



## Original Article

# Gender-based analysis of the characteristics and outcomes of surgery for anal fistula: analysis of more than 560 cases



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### ABSTRACT

**Background:** Fistula-in-ano commonly affects males more than females. Some differences in the characteristics of fistula-in-ano between both genders have been recognized, yet the impact of these differences on the outcomes of surgery for fistula-in-ano is still unclear. The present study conducted a gender-specific analysis aiming to assess the characteristics and the outcomes of surgery of fistula-in-ano in each gender.

**Patients and methods:** The records of patients with fistula-in-ano were retrospectively reviewed and the following variables were extracted: patients' demographics, type of fistula-in-ano, position of the external opening, operation performed, incidence of recurrence and complications, particularly fecal incontinence. Gender-based analysis of the characters and outcomes of surgery for fistula-in-ano was performed.

**Results:** 565 (491 males) patients of a mean age of 41.7 years were included. Females had a significantly higher percentage of low fistula-in-ano than males (70.2% vs. 50.3%,  $p = 0.002$ ). Males had a significantly higher percentage of high trans-sphincteric fistula-in-ano (48.5% vs. 29.7%;  $p = 0.003$ ). Anterior fistula-in-ano was more common in female patients (69% vs. 16.3%;  $p < 0.0001$ ). Recurrence of fistula-in-ano was detected in 42 (7.4%) patients. Males had higher recurrence rate than females (7.9% vs. 4%;  $p = 0.34$ ). Fecal incontinence developed in 1.7% of patients with higher incidence observed in females (4% vs. 1.4%).

**Conclusion:** The majority of fistula-in-ano in males were posterior and high trans-sphincteric whereas most fistula-in-ano in females were low and anteriorly based. Despite the different characteristics of fistula-in-ano; no significant differences in the rates of fistula recurrence and fecal incontinence between males and females could be recorded.

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## Análise baseada no sexo das características e desfechos de cirurgia para fístula anal: análise de mais de 560 casos

### R E S U M O

#### Palavras-chave:

Fístula anal  
Fistula-in-ano  
Sexo  
Características  
Desfechos

**Background:** A fístula anal comumente acomete mais os homens que as mulheres. Algumas diferenças nas características da fístula anal entre ambos os sexos têm sido reconhecidas, embora o impacto dessas diferenças nos desfechos da cirurgia para fístula anal ainda seja incerto. O presente estudo realizou uma análise específica para sexo, com o objetivo de avaliar as características e os desfechos da cirurgia de fístula anal em cada sexo.

**Pacientes e métodos:** Os prontuários de pacientes com fístula anal foram revisados retrospectivamente e as seguintes variáveis foram extraídas: dados demográficos dos pacientes, tipo de fístula anal, posição da abertura externa, cirurgia realizada, incidência de recidiva e complicações, particularmente incontinência fecal. Realizou-se uma análise baseada no sexo dos sujeitos e desfechos da cirurgia para fístula anal.

**Resultados:** Foram incluídos 565 pacientes (491 do sexo masculino) com idade média de 41,7 anos. As mulheres apresentaram uma porcentagem significativamente mais alta de fístula anal baixa do que os homens (70,2% vs. 50,3%,  $p=0,002$ ). Os homens tiveram uma porcentagem significativamente maior de fístula anal transesfíncteriana alta (48,5% vs. 29,7%;  $p=0,003$ ). A fístula anal anterior foi mais comum em pacientes do sexo feminino (69% vs. 16,3%;  $p<0,0001$ ). A recorrência de fístula anal foi detectada em 42 (7,4%) pacientes. Os homens apresentaram maior taxa de recorrência do que as mulheres (7,9% vs. 4%;  $p=0,34$ ). A incontinência fecal desenvolveu-se em 1,7% dos pacientes com maior incidência observada no sexo feminino (4% vs. 1,4%).

