Pre and Postoperative Assessment of Anal Sphincters Integrity in Fistula in Ano by 3D Endo-anal Ultrasound

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ABSTRACT

Purpose*: The aim of the study was the evaluation of the anal sphincter integrity and the occurrence of anal incontinence after fistula in ano surgery using 3D endoanal ultrasonography.* ***Methods:*** *61 patients with different types of fistula in ano were enrolled in the study during the period from October 2012 to December 2013. All the patients were subjected to preoperative and postoperative 2D and 3D endoanal ultrasonography (EAUS). Different techniques of fistula in ano surgery were done. Measurements of the anal sphincters length were calculated preoperative and postoperative.* ***Results****: The patients' age ranges from 19 to 74 years. 36 (60%) of the patients were males. 20 (32.8%) patients had low transsphincteric fistula, 18 (29.5%) patients had intersphincteric fistula, 10 (16.4%) patients had extrasphincteric fistula, 7 (11.5%) patients had suprasphincteric fistula, 5 (8.2%) patients had high transsphincteric fistula and 1 (1.6) patient had submucosal tract. It was observed that the highest percent of divided external anal sphincter (EAS) and internal anal sphincter (IAS) were 75.7% and 87.3% respectively. 4 cases were incontinent. The lowest percent of the divided external anal sphincter (EAS) and internal anal sphincter (IAS) in incontinent patients were 63.5% and 44.4% respectively that showed statistical significance (P value is 0.001, 0.002 respectively).* ***Conclusion****: During fistula in ano surgery preservation of the anal sphincter is an integral part of the techniques. Inspite of the small number of the cases and the anal incontinence is a multifactorial disease, the patient is at risk of incontinence if >63 % of external anal sphincter (EAS) and 44% of internal anal sphincter (IAS) were divided during surgery.*
Key words: *Fistula in ano, external anal sphincter, internal anal sphincter and endoanal ultrasonography.*
This study helped us not to dived more than 60% or 40% of the EAS and IAS respectively during fistula in ano surgery.

INTRODUCTION

Fistula in ano is a common anal disease and defined as abnormal communication between anal canal or rectum and perianal skin [1]. Although simple fistula is easy to treat, complex anal fistula might be very demanding [2]. To decrease the incidence of postoperative fecal incontinence and keep the recurrence rate as low as possible, the surgeon must be aware of the relationship of the fistula to the surrounding perianal structures[3]. Iatrogenic injury of the anal sphincters during surgical treatment of a fistula in ano may lead to fecal incontinence so delineation of the anatomy of the fistula track and its relation to the surrounding structures is an important issue [4]. The anal sphincter complex responsible for fecal continence is composed of the internal and external anal sphincters and puborectalis muscle [5]. Endoanal ultrasound technique became a very important diagnostic tool in the management of fistula in ano [6-10]. It consists of a rotating rectal endoprobe provided 2D and 3D images of high spatial resolution. This technique gives the ability to demonstrate the presence and extent of anal sphincter disruption [11]. The objectives of our study are to use 3D endoanal ultrasound (EAUS) to quantify the height of the perianal fistula preoperatively and the extent of fistulotomy or fistulectomy postoperatively, with respect to total sphincter length and compare these results with postoperative fecal incontinence.

PATIENTS AND METHODS

Patients:

This was a prospective study that included 61 patients suffering from different types of fistula in ano of age ranging from 19 to 74 years old and from both sexes at Cairo University hospitals, surgery department during the period from October 2012 to December 2013. The study was approved by the ethical committee.

The patients were informed about the study and signed a written consent before inclusion in the study.

The inclusion criteria:

- Patients diagnosed of any type of anal fistula whether it was high or low, recurrent or not.

Exclusion criteria:

- Patients with chronic inflammatory bowel disease
- Fistula in ano treated with other non-surgical techniques or drugs that could influence the outcome, such as the use of plugs, biological glues, stem cell therapy, etc.

Methods:

Clinical history and physical examination was performed in all patients to exclude cases which did not match with the inclusion criteria. All patients underwent proper history taking:

- Age
- Occupation
- Presentation
- History of anorectal diseases e.g. anorectal abscess
- History of previous anorectal surgery e.g. abscess drainage or fistulotomy, risk factors for fecal incontinence…)
- Preoperative continence and calculation of incontinence score preoperatively and 6 months postoperatively according to Jorge and Wexner score.

Physical examination was done for localization of the external and internal fistulous opening and the existence of a secondary tract.

2D and 3D EAUS was performed to confirm the diagnosis preoperatively and 6 months postoperatively.

