



# Accuracy prediction of Goodsall's rule for anal fistulas of cryptoglandular origin, is still standing?

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**Background:** Treatment of anal fistulas is still a challenging task because of high recurrence and risk of incontinence. Identification of internal fistula opening is paramount for successful treatment. Goodsall's rule is commonly used to predict the course of fistula and internal opening. However, its accuracy has been questioned by many investigators and its role became a controversial topic.

**Method:** This is a case series prospective study in which 320 consecutive patients with anal fistula with Mean age  $48.9 \pm 6$  years ages (ranges from 16 to 64 years) and mean body mass index  $24.8 \pm 5.5$  average 18.5–30.6) were enrolled. Goodsall's rule was applied to all fistulas according to the site of external fistula opening. Location of internal fistula opening as suggested by Goodsall's rule then compared to the exact location of internal opening identified by perineal or pelvic MRI and intraoperative findings. to assess the accuracy and positive predictive value of the Goodsall's rule in predicting the internal opening of the tract.

**Results:** The overall accuracy rate, positive predictive value (PPV), sensitivity and specificity of Goodsall's rule in this study were 74.75%, 77.1, 74.5, and 72.05, respectively. The accuracy in predicting the internal fistula opening was 52.4% in anterior tracts and 73% in posterior tracts. Goodsall's rule was found to be more accurate in posterior fistulas than anterior fistulas and in short superficial fistulas rather than in long and high fistulas.

**Conclusion:** Goodsall's rule was accurate in 74.75% of anal fistulas. It was more accurate for posterior long fistulas and anterior short and superficial fistulas. Patients with long (> 3 cm) anterior fistulas defied Goodsall's rule when they found to have fistulas tracking to a midline anterior origin. Further, short posterior fistulas were found to open more commonly in a direct radial course rather to midline posteriorly.

**Keywords:** accuracy rate, anal fistulas, goodsall's rule, midline rule

## Introduction

Fistula-in-ano is an abnormal tract lined by granulation tissue which connects between the epithelialized surface of anal canal or the rectum and the perianal skin or perineum. It develops most frequently from spontaneously draining anorectal abscess which evolves from infection and suppuration of anal crypt glands at dentate line<sup>[1]</sup>. These fistulas are generally divided into low and high types which are further classified according to Park's classification into intersphincteric, transsphincteric, suprasphincteric and extrasphincteric types<sup>[2]</sup>. Management of perianal fistulas, in particularly complex and high types, remains one of the most

## HIGHLIGHTS

- Identifications of internal fistula opening and course of fistula tract is paramount for successful treatment of anal fistula.
- Goodsall's rule is commonly used to predict the course of fistula and internal fistula opening. Its accuracy has been questioned by several investigators.
- Goodsall's rule could be accurate for posterior long tract fistulas, horseshoe fistulas and short tract anterior fistulas.
- For long tract anterior fistulas, midline rule is more accurate.
- Short tract posterior fistulas could be open in a direct radial fashion.

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challenging and difficult task in general surgical practice. Draining and control of local sepsis, eradication of fistulous tract including both external and internal openings and avoiding recurrence while preserving anal sphincter complex function are essential components of successful treatment<sup>[3]</sup>. Further, Perianal fistulas are classified into anterior fistula when external fistulous opening lying anterior to imaginary transverse line across the anus and posterior fistula when external opening is posterior to transverse anal line<sup>[4]</sup>.

Surgery is still the main treatment modality for perianal fistulas. Several surgical procedures were practiced for eradication of anal fistulas with variable success rate depending on certain factors such as type of the fistula whether simple or complex, single