**Conclusão:** A maioria das fístulas anais no sexo masculino foi posterior e transesfíncteriana alta, enquanto a maioria das fístulas anais no sexo feminino foi baixa e anterior. Apesar das diferentes características da fístula anal, não foi possível registrar diferenças significativas nas taxas de recorrência de fístula e incontinência fecal entre homens e mulheres.

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## Introduction

Anal fistula is a hollow track lined with granulation tissue that connects an internal opening in the anal canal with the perineal skin. The vast majority of Fistula-In-Ano (FIA) is secondary to anorectal abscess which is known as the cryptoglandular hypothesis where infection starts in the anal glands and then progresses through the anal sphincters to cause an anorectal abscess. However, some FIA are secondary to a specific etiology such as trauma, Inflammatory Bowel Diseases (IBDs), anal fissure, malignancy, and radiotherapy.<sup>1,2</sup>

Primary cryptoglandular FIA usually affects young and middle-aged males, with a mean age of around 38 years.<sup>3</sup> The documented male-to-female ratio of FIA is 1.8:1,<sup>3</sup> nevertheless this ration can reach up to 9:1 as Eisenhammer<sup>4</sup> has reported. The male predilection of FIA is not only noticed in adults, but also in the pediatric population where males represent more than 97% of infants with non-specific FIA.<sup>5</sup>

This strong male predilection cannot be explained solely on the basis of the cryptoglandular hypothesis as Lunniss and colleagues<sup>6</sup> have proposed. They thought that hormones, particularly androgens, had a possible role in the pathogenesis of FIA akin to the hormonal aspects of hidradenitis suppurativa. Another theory that may explain the higher incidence of FIA in males was the stronger tone of the anal sphincters in males

compared to females which may lead to ductal obstruction and subsequently inflammation of the anal glands.<sup>7</sup>

Male and female are not only different with regard the incidence of FIA, yet they also tend to differ in the characteristics of the disease and the outcomes of management. For example, the anterior location of FIA in females is considered a high-risk condition, rendering these fistulas a more complex entity that predisposes to higher risks of recurrence and Fecal Incontinence (FI).<sup>8</sup>

Patient's gender seems to affect the outcome of fistula surgery. Hyman et al.<sup>9</sup> reported that female gender was significantly associated with failure of wound healing after fistulotomy. However, other investigators disclosed that there was no difference between male and female regarding the incidence of fistula recurrence after anal advancement flap.<sup>10,11</sup> On the other hand, Garcia-Aguliar and associates<sup>12</sup> found that females were associated with a higher risk of FI after surgery for anal fistula than males.

There is paucity of data in the current literature concerning the different characters of FIA and the outcomes of its management among both genders. The outcome of any procedure is usually dependent on both patient-related and technical factors; learning how the patient-related factors can influence the outcome of surgery may ultimately help improve clinical practice by tailoring surgical treatment for each individual patient. This study aimed to conduct a gender-specific

analysis of FIA in a large cohort of patients to highlight the differences between males and females with regard the characteristics of FIA and whether these differences have an influence on the outcomes of surgical treatment.

## Patients and methods

### Study design and setting

This is a retrospective analysis of a prospectively maintained database of patients with FIA who were admitted to the colorectal surgery unit of Mansoura University hospitals in the period between January 2009 and January 2017. Ethical approval of the study was obtained from the institutional review board of Mansoura Faculty of medicine. The study was registered on [www.researchregistry.com](http://www.researchregistry.com) with Unique Identifying Number (UIN): researchregistry1877.

### Eligibility criteria

The records of the patients who were treated surgically for cryptoglandular FIA within the period of the study were retrieved from the archives of the colorectal surgery unit and were screened by two investigators (S.E & A.S). Adult patients (above 18 years) with primary cryptoglandular anal fistula were considered eligible to be included in the study. Patients with secondary FIA due to traumatic conditions, IBDs, malignancy, radiation therapy, sexually transmitted diseases, tuberculosis, or other specific etiologies were excluded. Patients with incomplete records missing some of the vital data were also excluded from the study.