Ultrasound technique:

The patient had an enema to clear the rectum and after digital rectal examination, a rigid rotating probe with a 360° radius and an ultrasound frequency between 6 MHz and 16 MHz was introduced into the rectum while the patient was in a left lateral position. The probe is then slowly withdrawn so that the pelvic floor and subsequently the sphincter complex are seen. The anal canal 6 cm length was scanned with the 2D cuts from the upper to the lower part then these 2D cuts were reconstructed to form the 3D image. Hydrogen peroxide may be injected through the external opening to delineate the fistulous tract. In the 2D images: We evaluated the visualization of the internal fistulous opening (IFO) empty or with hydrogen peroxide injected, the secondary tracts, the abscess cavities and the primary tract that was classified according to modified Parks classification[12] as:

- Not visualized
- Intersphincteric: the tract crosses the intersphincteric space without crossing fibers of the external anal sphincter (EAS)
- Low transsphincteric: the tract crosses the EAS or both sphincters in the most distal one third of the anal canal
- High transsphincteric: the tract crosses both sphincters in the upper two thirds of the anal canal,
- Suprasphincteric: the tract crosses the intersphincteric space surrounding the upper edge of the puborectalis
- Extrasphincteric: the tract is found to be outside the EAS.

Other data obtained with this technique are the presence of secondary tracts and the existence or not of perianal cavities and abscesses.

The 3D images allowed us to obtain sagittal and coronal images of the anal canal. The site of the IFO, the primary tract of the fistula and the possible secondary tracts and abscesses reassessed. At the end of the examination the 3D image was reviewed and the following variables were measured in millimeters Figs. 1,2,3:

- total length of the anal canal
- length of the puborectalis muscle,
- length of the EAS and
- length of the IAS

Preoperative calculation of the percentage of the involved EAS and IAS by the fistula was done. 6 months postoperatively the percentage of the divided EAS and IAS was calculated. All the cases were examined by the same surgeon using the B-K Medical Systems Pro Focus and B-K 2050 probe (BK Medical ApS- Mileparken 34DK-2730 Herlev- Denmark, 2012,Windows XP Embedded is of US-origin).

