

A study on validity of Goodsall's rule in accurately predicting the course of anal fistulous tract ; comparison with MRI and surgical findings

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Abstract

Background:

Fistula-in-ano is a granulation tissue lined tract that opens deeply in the anal canal or rectum and superficially on the perianal skin. Most of these fistulae are formed from anorectal abscess which burst spontaneously. The secondary causes of fistula in ano include conditions such as Crohn's disease, Tuberculosis and Carcinoma rectum. Fistula in ano can be broadly classified into Anterior and Posterior, Low lying or High Fistula in ano as well as Simple and Complex fistula in ano. Goodsall's rule depicts the relationship of the external opening of the fistula with the course of fistulous tract. The three main radiological imaging techniques that are used in evaluating perianal fistulas include contrast fistulography, endorectal ultrasonography and magnetic resonance imaging(MRI). Our aim was to assess the accuracy of Goodsall's rule in predicting the course of anal fistulae and its reliability for evaluating patients presenting with Fistula in ano. We also correlated the clinical and intra-operative findings with that of Magnetic Resonance(MR) Fistulogram to know whether MR Fistulogram can be used selectively for evaluating Complex Fistula in Ano

Methods:

This was a Prospective Mono-centric Observational Study conducted at the General Surgery department of Apollo Main Hospital Chennai, from August 2022 to December 2023. The final study sample after considering the inclusion and exclusion criteria was 67. Various parameters such as demographic details, clinical symptoms, characteristics of fistula were studied and comparison was done between the clinical and intra operative findings as well as the imaging findings.

Results:

Out of the 67 patients with Fistula in ano, 56 (83.6%) were

males and 11 (16.4%) were females. Out of the 67 patients, 43(64.2%) had pain, 46(68.7%) had perianal swelling, 59(88.1%) people had complaints of discharge per anum. Anterior fistula in ano was observed (43.3%) and a posterior opening was observed in 38 (56%). The fistulous tract was found to be simple in 42(62.69%) and complex in 25(37.31%). The overall predictive accuracy of Goodsall's rule was 71.6%, The predictive accuracy was 75.86% with anterior fistula in ano and 68.42% with posterior fistula in ano. MRI was able to accurately delineate the course of the tract in 92.5%. MR fistulogram had a sensitivity of 93.8% (95% CI) - 93.8% (91.4% - 96.2%)

Conclusion:

We conclude that the overall accuracy of Goodsall's rule in predicting the course of the fistulous tract is 72% and the predictive accuracy was high for anterior fistulae and complex fistulae. Goodsall's rule can thus be used as tool for the pre operative evaluation of patients with fistula in ano and also can help in assessing the necessity of MR fistulogram in complex cases.

Introduction

The medical definition of fistula is an abnormal "pipe-like" communication between any two anatomic body parts that do not normally communicate[1]. Fistula-in-ano is a granulation tissue lined tract that opens deeply in the anal canal or rectum and superficially on the perianal skin[2].

The incidence of anal fistula is about 8.6 per 100,000. Fistulae are two to three times more common in men than in women[3].

An anal fistula usually presents with a history of intermittent swelling with pain, discomfort and discharge in the perianal region. Fistula in ano can be simple or complex. "Complex" fistulas include those involving more sphincter muscle, or recurrent fistulas, anterior fistulas in females and those that are associated with pre-existing faecal incontinence, those associated with radiation exposure, or inflammatory bowel disease[4].

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Fistulas are divided into anterior and posterior based on the location of the external opening with respect to a transverse line drawn along the middle of the anus. Identification of both the external and internal openings of the fistula tract are essential to delineate the course of the tract completely[5].

David Henry Goodsall postulated a rule, in the year of 1900, regarding the relationship of 'external opening to the tract' in cases of Fistula-in-ano. According to Goodsall's rule, 'if the external opening is anterior to the transverse anal line and within 3 cm. from the anal verge, the internal opening will be in straight radial line. But, if the external opening is behind the transverse line or more than 3 cm. from the anal verge, the internal opening will be at the posterior midline of the anal canal.' In such cases the tract will be a tortuous one[6]. In cases when there are multiple anal fistulae, because of branching and communication between the openings, the tract will take a course similar to that of posteriorly opening fistulae[7].

The three main radiological imaging techniques that are used in evaluating perianal fistulas include contrast fistulography, endorectal ultrasonography and magnetic resonance imaging(MRI).

For preoperative evaluation of perianal fistulas, MR imaging has emerged as the imaging technique of choice, providing a highly accurate, rapid and non-invasive means of pre-surgical assessment[8]. In addition to accurately demonstrating the disease extent, MRI also helps to make therapeutic decisions, predict prognosis and monitor therapy[9-10].

Materials and methods

A prospective, monocentric observational study was conducted at the.....at the General Surgery department of Apollo Main Hospital Chennai, from August 2022 to December 2023. We included all the patients above the age of 18 years with primary fistula in ano and with a visible external opening and were advised Magnetic Resonance(MR) fistulogram and were willing for surgical intervention. The exclusion criteria included Patients with recurrent fistulae, fistula in ano secondary to peri-anal abscess, patients for whom MRI is contra-indicated and those who are not willing for MR fistulogram.