### Procedures

The selection of procedure for each patient was based on the type and complexity of anal fistula demonstrated by clinical and radiologic assessment. Patients with recurrent or clinically complex fistulas were assessed by either MRI or endoanal ultrasonography.

Anal fistulas were classified according to the intraoperative findings into low fistulas (subcutaneous track with internal opening connected to anal canal, intersphincteric, and low transsphincteric fistulas) and high fistulas (high transsphincteric, extrasphincteric and suprasphincteric fistulas). For subcutaneous FIA, fistulotomy was performed. For intersphincteric FIA, fistulotomy, fistulectomy, or LIFT were done. For trans-sphincteric and extrasphincteric FIA, either fistulectomy, two-stage drainage seton, LIFT, or anocutaneous flap were performed.

All procedures were done under spinal anesthesia with the patient in the modified lithotomy position and prophylactic antibiotics (1 gm of cefotaxime) being administered on induction. Injection of hydrogen peroxide through the external opening verified the position of the internal opening then a metallic malleable probe was introduced from the internal orifice through the external opening.

In fistulotomy, lay open of the fistula tract over the probe was done followed by curettage of the opened tract with metallic curette. In fistulectomy, the entire tract

was excised along with any detected secondary branches. Ligation of Intersphincteric Fistula Tract (LIFT) was conducted according to the original technique described by Rojanasakul.<sup>13</sup>

If the tract was involving a considerable portion of the anal sphincters, the superficial part of the tract was excised until the point where it passes beneath the external anal sphincter then a Silk 0 thread was passed through the fistula tract and tied loosely. When the fistula track becomes superficial (within 2–3 months after seton placement) the seton was removed and the tract was divided or excised. In the cases of delayed healing or development of perianal abscess, seton removal was postponed.

Anocutaneous flap was construed by doing an inverted U-shaped incision in the anoderm close to the internal opening with a 2 cm wide apex. The main fistulous track and the internal opening were excised then the muscular defect at the site of the excised internal opening was sutured with interrupted 2/0 polyglactin sutures. The mobilized flap that consisted of mucosa, submucosa and perianal skin was then advanced over the internal opening and approximated to the anal mucosa with interrupted 3/0 polyglactin sutures. The external wound was left open for drainage.

Patients were followed in the outpatient clinic at one week, one, six, and 12 months postoperatively. At each visit the patients were asked about the presence of perianal discharge or pain and fecal incontinence. Patients were examined in the left lateral position to ensure complete healing of the surgical wound and to exclude recurrence of FIA.

### Data collection

The variables chosen for the study included: patients' demographics as age and gender, type of FIA (high or low), number and position of the external opening of the fistula, type of operation performed, outcomes of surgery as the incidence and timing of recurrence of FIA, and perioperative complications, particularly FI and its degree.

### Outcomes assessed and definitions

The primary outcome assessed by the study was the incidence and characteristics of FIA in male and female patients. Secondary outcomes comprised the type of procedure performed and the rates of fistula recurrence and development of FI postoperatively.

Recurrence was defined as the clinical occurrence of the fistula after recovery of the surgical wound, occurring within one year after the procedure. FI was diagnosed by history taking during follow-up and was assessed by the Wexner incontinence score.<sup>14</sup>

Low anal fistulas comprised subcutaneous, intersphincteric and low trans-sphincteric anal fistulas whereas high anal fistulas comprised high trans-sphincteric, extrasphincteric, and suprasphincteric anal fistulas. High trans-sphincteric anal fistula was defined as the FIA in which the tract traverses more than 30% of the external anal sphincter.<sup>8</sup>