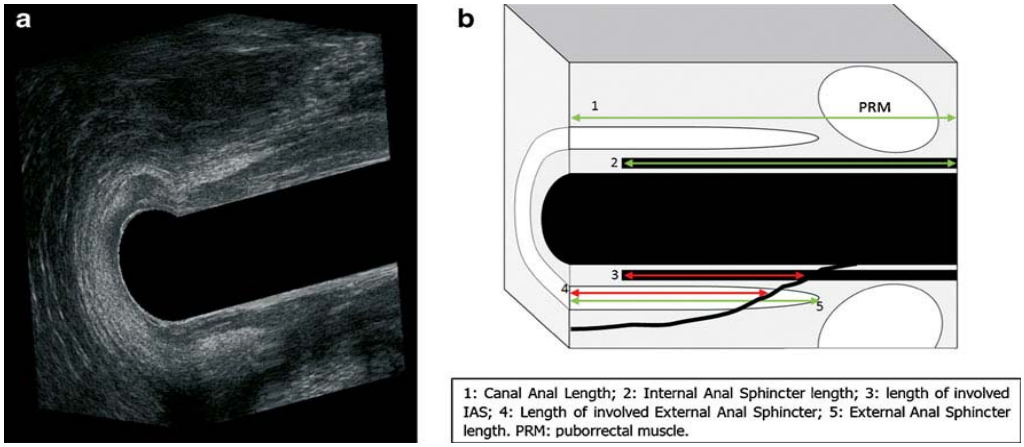

Fig. 1: Calculation of different measurements

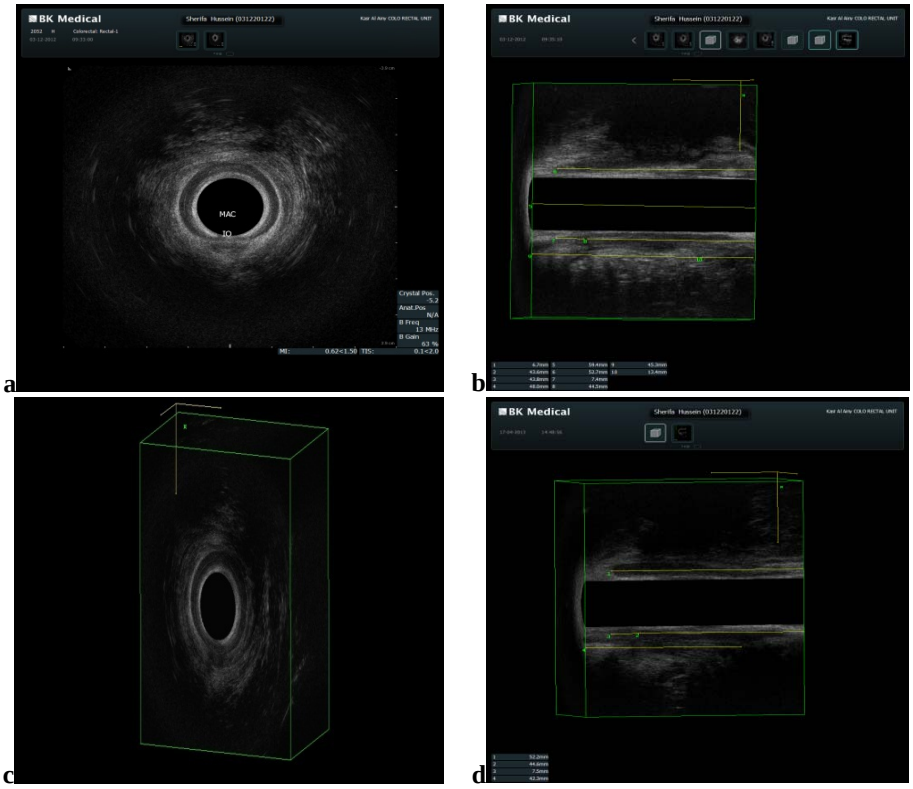

Fig. 2: Intersphincteric fistula: a) preoperative 2D EAUS of inters intersphincteric fistula. b) preoperative 3D EAUS measurement of EAS and IAS. C) postoperative 3D EAUS of the anal canal axial cuts d) postoperative 3D EAUS measurement of EAS and IAS with no injury to the anal sphincters.

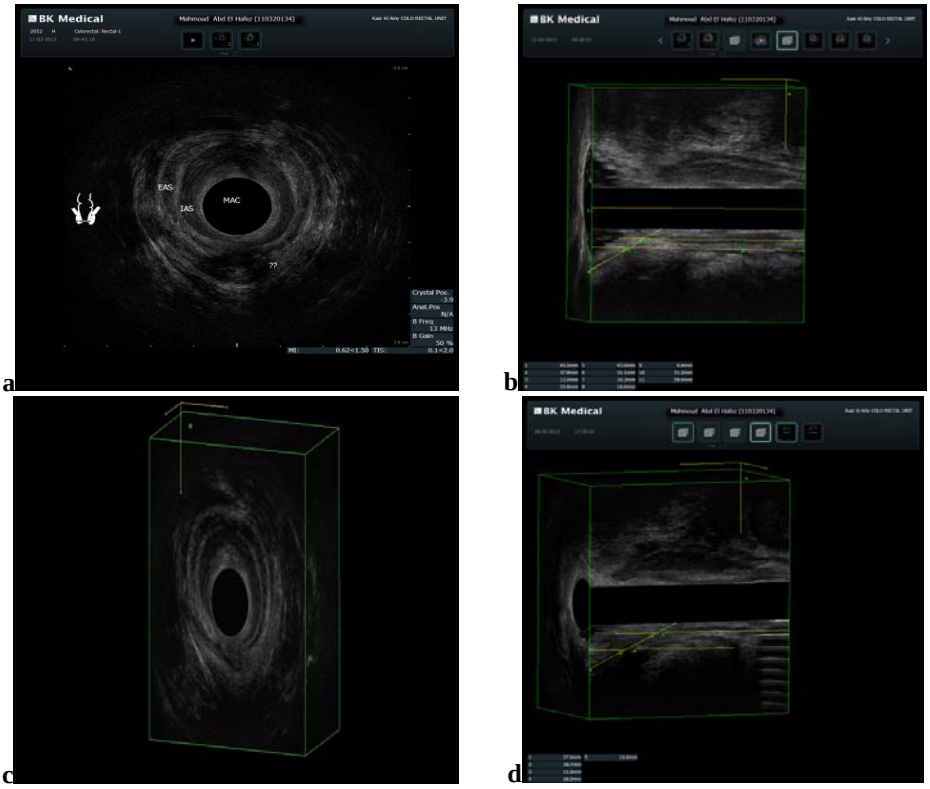

Fig. 3: Low trans-sphincteric fistula: a) preoperative 2D EAUS of low trans-sphincteric fistula. b) preoperative 3D EAUS measurement of EAS and IAS. C) postoperative 3D EAUS of the anal canal axial cuts d) postoperative3D EAUS measurement of EAS and IAS with 20% defective EAS

