2 and 3 months postoperatively was observed. The follow-up time ranged from 6 to 8 months after the surgical procedure. The control group included 19 asymptomatic volunteers.

The mean age of patients undergoing sphincterotomy was 42.35 (21–55) years. The mean age of patients in the control group was 38.68 (21–50) years.

Regarding parity, among those patients who underwent sphincterotomy 14 (39%) were nulliparous, 12 (33%) had at least one vaginal delivery with a mean of 2 (1–3) births, and 10 (28%) underwent cesarean delivery without labor. In the control group, 7 (37%) patients were nulliparous, 7 (37%) had at least one vaginal delivery with an average of 2 (1–3) deliveries, and 5 (26%) underwent cesarean section without labor. The distribution of parity and type of delivery were similar between groups ( $p = 0.8901$ ).

The incontinence score ranged from 0 to 7. Seventeen patients had an incontinence score of zero (group I) and 19 patients had greater than or equal to 1 scores (group II). In relation to group II scores, the median was 4 (3–7). When groups I and II were compared regarding age, parity and mode of delivery, no statistical difference ( $p = 0.6361$  and  $p = 0.9039$ , respectively) was observed.

Anal resting pressures in both groups decreased significantly when preoperative and postoperative figures were compared ( $p < 0.0001$ ). There was no significant difference in preoperative ( $p = 0.2185$ ) and postoperative ( $p = 0.1564$ ) resting



**Fig. 1 – (A) Anal canal of female patient (sagittal plane). Sonographic parameters: 1, length of previous EAS; 2, length of previous IAS; 3, length of the gap; 4, length of posterior IAS; 5, length of EAS-PR complex. (B) Anal canal of female patient (coronal plane) – sonographic parameters: 1, length of contralateral IAS; 2, length of remaining IAS; 3, length of transected IAS (dashed line).**

pressures in group I versus group II. However, a significant difference was observed with respect to percentage decrease in resting pressure, when comparing pre- versus postoperative values in group I versus group II ( $p=0.0452$ ) (Table 1).

There was no significant difference between preoperative and postoperative maximal voluntary pressures ( $p=0.4014$ ) in both groups. Likewise, there were no significant differences in preoperative versus postoperative voluntary pressures ( $p=0.6316$ ) when compared group 1 versus group 2 ( $p=0.9793$ ) (Table 1).

The ultrasound evaluation showed internal anal sphincter lesion in all 35 patients included in the study who underwent lateral internal sphincterotomy. There was no evidence

of anterior external anal sphincter and posterior puborectalis injury, even in patients undergoing vaginal delivery.

The measures of sphincter muscle using 3DUS are listed in Tables 2 and 3.

No significant difference in the length of anterior external anal sphincter, external anal sphincter-puborectal (posterior) complex and in the gap, when comparing group I versus group II. However, the length and percentage of transected IAS were significantly higher in group II compared to group I. No statistically significant difference in the length of contralateral IAS was observed (Table 2).

No significant difference in the length of the anterior external anal sphincter, external anal sphincter-puborectal

**Table 1 – Clinical and functional (manometric) parameters of Groups 1 and 2.**

Evaluated data	Group 1	Group 2	P
	n = 17 (47%) Mean ± SD (range)	n = 19 (53%) Mean ± SD (range)	
Age (years)	41.33 ± 3.17 (21-54)	43.35 ± 2.81 (21-55)	0.6361
Preoperative resting pressure (mmHg)	85.47 ± 4.48 (64-110)	98.66 ± 8.68 (40-139)	>0.2185
Post-operative resting pressure (mmHg)	77.02 ± 13.19 (42-100)	59.55 ± 3.50 (34-80)	0.1564
Percentage of resting pressure reduction (%)	25.29 ± 4.75 (9-48)	39.20 ± 4.39 (17-62)	0.0452 <sup>a</sup>
Preoperative voluntary pressure (mmHg)	173.4 ± 22.51 (82-281)	187.0 ± 17.21 (120-289)	0.6316
Post-operative voluntary pressure (mmHg)	160.5 ± 17.89 (70-239)	161.0 ± 11.67 (82-224)	0.9793

<sup>a</sup>  $p < 0.05$ .