**Table 1 – Characteristics of anal fistula in both genders.**

Variable	Male	Female	p-Value
Number (%)	491 (87)	74 (13)	–
Mean age $\pm$ SD in years (range)	42 $\pm$ 12.7 (18–87)	39.5 $\pm$ 10.6 (18–73)	0.107
Previously recurrent fistula (%)	158 (32.1)	13 (17.5)	0.015
<b>Low anal fistula</b>			
Subcutaneous (%)	21 (4.3)	12 (16.2)	<0.0001
Intersphincteric (%)	94 (19.1)	14 (18.9)	0.96
Low trans-sphincteric (%)	132 (26.9)	26 (35.2)	0.18
Total	247 (50.3%)	52 (70.3)	0.002
<b>High anal fistula</b>			
High trans-sphincteric (%)	238 (48.5)	22 (29.7)	0.003
Extra-sphincteric (%)	6 (1.2)	0	1
Total	244 (49.7)	22 (29.7)	0.002
<b>Position of external opening</b>			
Anterior (%)	80 (16.3)	51 (69)	<0.0001
Posterior (%)	352 (71.6)	16 (21.6)	<0.0001
Lateral (%)	44 (9)	5 (6.7)	0.68
Multiple (%)	15 (3.1)	2 (2.7)	1
Horse-shoe fistula (%)	27 (5.5)	3 (4)	0.78
Supralevator extension (%)	49 (10)	6 (8.1)	0.76

### Statistical analysis

Data collected was arranged in Excel spreadsheet and analyzed using SPSS™ version 21 (IBM corp., Bristol, UK). Continuous variables were expressed as mean and Standard Deviation (SD) or median and normal range. Categorical variables were expressed as percentage and ratio. Student t test was used to analyze the continuous variables whereas fisher exact test or Chi square test were used for categorical data. *p*-Value less than 0.05 was considered significant.

## Results

### Characteristics of the patients

After exclusion of patients with secondary FIA (*n*=22) and patients with incomplete records (*n*=12), 565 patients with primary FIA were included in the study. Patients were 491 (87%)

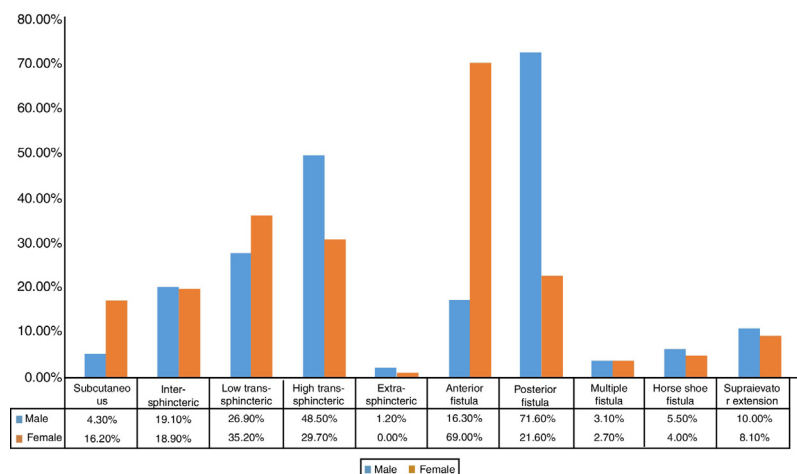
males and 74 (13%) females with a male-to-female ratio of 6.6:1. The mean age of patients was 41.7  $\pm$  12.4 (range, 18–87) years. There was no significant difference in the mean age of male and female patients (Table 1). Fifty-six (75.6%) females had history of normal vaginal delivery with or without episiotomy.

### Characteristics of FIA (Fig. 1)

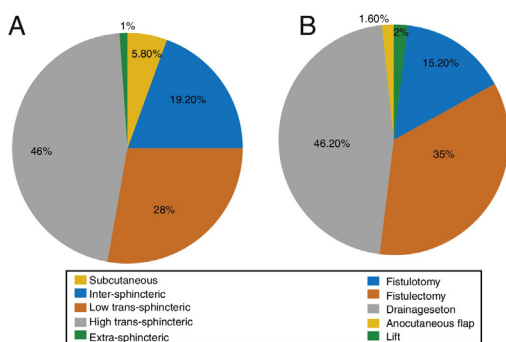
One hundred and 71 (30.2%) patients had recurrent FIA after previous surgical procedures. Male patients had previous surgery for anal fistula significantly more than female patients (32.1% vs. 17.5%; *p*=0.015).