or multiple, primary or secondary to other conditions such as inflammatory bowel diseases, namely Crohn's diseases or malignancy<sup>[4,5]</sup>. Knowing the exact path of an anal fistula is very essential and crucial for effective and valid treatment of anal fistula<sup>[6]</sup>. The external fistula opening is usually easily seen and identified in perianal skin or perineum, Finding the internal fistula opening, however, is not an easy task and is more complicated especially in complex, recurrent and high types anal fistulas. Proper localization of the internal fistula opening is an integral part of fistula management for high success healing rate and if an unacceptable high recurrence rate is to be avoided<sup>[7]</sup>. Recurrence is inevitable if the internal fistula opening is not identified. Therefore, the preoperative workup to localize the internal fistula opening is so important to ensure complete eradication and avoid recurrence. Although, several preoperative investigations and imaging are used for preoperative localization of the internal opening, none of these investigations are particularly perfect or accurate. Thus, it is not uncommon to operate on anal fistulas with inaccurately localized internal openings<sup>[8]</sup>. In such cases, accurate intraoperative localization is essential and hereby, we are dealing with an unidentified internal opening which mandates certain manoeuvres for careful and correct localization of internal fistula opening. One of most commonly used manoeuvre is Goodsall's rule<sup>[9,10]</sup> which states that if the external fistula opening is posterior to an imaginary transverse line across the anus will open in the posterior midline at 6 o'clock position while those fistulas with external opening anterior to transverse line, open radically into anterior wall of the anal canal provided it is less than 3 cm from anal verge, otherwise it will open in the midline posteriorly<sup>[10]</sup>.

Although the Goodsall's rule is still widely used as a preliminary guide for identification of internal fistula opening in general surgical practice, the accuracy of Goodsall's rule were questioned by several researchers and its overall predictive accuracy was a controversial topic among investigators<sup>[11-13]</sup>. It has been found that, the application of Goodsall's rule has several limitations in particularly for long anterior lying fistula, complex fistula and multiple tracts fistulas<sup>[13]</sup>. Data regarding the accuracy rate and the positive predictive value of Goodsall's rule are inconsistent in several studies showing a wide variance and conflicting results<sup>[12,14,15]</sup>. Thus, it is unwise to confidently and completely depend on Goodsall's rule for localization of the internal fistula opening. The aim of this study was to evaluate the accuracy rate and positive predictive value of Goodsall's rule in predicting internal opening of perianal fistulas of cryptoglandular origin.

## Patients and methods

This is a case series prospective study conducted for the period between April 2016 and March 2023, in which in which 320 adult consecutive patients attending private surgical clinic (224 males, 96 females) were enrolled. Ages ranges from 16 to 64 years and mean body mass index  $24.8 \pm 5.5$  average  $18.5-30.6$ . Inclusion criteria were those adult patients with perianal fistulas of cryptoglandular origin including simple, complex and recurrent types. Exclusion criteria include fistulas associated with abscess and fistulas secondary to inflammatory bowel diseases, tuberculosis and malignancy.

Detailed history and thorough clinical examination were done for all the patients. Routine laboratory investigations including complete blood count, blood sugar, and viral study were also done. Prior to intervention, anal continence was assessed using Wexner score especially for those patients who had previous anal fistulas surgery to examine the ability of the patient to hold solid stool, liquid stool, gases, and soiling. Apparent faecal incontinence was not observed in any patient at the moment of enrolment in this study (mild soiling was recorded in 18 patients)

All patients were proceeded then for Pelvic or perineal MRI consisting of T1-weighted and high -spatial resolution T2 images and STIR Sequences in Axial, Coronal and Sagittal planes for delineation of fistula tract, muscles group and fat plane and the fistula tract, thus giving the most detailed information about the anatomical characteristics of fistula and its relationship to the anal sphincter complex. The fistulas then were classified according to Park's classification<sup>[16]</sup> into intersphincteric, transsphincteric, suprasphincteric, and extrasphincteric and into anterior, posterior or horseshoe fistulas depending mainly on pelvic and perineal MRI findings. Patient's characteristics and demographics are illustrated in Table 1. Written informed consent was obtained from all the patients prior to intervention. The bowel cleansing was done prior to intervention by mechanical bowel preps. Preoperatively, patients were examined in lithotomy position under either general anaesthesia or spinal anaesthesia. After careful inspection of perianal and perineal regions, looking for external fistula opening and the length of fistula tract from anal verge, three dimensional endoanal ultrasound with rotating 10-16 MHz endoprobe giving a 360° 3D image. Internal fistula opening was identified according to Cho criteria which appeared as submucosal breach connected to an internal sphincter defect or as a budding which is in contact or inside the internal sphincter.