**Table 2 – Measures of sphincter muscles using 3D anorectal ultrasonography in Groups 1 and 2.**

Evaluated parameters	Group 1	Group 2	P
	n = 17 (47%) Mean ± SD (range)	n = 19 (53%) Mean ± SD (range)	
Sectioned IAS (cm)	0.59 ± 0.04 (0.4–1)	0.87 ± 0.06 (0.4–1.3)	0.0024 <sup>a</sup>
Percentage of transected IAS (cm)	18.71 ± 1.57 (9–30)	25.65 ± 2.14 (10–37)	0.0138 <sup>a</sup>
Contralateral IAS length (cm)	3.14 ± 0.10 (2.7–4.3)	3.39 ± 0.08 (3.0–4.0)	0.0721
Anterior EAS (cm)	1.89 ± 0.04 (1.6–2.3)	1.90 ± 0.07 (1.6–2.6)	0.9464
EAS-PR (cm)	3.38 ± 0.11 (2.9–4.3)	3.66 ± 0.09 (3.0–4.5)	0.0840
Gap (cm)	2.01 ± 0.13 (1.1–3.2)	1.90 ± 0.07 (1.6–2.6)	0.4795

<sup>a</sup> p < 0.05.

**Table 3 – Comparison between lengths of the anal sphincters (EAS – external anal sphincter, EAS-PR – external anal sphincter-puborectal complex) and of the gap between patients who underwent sphincterotomy and voluntary participants.**

	Control group	Sphincterectomy group	P
	n = 24 Mean (standard deviation)	n = 36 Mean (standard deviation)	
EAS, anterior (cm)	1.83 ± 0.234 (1.6–2.5)	1.89 ± 0.263 (1.6–2.6)	0.3456
EAS-PR (cm)	3.47 ± 0.449 (2.6–4.4)	3.49 ± 0.360 (2.9–4.5)	0.3870
Gap (cm)	2.00 ± 0.535 (0.9–3.2)	1.98 ± 0.504 (1.1–3.2)	0.4786

(posterior) complex and in the gap, when patients undergoing sphincterotomy were compared with volunteers (Table 3).

The intraclass correlation coefficient for measures by anorectal three-dimensional ultrasonography evaluated 30 patients: 20 patients who underwent sphincterotomy and 10 volunteers presenting a very good result, ranging from 0.756 to 0.975 (Table 4).

## Discussion

This study evaluated the clinical, morphological and functional results after sphincterotomy for treatment of anal fissure exhibiting high levels of fecal incontinence (in about half of patients) compared with the literature. The true incidence of fecal incontinence is underestimated and only few doctors actively question this subject, especially in patients who do not provide this information voluntarily.<sup>19</sup> In this study, changes in fecal continence were evaluated after complete wound healing, using the Wexner incontinence score.<sup>15</sup> It is possible that the high frequency observed is due to the fact of considering as incontinent those patients with a score equal to or greater than 1, by the inclusion of only women (who have

a shorter anal canal) and also by the way of questioning about incontinence, which was performed actively: each patient was individually assessed by a coloproctologist not participating in her colorectal surgical procedure, so that the woman could feel more comfortable in her answer. Casillas et al. demonstrated that patients may feel embarrassed and deny some symptoms in the presence of their surgeons, and that they tend to ignore subtle problems after surgery, such as gas incontinence.<sup>20</sup>

Although controversial, several factors seem to affect the final postoperative result. Among these, the surgical technique (open or closed),<sup>21</sup> type of anesthesia (general or local),<sup>22</sup> length of the sphincterotomy,<sup>23,24</sup> additional procedures performed,<sup>25</sup> presence of previous anorectal surgery and obstetric history are included.<sup>26,27</sup> In this study, the sphincterotomy was of open-type and according to the length of the anal fissure, showing excellent results with respect to wound healing. The rates of postoperative incontinence are similar when open versus closed technique were compared.<sup>8,11</sup> Sultan et al. suggest in their study that the sphincterotomy ends up implying proportionally greater extension of IAS than the surgeon's initial intention of performing.<sup>23</sup> In our study, we observed that in patients with symptoms of fecal incontinence, the size and percentage of the transected internal anal sphincter were significantly higher, around 25%, and this was the only factor that interfered with fecal incontinence. It has been shown also that the measurements of the anal sphincters (EAS, EAS-PR and contralateral IAS) and of the gap were similar in patients with and without symptoms of fecal incontinence, excluding any morphological change additional to IAS injury that could interfere with the results of this problem.