FIA was classified according to the position of the tract into 299 (53%) low and 266 (47%) high anal fistula. Females had a significantly (*p*=0.002) higher percentage of low anal fistula than males (52/74; 70.2% vs. 247/491; 50.3%).

Low anal fistulas included subcutaneous (*n*=33; 5.8%); intersphincteric (*n*=108; 19.2%); and low trans-sphincteric



**Fig. 1 – Gender-based characteristics of anal fistula in the studied group.**



**Fig. 2 – Distribution of anal fistula according to the type (A) and surgical management (B).**

fistula ( $n = 158$ ; 28%), whereas high anal fistulas included high trans-sphincteric ( $n = 260$ ; 46%) and extra-sphincteric fistula ( $n = 6$ ; 1%) (Fig. 2A).

The percentage of low subcutaneous FIA was significantly higher in female than male patients (16.2% vs. 4.3%;  $p < 0.0001$ ). Conversely, male patients had a significantly higher percentage of high trans-sphincteric anal fistula (48.5% vs. 29.7%;  $p = 0.003$ ).

The position of the external opening of the fistula was anterior to the transverse anal line in 131 (23.1%) patients, posterior in 368 (65.1%) patients, lateral in 49 (8.7%) patients, whereas 17 (3%) patients had more than one external opening. Anterior anal fistula was more common in female patients (69% vs. 16.3%;  $p < 0.0001$ ) whereas posterior FIA was more common in males (71.6% vs. 21.6%,  $p < 0.0001$ ).

Assessment of complex and recurrent fistulas was done by MRI in 151 patients and by endoanal ultrasonography in 107 patients. Thirty (5.3%) patients had a horse-shoe fistula extending in the inter-sphincteric plane and 55 (9.7%) patients had complex branched FIA with supralelevator extension. No statistically significant differences were observed between male and female patients with regard the incidence of lateral anal fistula, fistula with multiple external openings, horse-shoe fistula, and branched fistula with supralelevator extension (Table 1).

**Procedures**

Fistulotomy was performed in 86 (15.2%) patients (33 subcutaneous & 53 intersphincteric FIA), fistulectomy in 198 (35%) patients (46 intersphincteric, 152 low transsphincteric), two-stage drainage seton in 261 (46.2%) patients (6 low transsphincteric, 252 high transsphincteric, 3 extrasphincteric) anocutaneous advancement flap in 9 (1.6%) patients (6 high transsphincteric, 3 extrasphincteric), and LIFT in 11 (2%) patients (9 intersphincteric and 2 high transsphincteric) (Fig. 2B).

The percentage of female patients that underwent lay open fistulotomy was significantly higher than males (31.1% vs. 12.8%;  $p < 0.0001$ ), whereas males were treated with draining seton significantly more than females (48.7% vs. 29.7%;  $p = 0.003$ ) (Table 2).

**Outcomes**

Overall, recurrence of FIA was detected in 42 (7.4%) patients. Although males had around twice the recurrence rate of females (7.9% [95% CI: 5.8–10.7%] vs. 4% [95% CI: 0.9–11.7%]); this difference was not significant ( $p = 0.34$ ). Regarding the outcome of the individual procedures, fistulotomy and fistulectomy achieved the lowest rates of recurrence (0 and 4%), followed by recurrence after removal of the drainage seton (10.7%) and LIFT (18.1%). Anocutaneous advancement flap had the highest recurrence rate (44.4%).

FI developed in 10 (1.77%) patients with higher incidence in female than male patients (4% vs. 1.4%); yet again the difference did not attain any statistical significance. Both genders had comparable Wexner continence scores and rates of wound infection postoperatively (Table 2).