**Table 1**

**Demographics and baseline characteristics of 320 patients with anal fistulas**

Patients	Total	(%)
Total	320	100
Male	224	70
Female	96	30
Age (mean)	48.9 ± 6	
BMI	24.8 ± 5.5	
Wexner <sup>a</sup>	2.2 ± 1.7	
No. fistulas	365	
Primary fistula	309	84.7
(No prior intervention)		
Recurrent fistula	56	15.3
Anterior external fistula opening	164	44.9
Fistula less ≤ 3 cm	94	
Fistula > 3 cm	70	
Posterior external fistula opening	201	55.1
Fistula less ≤ 3 cm	117	
Fistula > 3 cm	84	
Fistula type (by perineal MRI)		
Intersphincteric	238	65.2
Transsphincteric	86	23.6
Horseshoe fistula	23	6.3
Suprasphincteric	14	3.8
Extrasphincteric	4	1.1
Co-morbidities	48	15

<sup>a</sup>Score ranges from 0 to 20; higher scores suggest severe anal incontinence.

Injection of hydrogen peroxide and/or methylene blue through external fistula opening was not used in this study as these measures could masquerade the site of internal fistula opening.

We then applied Goodsall’s rule as a guide for localization of the internal opening. This followed by palpation and probing of the fistula starting at the expected site of the internal opening. Probing of fistula tract was so gentle in order to avoid the creation of a false passage and false internal opening. In some patients, the internal opening was palpated as a dimple, an elevation, a fibrous pit or soft granulation tissue pimple. In other cases, a palpable transcutaneous transsphincteric track can be used as a guide to the site of the internal opening. Parameters including the site, number and distance from anal verge of external fistula opening, internal fistula opening and the path of fistulous tract were observed and recorded. Goodsall’s rules were applied to all fistulas according to the site of external fistula opening. Location of internal fistula opening as suggested by Goodsall’s rule then compared to the exact location of internal opening identified by perineal or pelvic MRI, endoanal ultrasound and intraoperative findings which are considered as standard for which to the accuracy and positive predictive value of the Goodsall’s rule in predicting the internal opening of the tract were assessed and compared. Data were analyzed using SPSS version 22.0. statistical software to assess sensitivity, specificity, positive predictive value, negative predictive values and accuracy rate of Goodsall’s rule in predicting the location of internal fistula opening. This work is fully compliant with the STROCCSS 2021 criteria [www.strocsguideline.com](http://www.strocsguideline.com)<sup>[17]</sup>, and registered in Research Registry. Unique identifying number (UIN) is: [researchregistry9316](https://www.researchregistry.com/browse-the-registry#home/): Hyperlink:<https://www.researchregistry.com/browse-the-registry#home/>.

## Results

This is a case series prospective study consisted of total 320 patients presented with 365 anal fistulas of cryptoglandular origin (309 primary fistulas, 56 recurrent fistulas), of which 224 (70%) were males and 96 (30%) were females. The male to female ratio being 2.3:1. Their mean age and BMI were 48.9 ± 6 and 24.8 ± 5.5, respectively. Out of these 365 fistulas, 164 (44.9%) had external opening anterior to the transverse anal line and 201 (55.1%), whereas posterior external opening found in 201 (55.1%) fistulas. The external fistula opening of those patients with anterior fistulas (164 patients) lies within 3 cm for 94 (57.3%) patients, and beyond 3 cm in 70 (42.7) patients, while in those patients with posteriorly located fistulas (201 fistulas); the external fistula opening lies within 3 cm from anal verge in

117 (58.2%) patients and beyond 3 cm in 84 (41.8%) patients. (Table 1).