Surgical technique:

Fistula surgery was performed with general anesthesia without muscle relaxation (to identify the tone of puborectalis and EAS) except cases of low fistulae in which surgery was performed with spinal anesthesia. Patients were placed in the lithotomy position and examination under anesthesia was done. A probe was introduced from the external to the internal opening then fistulotomy or fistulectomy was done. Fistulotomy was done for fistula as it laid open in 20 patients of low transsphincteric fistula, 18 patients of intersphincteric fistula and 1 patient of submucosal tract. Fistulectomy was done for the high type of fistula where the fistulous tract was cored out in 10 patients of extrasphincteric fistula, 7 patients of suprasphincteric fistula and 5 patients of high transsphincteric fistula. There were sphincter defect in 7 cases 3 of them were suprasphincteric fistula, 2 cases high transsphincteric fistula and 2 cases extrasphincteric fistula. All the defects were repaired immediately intraoperative.

6 months after surgery anal incontinence was evaluated using the Jorge and Wexner scale (JW) table 1.

Table 1: Jorge and Wexner score:[13]

Type of incontinence	*Frequency*				
	Never	**Rarely**	**Sometimes**	**Usually**	**Always**
Solid	0	1	2	3	4
Liquid	0	1	2	3	4
Gas	0	1	2	3	4
Wears pad	0	1	2	3	4
Lifestyle alteration	0	1	2	3	4

The following variables were then compared in all patients with different types of fistulae pre and postoperatively and correlated with the change of incontinence score of the patient pre and postoperatively:

1. pre and postoperative length of the EAS
2. pre and postoperative length of the IAS
3. length of involved EAS by the fistula
4. length of divided EAS after surgery
5. length of involved IAS by the fistula
6. length of divided IAS after surgery
7. the percentage of involved EAS by the fistula
8. the percentage of divided EAS after surgery
9. the percentage of involved IAS by the fistula
10. the percentage of divided IAS after surgery.

Statistical methods

Data were statistically described in terms of range, mean, standard deviation (SD), median, frequencies (number of cases) and percentages when appropriate. Comparison of quantitative variables between the study groups was done using Mann Whitney U test for independent samples. For comparing categorical data, Chi square (2) test was performed. Exact test was used instead when the expected frequency is less than 5. P values less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel 2007 (Microsoft Corporation, NY, and USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

RESULTS

The study included 61 patients with different types of fistula in ano, 36 males and 25 female patients with age ranging from 19 to 74 years (Mean 43). The most common type of fistula in ano enrolled in the study was the low transsphincteric type
(20 cases) followed by the intersphincteric type (18 cases) table 2.

Table 2: Types of fistula in ano enrolled in the study

Fistula type	*Frequency*	*Percent*
Extrasphincteric	10	16.4
High Transsphincteric	5	8.2
Intersphincteric	18	29.5
Submucosal tract	1	1.6
Suprasphincteric	7	11.5
Low transsphincteric	20	32.8
Total	61	100.0

Upon comparing preoperative measurement of fistula height and postoperative extent of sphincter division, it was statistically significant ($P < 0.001$ for both EAS & IAS) table 3.

Table 3: Correlation between the percentage of the involved and the divided anal sphincters.

	Minimum	*Maximum*	*Mean*
% involved EAS	0.000	100	50
% of divided EAS-Post	0.000	75.799	26.14907
% of involved IAS	0.000	100	50
% of divided IAS-Post	0.000	87.332	33.63202

Preoperatively, all patients were completely continent. Only 4 of the 61 patients had deterioration in anal continence (6.6%) postoperatively according to JW scale. There was statistical significant difference between the degree of anal continence before and after surgery ($P<0.045$), and deterioration in fecal continence was significant in all the 4 cases (postoperative incontinence score was 16 in all cases). There was a strong correlation between change in the degree of anal continence and the percentage of the

EAS and IAS divided by surgery (P 0.001 & 0.002 respectively). By reviewing the data of the 4 incontinent patients, only one had 68.15 % of

EAS and 74.62 % of IAS involved by the fistula (High trans-sphincteric fistula), the other 3 patients (2 Extrasphincteric and 1 Supra-sphincteric fistulae) had 100 % of EAS and IAS involved by the fistula. Postoperatively 63.59-75.79 % of EAS and 44.44-87.33 % of IAS was divided tab 5. We observed that 2 patients were incontinent to liquid and gas; the other 2 patients were incontinent to solid, liquid and gas.