**Analysis of recurrence of FIA in both genders**

Univariate analysis (Table 3) of the predictive factors for recurrence of FIA demonstrated that previous fistula surgery ( $p = 0.0002$ ), and complex FIA [high trans-sphincteric FIA ( $p = 0.0003$ ); horse shoe fistula ( $p < 0.0001$ ); and branched fistula with supralelevator extension ( $p < 0.0001$ )] significantly predicted the recurrence of anal fistula postoperatively.

**Table 2 – Procedures and outcomes of anal fistula in both genders.**

Variable	Male (n = 491)	Female (n = 74)	Total (n = 565)	p-Value
<b>Surgical treatment</b>				
Lay open fistulotomy (%)	63 (12.8)	23 (31.1)	86 (15.2)	<0.0001
Fistulectomy (%)	172 (35)	26 (35.1)	198 (35)	0.95
Two-stage seton (%)	239 (48.7)	22 (29.7)	261 (46.2)	0.003
Anal advancement flap (%)	8 (1.6)	1 (1.3)	9 (1.6)	1
LIFT (%)	9 (1.8)	2 (2.7)	11 (1.9)	0.64
Recurrence (%)	39 (7.9)	3 (4)	42 (7.4)	0.34
Fecal incontinence (%)	7 (1.4)	3 (4)	10 (1.7)	0.13
Median Wexner continence score (range)	5 (4–10)	6 (5–8)	11 (1.9)	–
Infection (%)	27 (5.5)	2 (2.7)	29 (5.1)	0.407
Disruption of flap (%)	4/8 (50)	1/1 (100)	5/9 (55.5)	1
Median follow-up in months (range)	26 (6–42)	22 (5–34)	–	–



**Table 3 – Univariate analysis of the risk factors for recurrence of FIA.**

Variable	Recurrent (n = 42)	Non recurrent (n = 523)	p-Value
Mean age in years ± SD	40 ± 11.9	41.4 ± 12.8	0.49
Gender (male/female)	39/3	452/71	
Previous recurrence (%)	24 (57.1)	147 (28.1)	0.0002
High trans-sphincteric fistula (%)	31 (72.1)	229 (43.8)	0.0003
Anterior fistula (%)	11 (26.2)	120 (22.9)	0.77
Posterior fistula (%)	29 (69)	339 (64.8)	0.7
Horse shoe fistula (%)	24 (57.1)	6 (1.1)	<0.0001
Suprlevator extension (%)	38 (90.4)	17 (32.5)	<0.0001

**Table 4 – Analysis of fistula recurrence in both genders in relation to the characteristics of FIA.**

Variable	Male (n = 39)	Female (n = 3)	p-Value
Mean age in years ± SD	39.9 ± 12.3	40.6 ± 5.1	0.92
Previous recurrence (%)	23 (59)	1 (33.3)	0.56
High trans-sphincteric fistula (%)	29 (74.3)	2 (66.6)	1
Anterior fistula (%)	9 (23)	2 (66.6)	0.16
Posterior fistula (%)	28 (71.7)	1 (33.3)	0.22
Horse shoe fistula (%)	22 (56.4)	2 (66.6)	1
Suprlevator extension (%)	35 (89.7)	3 (100)	1

Subgroup analysis (Tables 4 and 5) of the risk factors for recurrence in male and female patients revealed no significant differences between both genders in terms of patients' age, previous recurrence, high FIA, position of the external opening, complex FIA, and the procedure performed.

#### Follow-up details

Patients were followed for a median period of 22 (range, 5–42) months. One hundred and 19 (21.1%) patients were followed for less than 12 months, 348 (61.6%) were followed for a period ranging between 12 and 24 months and 98 (17.3%) were followed for more than 24 months postoperatively.