Our results showed that, when compared with perineal MRI, endoanal ultrasound and intraoperative findings; Goodsall’s rule was accurate in predicting the internal fistula opening in 147 (73%) of 201 patients with an external opening posterior to the transverse anal line. These patients had anal fistulas tracking to posterior midline at 6 o’clock position compared to direct tract in 54 (27%) patient. Further, the prediction of Goodsall’s rule was higher for long fistula tract (> 3 cm) compared with short fistulous tract (85.7% vs. 64.1%).

In case of 164 patients with an external fistula opening anterior to the transverse anal line, Goodsall’s rule, when compared with MRI and intraoperative findings; found to be consistent in 86 patients (52.4%) who had their fistulas tracking in a direct and radial fashion as predicted by Goodsall’s rule. Instead, 78 patients (47.6%) of these patients had anterior fistulas tracking to the midline anteriorly. In contrary to anterior fistulas, Goodsall’s rule was more accurate for short and superficial anterior fistulas than long and deep intersphincteric and transsphincteric fistulas (70.2% vs. 28.6%). (Tables 2, 3) thus. The accuracy in predicting the internal fistula opening was 52.4% in anterior tracts and 73% in posterior tracts. Goodsall’s rule was found to be more accurate in posterior fistulas than anterior fistulas. The overall accuracy rate, positive predictive value (PPV), sensitivity and specificity of Goodsall’s rule in this study were 47.75%, 77.1, 74.5, and 72.05, respectively. (Table 3).

## Discussion

Anal fistulas are frequently encountered in general surgical practice. Management of this fistula is still challenging. The risk to the faecal continence due to damage to the anal sphincters complex and high recurrence rate are the main tow challenges in the management of this condition<sup>[18,19]</sup>. Despite advancements in management of anal fistulas, gold standard treatment and general consensus are still not available in particularly for complex perianal fistulas. The successful management of anal fistula requires identification of the fistulous tract and internal fistula opening<sup>[20]</sup>. In majority of patients a single primary fistula tract exists and the anatomy can be determined by examination under anaesthesia adhering to the rules described by Goodsall helped by imaging such as perineal or pelvic MRI and endoanal ultrasonography. Identification of internal opening is crucial and paramount for feasible and valid management. It has been found that the inability to accurately localize the internal opening is one of the main reasons for treatment failure and associated with highest risk of recurrence<sup>[20,21]</sup>. Although Goodsall’s rule is

**Table 2**  
**Accuracy of Goodsall’s rule in comparison with pelvic and perineal MRI finding**

Perineal MRI Goodsall’s rule	Anterior fistula (> 3 cm in length) <sup>a</sup>	Anterior fistula (≤ 3 cm in length)	Posterior fistula (> 3 cm in length)	Posterior fistula (≤ 3 cm in length)	All fistulas
Anterior fistula (≤ 3 cm in length) <sup>a</sup>	66	32	0	0	98
Anterior fistula (> 3 cm in length)	38	20	0	0	58
Posterior fistula (≤ 3 cm in length)	0	0	75	36	111
Posterior fistula (> 3 cm in length)	0	0	26	72	98
All fistulas	104	52	101	108	365

<sup>a</sup>The distance of external fistula opening from anal verge.

**Table 3****Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of goodsall's rule in prediction the site of internal fistula opening**

	Anterior fistula (> 3 cm in length) <sup>a</sup>	Anterior fistula (≤ 3 cm in length)	Posterior fistula (> 3 cm in length)	Posterior fistula (≤ 3 cm in length)	All fistulas
Sensitivity	83.4	34.6	100	80.9	74.5
Specificity	80.8	56.7	89.3	61.4	72.05
Positive predictive value	76.5	52.8	72.4	92.3	73.5
Negative predictive value	84.4	67.7	88.1	82.6	80.7
Accuracy rate	78.4	60.8	70.6	89.2	74.75

<sup>a</sup>The distance of external fistula opening from anal verge.

frequently used as a method or a guide to determine the course of the fistula and location of internal fistula opening; recent several studies showed conflicting results and its role have been questioned by several investigators<sup>[12,15,22]</sup>.