The remaining 57 patients (93.4 %) who had 0.0- 59.94% of EAS and 0.0-57.26% of IAS involved by the fistula, 0.0-50.96 % of EAS and 0.0-48.23% of IAS divided postoperatively had no deterioration in anal continence. Finally, there was a very low recurrence rate of about 4.91% (6 months follow up revealed recurrence in 3 patients out of 61 patients).

Table 4: Relation between the incontinence and anal sphincter damage

Incontinence		*% Involved EAS*	*% Involved IAS*	*% Divided EAS*	*% Divided IAS*
No	**Minimum**	0.00	0.00	0.00	0.00
	Maximum	59.94	57.26	50.96	48.23
	Mean	14.97	23.29	23.07	31.12
Yes	**Minimum**	58.37	51.56	63.59	44.44
	Maximum	100	100	75.79	87.33
	Mean	79.19	75.78	70.05	69.47

DISCUSSION

Fistula in ano is an important disease needs proper management planning to decrease the incidence of postoperative recurrence and fecal incontinence [14]. A lot of colorectal centers are using preoperative 3D endoanal ultrasonography to allow proper management of fistula in ano[15,16,17].

3D endoanal ultrasonography gives views in axial, coronal and sagittal cuts through which the angles, volumes, areas and distances can be calculated also it gives quantitative and qualitative data [18,19]. These advantages allow the examiner to measure the exact length of the anal sphincter complex, visualization of the fistula and improve the results of physical examination, so the incidence of fecal incontinence will decrease[20,21,22].

3D-EAUS had been shown to be a useful instrument, providing a more accurate preoperative diagnosis of perianal fistulae. It identifies the internal opening in a high percentage of cases, the primary tract, secondary tracts and abscesses or residual cavities [15,16].

A study included 29 patients, there was a 79% matching between primary tracts identified by examination under anesthesia and preoperative 3D-EAUS [17].

A study was done in 2012 demonstrated the use of 3D-EAUS in measurements of the amount of EAS and IAS which can be divided without impairment of fecal continence. They divided a median of 40% of the EAS and 29.2% of the IAS with no recurrence and minimal impaired continence and staining. They found no significant differences between the fistula heights preoperatively and the amount of divided sphincter postoperatively. In this study few patients developed deterioration in continence score [23]. These results were similar to those published by others with rates of minor incontinence after fistula in ano surgery ranging from 7% to 44%[24,25,26,27].

Very few studies were found which describe the effect of surgery on the anal sphincters as seen by 3D-EAUS and compare it to postoperative fecal incontinence. A study included 40 patients, the extent of the fistulotomy/fistulectomy was evaluated by 2D-EAUS, fistulotomy causes less damage to the sphincters [28].

In 2003, Voyvodic F et al. studied 330 patients and found no significant matching between the extent of fistulotomy assessed by 2D-EAUS and manometry with postoperative incontinence rates. They concluded that there was minimal deterioration in continence with fistulotomies limited to the lower two thirds of the EAS or IAS[29].

As in multiple studies done for assessment of lateral internal sphincterotomy in chronic anal fissure cases using 2D-EAUS, it was found that lateral sphincterotomy limited to the lower third was effective for cure and continence[7,30,31,32,33].

In our study that included 61 patients suffering from different types of fistula in ano surgery, we found that the 3D-EAUS allow us to perform quantitative measures for the anal sphincters length, the fistula height and the percentage of the involved and divided anal sphincters pre and postoperatively. The results were compared with the pre and postoperative continence score and we believed that it is safe to divide about two thirds of the anal sphincters during fistula in ano surgery with high cure rate and less deterioration of the anal continence.

6 months follow up revealed recurrence in 3 patients out of 61 patients with a recurrence rate of about 4.91 %.

The relationship between the level of EAS division and fecal incontinence showed a significant difference in incontinence rates between fistulotomies limited to the lower two thirds of the EAS and those above this level.

Four patients (6.6%) had worse anal continence after surgery, this was marked in all the 4 patients (16/20 Jorge and Wexner scale). There was a significant difference in continence scores before and after surgery (*P* 0.045).

Despite that, we noticed that there is no relation between type of incontinence and type of fistula or extent of EAS or IAS division. This may be explained by lifestyle alteration, educational and socioeconomic level of each patient.

CONCLUSIONS

In patients without risk factors, division of the EAS during fistulotomy limited to the lower two thirds of the EAS is associated with excellent continence and cure rates.

Abbreviations:
EAS: External anal sphincter
EAUS: endoanal ultrasound
IAS: internal anal sphincter.
IFO: internal fistulous opening

There are no potential conflicts of interest.
The author(s) declare that they have no competing interests'.

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