#### Discussion

FIA represents one of the most common anorectal disorders in the surgical practice. Reviewing the current literature, all efforts have been directed toward improving the outcome of management of FIA by the application of new diagnostic tools and the introduction of novel treatment modalities. However, very few reports<sup>3,6,7</sup> have discussed the differences in the incidence, characters, and management outcomes of FIA between males and females.

The male predominance of anal fistula is obvious in the literature, we found the male-to-female ratio to be 6.6:1, within

the range (1.8:1–9:1) reported in the previous studies.<sup>3,4,15</sup> Nevertheless, these incidences reflect the experience from a single institution and not the precise distribution of FIA due to lack of a proper denominator as Abcarian<sup>16</sup> has previously stated.

A few theories were proposed to explain this male predominance including the role of androgens and the strong tone of the external anal sphincter in males.<sup>7</sup> Lunniss et al.<sup>6</sup> suggested that the differences in the sex hormones levels were the key to understand this male predominance. Nonetheless, no tangible differences were noted between male patients and healthy controls in the levels of the measured hormones. In addition, female patients had higher levels of circulating estradiol, yet none of them had increased androgen level than healthy controls. The authors recommended further investigations to ascertain the possibility of conversion of estradiol to androgen locally in the anal glands or a possible increased sensitivity of the anal glands to the circulating androgens in females with FIA.

The mean age of presentation of FIA in the present series was comparable in both genders, revolving around the mean age reported in the literature.<sup>3,15</sup> Male patients did not only have a higher overall incidence of FIA; but they also had a higher incidence of complex high FIA, around half of the cases. This observation may explain why males presented with recurrent FIA after previous surgery significantly more than female patients did since complex fistulas are more amenable to recur after surgical treatment.

**Table 5 – Analysis of fistula recurrence in both genders in relation to the procedure performed.**

Variable	Male (n = 39/491)	Female (n = 3/74)	Total (n = 42/565)	p-Value
Recurrence after fistulotomy (%)	0/63 (0)	0/23 (0)	0/86 (0)	1
Recurrence after fistulectomy (%)	8/172 (4.6)	0/26 (0)	8/198 (4)	0.6
Recurrence after removal of drainage seton (%)	26/239 (10.8)	2/22 (9.1)	28/261 (10.7)	1
Recurrence after advancement flap (%)	3/8 (37.5)	1/1 (100)	4/9 (44.4)	0.44
Recurrence after LIFT (%)	2/9 (22.2)	0/2 (0)	2/11 (18.1)	1

Around one-quarter of fistulas in the present study had their external opening anterior to the transverse anal line. It was notable that the incidence of anterior FIA in females was around four-folds that in males. The reason for this high prevalence of anterior-based fistulas in females is not clear, perhaps the anatomic differences between both genders can shed some light on this issue. The external anal sphincter is relatively deficient anteriorly in females due to less defined transverse perinii and longitudinal muscles,<sup>17</sup> in addition the obstetric trauma sustained during vaginal delivery which can add further weakness to the anterior sphincter complex. Although according to Goodsall's rule<sup>18</sup> anterior FIA are expected to have a short straight tract leading directly to the anal canal; anterior fistulas in female patients have been recognized as a complex type of FIA that may predispose to higher rates of recurrence and FI.<sup>8</sup>

On the other hand, around two-third of the patients had posterior anal fistula, the incidence of posterior FIA in males was more than three-folds that in females. Since posterior FIA can have more complex tracks than that of anterior FIA,<sup>18</sup> this explains the higher incidence of high trans-sphincteric fistula in males that we observed.

Other complex types of FIA were observed, 3% of patients had anal fistula with multiple external openings, around 5% had horse-shoe fistula, and around 10% had branched fistula with supralelevator extension, similar to the incidence of complex anal fistula (9.1%) reported in another retrospective study.<sup>19</sup> There were no significant differences between males and females regarding the incidence of these complex types of FIA.