The accuracy rate and positive predictive value of Goodsall's rule in this study were 74.75 and 73.5. We found that Goodsall's rule was more accurate for simple, superficial and short (≤ 3 cm) fistulas than long and complex fistulas. Our results were consistent with that of Thulasibai *et al.*<sup>[23]</sup> and Jayarajah *et al.*<sup>[24]</sup> who found that the predictive accuracy was significantly higher in superficial fistulas and intersphincteric fistulas compared to transsphincteric and higher fistulas. Our results have been further shown that the accuracy of Goodsall's rule was higher for posterior fistulas compared with anterior located fistulas (79.9 vs. 69.6). Table 3.

Regarding posterior fistulas, we found that Goodsall's rule was more accurate for long fistulas (3 cm and more) compared with short fistulas. (98.2 vs. 70.6). Hence, most of long fistulas open in midline posteriorly at 6 o'clock position consistent with Goodsall's rule while short posterior fistulas could be opened in a direct and radial fashion. We further noticed, in contrast, the predictive accuracy of Goodsall's rule for anterior fistulas was higher for short fistulas compared long and higher fistulas which tend to open in anterior midline, (78.4 vs. 60.8) Table 3. These results emphasized the role deep anal space in the etiopathogenesis of anal abscess and fistulas<sup>[25]</sup>.

Ciocco *et al.*<sup>[26]</sup> recorded in their study of the factors challenging the predictive accuracy of Goodsall's rule for anal fistulas that Goodsall's rule is accurate only when applied to submuscular anal fistulas with posterior external openings. The rule was found to be inaccurate in describing the course of anal fistulas with an anterior external opening. The same authors<sup>[27]</sup> in their other similar study concluded that the midline was the dominant internal opening site of all anal fistulas with up to 95% accuracy. Goodsall's rule was inaccurate for anal fistulas with an anterior off-midline external fistula opening which tend to mirror posterior off-midline external fistulas and curve to a midline origin, rather than take a straight course to internal opening as postulated by Goodsall. Other similar study by Garcia-Botello *et al.*<sup>[28]</sup> recorded that both Goodsall's and midline rules are highly predictive of the course of posterior fistulas. Midline rule, however, is more accurate for anterior located fistulas and when the external opening is located more than 3 cm from anal verge. These findings are consistent with ours. Lastly, our results had been shown that pelvic or perineal MRI has very high accuracy and positive predictive values of detecting the course of perianal fistulas compared to Goodsall's rule. Certain types of fistulas do not strictly

adhere to Goodsall's rule with many of long anterior fistulas showing a curve tract that open in the midline and many short posterior fistulas showing linear tracts. Similar conclusion were reported by Pavan-Kumar *et al.*<sup>[29]</sup>. There few limitations of this study. Firstly, the sample size is relatively small. Larger sample is required for better results evaluation and to be more representative of a cohort. Secondly, Evaluation of anal continence was done objectively. Anal manometry was not done which has a better and superior evaluation of continence status.

## Conclusions

In general Goodsall's rule was more accurate for posterior fistulas. It could be an accurate guide for simple low type (superficial) fistulas in particularly with posterior external anal openings. It is more accurate for long posterior fistulas and horseshoe fistulas than short posterior fistulas. In contrary, Goodsall's rule was more accurate for short anterior fistulas while long anterior fistulas were commonly opened in the midline anteriorly instead of direct radial tract as depicted by Goodsall.

## Ethical approval

The study was approved by ethical committee of Basra medical college, University of Basra.

## Patient consent

Written informed consent was obtained from all the patients for publication of this case series.

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None.

## Author contribution

The surgical and imaging aspect of this study was done by I.F.N. and assistant Q.K. The Tables, results and statistical analysis of this study were done by A.F.N.

## Conflicts of interest disclosure

The author declares no conflict of interest.

## Research registration unique identifying number (UIN)

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## Guarantor

The authors are the sole guarantors for this work.

## Data availability

The data used during the current study are available from the corresponding author upon request.

## Provenance and peer review

Not commissioned, externally peer-reviewed.

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