When comparing age, parity and type of delivery between continent and incontinent groups, no difference was observed. Asymptomatic anal sphincter defects are common in women after vaginal childbirth.<sup>23</sup> In this study, we chose to exclude patients already with preoperatively diagnosed lesions of the external anal sphincter, or diagnosed on

**Table 4 – Distribution according to the intra-class correlation coefficient for ultrasound measures.**

Evaluated data	ICC	IC 95%
	n = 24	
EAS length (cm)	0.938	0.863–0.973
Contralateral IAS length (cm)	0.934	0.834–0.974
Sectioned IAS length (cm)	0.886	0.756–0.967
Remaining IAS length (cm)	0.903	0.773–0.953
EAS-PR length (cm)	0.854	0.868–0.962
Gap (cm)	0.947	0.851–0.973
IAS injury angle (°)	0.974	0.924–0.975

postoperative ultrasonography, in order to try to evaluate the results of the isolated transection of the internal anal sphincter as a factor that interferes with the loss of fecal continence.

A careful patient selection, the absence of preoperative problems of continence and a meticulously performed surgical technique by surgeons skilled in proctologic surgery are necessary to achieve good results.<sup>28</sup>

The endoanal ultrasound and anorectal manometry have been frequently used to evaluate patients with fecal incontinence. Tjandra et al. compared patients who underwent sphincterotomy and that have become incontinent versus those subjected to the same procedure, but without symptoms of anorectal incontinence, using anorectal ultrasound evaluation. Those patients with Wexner incontinence score above 4 were considered as incontinent.<sup>15,26,27</sup> The median score of incontinence was 9 (6–13) and all women had undergone previous vaginal birth and had a history of previous anorectal surgery.<sup>26,27</sup> In the present study, the score of incontinence ranged from 0 to 7, with a median of 4 for the incontinent group, and those participants with a score  $\geq 1$  were considered as incontinent. These differences in methodology and assessment may explain the differences in results in the comparison among studies.

The sphincterotomy permanently decreases the resting pressure that is elevated in most patients with anal fissures, with anorectal manometry being able to demonstrate this reduction, when the procedure is performed in the pre- and postoperative period in patients undergoing this operation.<sup>29</sup> In our patients, the manometric findings also demonstrated that lateral sphincterotomy significantly reduced anal resting pressures in patients with chronic anal fissure in the group with and without symptoms of fecal incontinence. However, the percentage of reduction in resting pressures was significantly higher in the incontinent group. On the other hand, Garcia-Aguilar et al. found no statistically significant difference between resting anal pressures in patients undergoing sphincterotomy and who became incontinent versus those who remained continent.<sup>24</sup> Studies show that the manometric findings and fecal incontinence symptoms may not present a correlation, because many factors can interfere with fecal continence and present divergent results.<sup>24,26</sup>

Imaging procedures in anatomical studies of the anal canal are being increasingly used, broadening our knowledge and providing details often not visible in classical anatomical dissections. Anorectal ultrasound, specifically the three-dimensional mode with automatic acquisition, enables a complete morphological evaluation of the anal canal in multiple planes, being possible to perform accurate measurements of the longitudinal length of the sphincter muscle.<sup>16,17</sup> Regadas et al. demonstrated, by comparing the longitudinal length of sphincter muscle in the anterior anal canal between genders, that EAS and IAS are smaller in women; and that the area deprived of EAS, the so-called gap, located in the proximal and superior middle anal canal, is larger in women.<sup>16,17</sup> Thus, this less resistant and significantly larger area could explain the high prevalence of disorders of continence and evacuation in females.