On analysis of the procedures performed for the treatment of FIA in both genders, the results were quite concordant with the previously stated characteristics of anal fistula. The percentage of lay open fistulotomy in females was significantly higher than males, which is logical as females had a higher percentage of simple, low anal fistula that can be satisfactorily treated with fistulotomy. In contrast, a significant portion of males were treated with drainage seton compared to females owing to the higher incidence of high trans-sphincteric fistula among males which warranted the use of a sphincter-saving procedure to preserve the anal continence.

The overall recurrence rate in our series was around 7.5%. Anocutaneous flap had the highest recurrence rate (44%) in concordance with Zimmerman and colleagues<sup>20</sup> who reported a success rate of only 46% after the use of anocutaneous flap for trans-sphincteric FIA. This high failure rate can be due to the early disruption of the flap which occurred in 55% of the patients. On the other hand, LIFT achieved a recurrence rate of 18% which copes with the mean success rate (76.4%) of LIFT reported by Hong and affiliates in a recent meta-analysis.<sup>21</sup> However, the limited number of patients treated with LIFT in our series may prevent drawing any meaningful conclusions about its clinical efficacy.

Fistulotomy and fistulectomy achieved comparably low recurrence rates in line with a recent meta-analysis<sup>22</sup> that concluded no significant differences in healing and recurrence rates between the two procedures. Recurrence after drainage seton occurred in 10.7% of patients, slightly higher than other series by Lim and colleagues<sup>23</sup> which can be attributed to the larger number of patients with previous fistula surgery

in our study; recurrence of FIA after previous surgery is a well-recognized risk factor for re-recurrence after further intervention.<sup>9,24</sup>

Although male patients had almost twice the recurrence rate of females (7.9% vs. 4%); this difference was not statistically significant, in concordance with other studies<sup>10,11</sup> that found comparable rates of recurrence of FIA between males and females after anal advancement flap. On the contrary, Hyman and associates<sup>9</sup> found failure of wound healing after fistulotomy higher in females. Subgroup analysis of the risk factors for fistula recurrence revealed no significant differences between males and females in terms of age, characteristics of FIA, and type of the operation. This indicates that the patients' gender did not constitute a risk factor for recurrence overall, with different types of FIA, and after different surgical procedures.

FI developed in ten (1.77%) patients, most cases were due to inadvertent injury of the anal sphincters during removal of seton. The incidence of FI in female patients was around three times that in males which copes with Garcia-Aguliar et al.<sup>12</sup> who found that females were associated with a higher risk of FI after surgery for FIA than males. However, the higher incidence of FI in females did not attain any statistical significance. Furthermore, the degree of FI was comparable in both genders. Seven of the patients with FI required surgical repair of the external and/or the internal anal sphincters, whereas three patients with less severe degrees of incontinence were managed conservatively with biofeed back therapy.

The present study, albeit the large cohort studied, has some limitations including its retrospective nature and the lack of some important demographic parameters of the patients including body mass index, cigarette smoking, and the presence of systemic diseases as diabetes mellitus. The influence of these demographic variables on the incidence of fistula recurrence and FI among males and females needs to be addressed in future prospective studies to elucidate their potential role. The long duration of the study could reflect variation in the experience of the operating surgeons, in addition to the variety of procedures performed. Although these variations could be considered as limitations to the study, we believe that the varying surgeons' experience and the diversity of the operative techniques may render the outcomes more clinically-germane, reflecting the real clinical practice better than focusing on a single technique performed by expert surgeons only.

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## Conclusion

The incidence of anal fistula in males was more than six times that in females. The mean age of presentation of FIA was comparable in both genders. Male patients presented with posterior and high trans-sphincteric anal fistula more than females, whereas the majority of FIA in females were low and anteriorly-based.

Despite the difference in some of the characteristics of FIA among both genders; there were no significant differences between males and females with regards the recurrence of anal fistula and the occurrence of FI postoperatively. This implies that patients' gender per se is not an independent

factor that can impact the outcome of surgical treatment, provided that each procedure is employed as properly indicated.

### Conflicts of interest

The authors declare no conflicts of interest.

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