The preoperative endoanal ultrasound can identify an inadvertent transection of EAS or an inadequate transection of IAS as reasons for the failure of fissure healing.<sup>30</sup> Thus, this

procedure may be indicated in patients with high risk of anal incontinence, and in multiparous women and in those with suspected or known sphincter injury.<sup>21</sup>

In the present study, we used the three-dimensional mode with automatic acquisition, enabling the assessment of the length of the sphincter muscle and the percentage of transected muscle, comparing the transected internal anal sphincter with its contralateral counterpart, to correlate with the presence of symptoms of fecal incontinence. Exact measurement of the length of the sphincter muscles was performed in all patients undergoing sphincterotomy and compared to those healthy volunteers without prior surgery, to assess the anatomical structures related to continence and not only the internal anal sphincter transected during the sphincterotomy. Our measurements of muscle length are comparable to those made by Regadas et al., considering that these authors used similar devices and anatomical references.<sup>17</sup> All measurements taken by ultrasound were compared between two observers with experience in performing the procedure; a very good intraclass correlation coefficient was observed, similarly to other studies in the literature, since simple measures of length of sphincter muscles were performed, with use of a transducer with automatic acquisition, excluding the interference of movement of the probe.<sup>13,14</sup>

This study was limited by the small number of patients and the exclusive review of female patients. Further studies evaluating the results in males are needed to verify the effect of sphincterotomy in both genders.

The postoperative anal incontinence is a well-described complaint among patients who underwent lateral internal sphincterotomy for anal fissure.<sup>21</sup> Thus, all these clinical, manometric and ultrasound data add important new information and perspectives on the pre- and postoperative evaluation of patients with anal fissure. This joint evaluation could provide data to plan quantitatively the muscle section during sphincterotomy, avoiding changes in fecal continence, since patients may add cumulative damage throughout their lives, especially females, for instance, by vaginal childbirth, other proctologic surgeries and menopause.

---

## Conclusion

Female patients undergoing lateral internal sphincterotomy present significant reduction in resting pressure of the anal canal associated with injury to the internal anal sphincter. There is a correlation between symptoms of fecal incontinence after sphincterotomy with the percentage of reduction in resting pressures and size and percentage of the transected internal anal sphincter. No other factors affecting the results were identified.

---

## Funding

CNPQ.

---

## Conflicts of interest

The authors declare no conflicts of interest.

## REFERENCES

1. Garner JP, Mcfall M, Edwards DP. The medical and surgical management of chronic anal fissure. *J R Army Med Corps*. 2002;148:230-5.
2. Poh A, Tan KY, Seow-Choen F. Innovations in chronic anal fissure treatment: a systematic review. *World J Gastrointest Surg*. 2010;2:231-41.
3. Altomare DF, Binda GA, Canuti S, Landolfi V, Trompetto M, Villani RD. The management of patients with primary chronic anal fissure: a position paper. *Tech Coloproctol*. 2011;15:135-41.
4. Sharp FR. Patient selection and treatment modalities for chronic anal fissure. *Am J Surg*. 1996;171:512-5.
5. Abcarian H. Surgical correction of chronic anal fissure: results of lateral internal sphincterotomy vs fissurectomy-midline sphincterotomy. *Dis Colon Rectum*. 1980;23:31-6.
6. Hawley PR. The treatment of chronic fissure-in-ano: a trial of methods. *Br J Surg*. 1969;56:915-8.
7. Chowcat NL, Araujo JG, Boulos PB. Internal sphincterotomy for chronic anal fissure: long term effects on anal pressure. *Br J Surg*. 1986;73:915-6.
8. Arroyo A, Perez F, Serrano P, Candela F, Calpena R. Open versus closed lateral sphincterotomy performed as an outpatient procedure under local anesthesia for chronic anal fissure: prospective randomized study of clinical and manometric longterm results. *J Am Coll Surg*. 2004;199:361-7.
9. Aysan E, Aren A, Ayar E. A prospective, randomized, controlled trial of primary wound closure after lateral internal sphincterotomy. *Am J Surg*. 2004;187:291-4.
10. Karamanlis E, Michalopoulos A, Papadopoulos V, Mekras A, Panagiotou D, Ioannidis A, et al. Prospective clinical trial comparing sphincterotomy, nitroglycerin ointment and xylocaine/lactulose combination for the treatment of anal fissure. *Tech Coloproctol*. 2010;14:S21-3.
11. Wiley M, Day P, Rieger N, Stephens J, Moore J. Open vs. closed lateral internal sphincterotomy for idiopathic fissure-in-ano: a prospective, randomized, controlled trial. *Dis Colon Rectum*. 2004;47:847-52.
12. Nelson RL. Operative procedures for fissure in ano. *Cochrane Database Syst Rev*. 2005:CD002199.
13. Murad-Regadas SM, Regadas FS, Rodrigues LV, Kenmoti VT, Fernandes GO, Buchen G, et al. Effect of vaginal delivery and ageing on the anatomy of the female anal canal assessed by three-dimensional anorectal ultrasound. *Colorectal Dis*. 2012;14:1521-7.
14. Knowles AM, Knowles CH, Scott SM, Lunniss PJ. Effects of age and gender on three-dimensional endoanal ultrasonography measurements: development of normal ranges. *Tech Coloproctol*. 2008;12:3-9.
15. Jorge JMN, Wexner SD. Etiology and management of fecal incontinence. *Dis Colon Rectum*. 1993;36:77-97.
16. Regadas SMM, Regadas FSP, Rodrigues LV, Silva FR, Lima DMR, Regadas-Filho FSP. Importância do Ultra-som Tridimensional na Avaliação Anorretal. *Arq Gastroenterol*. 2005;42:226-32.
17. Regadas FS, Murad-Regadas SM, Lima DMR, Silva FR, Barreto RGL, Souza MHL, Regadas-Filho FSP. Anal canal anatomy showed by three-dimensional anorectal ultrasonography. *Surg Endosc*. 2007;21:2207-11.
18. Altmann DG. *Practical statistics for medical research*. London: Chapman & Hall; 1991.
19. Johanson JF, Lafferty J. Epidemiology of fecal incontinence: the silent affliction. *Am J Gastroenterol*. 1996;91:33-6.
20. Casillas S, Hull TL, Zutshi M, Trzcinski R, Bast J, Xu M. Incontinence after a lateral internal sphincterotomy: are we underestimating it? *Dis Colon Rectum*. 2005;48:1193-9.
21. Garcia-Aguilar J, Belmonte C, Wong D, Lowry AC, Adoff RD. Open vs. closed sphincterotomy for chronic anal fissure. *Dis Colon Rectum*. 1996;39:440-3.
22. Keighley MR, Greca F, Nevah E, Hares M, Alexander-Williams J. Treatment of anal fissure by lateral subcutaneous sphincterotomy should be under general anesthesia. *Br J Surg*. 1981;68:400-1.
23. Sultan AH, Kamm MA, Nicholls RJ, Bartram CI. Prospective study of the extent of internal anal sphincter division during lateral sphincterotomy. *Dis Colon Rectum*. 1994;37:1031-3.
24. Garcia-Aguilar J, Belmonte C, Perez JJ, Jensen L, Madoff RD, Wong WD. Incontinence after lateral internal sphincterotomy: anatomic and functional evaluation. *Dis Colon Rectum*. 1998;41:423-7.
25. Leong AFPK, Husain MJ, Seow-choen F, Goh HS. Performing internal sphincterotomy with other anorectal procedures. *Dis Colon Rectum*. 1994;37:1130-2.
26. Tjandra JJ, Han WR, Ooi BS, Nagesh A, Thorne M. Fecal incontinence after lateral internal sphincterotomy is often associated with coexisting occult sphincter defects: a study using endoanal ultrasonography. *Aust N Z J Surg*. 2001;71:598-602.
27. Tjandra JJ, Milsom JW, Schroeder T, Fazio VW. Endoluminal ultrasound is preferable to electromyography in mapping anal sphincter defects. *Dis Colon Rectum*. 1993;36:689-92.
28. Elsebae MM. A study of fecal incontinence in patients with chronic anal fissure: prospective, randomized, controlled trial of the extent of internal anal sphincter division during lateral sphincterotomy. *World J Surg*. 2007;31:2052-7.
29. Mcnamara MJ, Percy JP, Fielding IR. A manometric study of anal fissure treated by subcutaneous lateral internal sphincterotomy. *Ann Surg*. 1990;211:235-8.
30. Farouk R, Monson JR, Duthie GS. Technical failure of lateral sphincterotomy for the treatment of chronic anal fissure: a study using endoanal ultrasonography. *Br J Surg*. 1997;84:84-5.