Since there is a lacuna in the application of Goodsall's rule, in this study, our aim was to assess the accuracy of Goodsall's rule in predicting the course of anal fistulae and its reliability for evaluating patients presenting with fistula in ano. We also correlated the clinical and intra-operative findings with that of MR fistulogram to know whether MR fistulogram can be used selectively for evaluating complex fistula in ano. This study

was approved by our institutional ethical committee - Bio Medical Research, Apollo Hospitals, Chennai. (Approval Number: AMH - DNB-049/08-22).

67 consecutive patients attending the General Surgery out patient department at Apollo Main Hospital Chennai, with fistula - in - ano during the time period from August 2022 to December 2023, who fulfill the inclusion criteria and exclusion criteria, were enrolled for the study and prior informed consent was taken from each patients.

After taking a detailed history focussing on the symptomatology and comorbidities, they were clinically examined for general physical parameters, systemic evaluation followed by Digital rectal examination and proctoscopy. Goodsall's rule was applied for identifying the course of fistulous tract and findings were recorded. Later, they were referred to radiology department for MR fistulogram. Findings as per MR fistulogram were noted. After adequate counselling of the patient, anesthetic evaluation and clearance, the patients were taken up for surgery. Intra operatively, the findings were recorded. Clinical findings and MR fistulogram findings were compared with the intra operative findings and the predictive accuracy of Goodsall's rule and sensitivity of MRI were assessed.

Statistical Analyses: Descriptive statistics were presented with frequency (percentage) and Mean $\pm$ SD (Standard Deviation) for the categorical and continuous factors respectively. Median (IQR) was presented while the data follows non-normal distribution. Shapiro-Wilk test was used to find out the normality of the data. Kappa statistics was used to find out the agreement between accuracy of Goodsall's rule and MRI. Chi-square/Fisher's exact test was used to find out the association between two independent categorical factors. Sensitivity, specificity, positive predictive Value, negative predictive value along with 95% CI(confidence interval) were calculated. P-value < 0.05 considered as statistical significance. All the analysis was carried out by using the statistical software SPSS (IBM, 28.0)

Results

Out of the 67 patients with Fistula in ano, 56 (83.6%)were males and 11 (16.4%) were females. The mean age was 43.2 years (+/-11.4). Other demographic details are given in Table 1.

Parameters	(n=67), n (%)
Age in years	
Mean $\pm$ Standard Deviation (SD)	43.2 $\pm$ 11.4
Range	18-73
Co-morbidities	
Diabetes Mellitus	2 (3.0)
Hypertension	7 (10.4)
Hypothyroidism	3 (4.5)
Diabetes Mellitus + Hypertension	3 (4.5)
Diabetes Mellitus + Hypothyroidism	3 (4.5)

Table 1: Demographic details of the study population

The mean BMI (Body Mass Index) was in the range of 17.8 - 43.01, with a mean of 26.2 (+/-3.9). Out of the 67 people, 7 were obese, 38 were overweight, 21 had a normal BMI, and 1 was underweight.

Out of the 67 patients, the most common symptoms were discharge per rectum (88.1%) followed by perianal swelling (68.7%) and pain (64.2%) (Table 2)

Clinical symptoms	(n=67), n (%)
Pain	43 (64.2)
Swelling	46 (68.7)
Discharge per rectum	59 (88.1)
Constipation	17 (25.4)
Bleeding	4 (6.0)
Fever	1 (1.5)
Burning sensation	3 (4.5)

Table 2: Table showing the frequency of various symptoms among the study population

Out of the 67 patients with fistula in ano, 29(43.3%) people had anterior fistula in ano and 38(56.7%) had posterior Fistula in ano. (Figure 1)

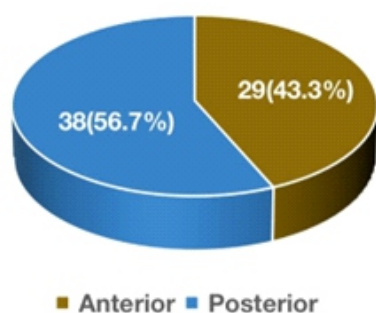


Figure 1: Pie diagram showing the distribution of patients according to the location of the external opening of the fistulous tract

According to Park's classification, 50(74.6 %) of the fistulae were Inter-sphincteric, and the remaining 17(25.4%) were trans-sphincteric in course. The fistulous tract was found to be simple in 42(62.69%) and complex fistulous tracts were observed in 25(37.31%) (Figure 2)

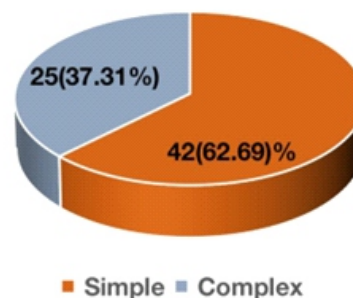


Figure 2: Pie diagram showing the distribution of patients according to the type of fistula in ano

Out of the 67 patients with fistula in ano, the course of the fistulous tracts, which were preoperatively predicted by applying Goodsall's rule, was found to correlate well with the intraoperative findings in 48(71.6%). (Figure 3)

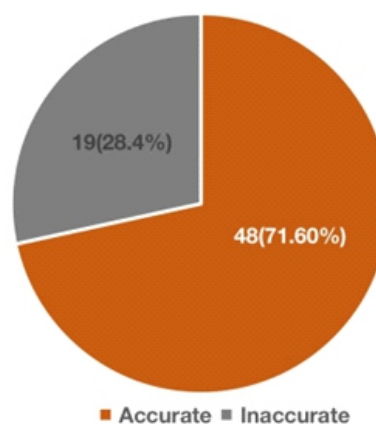


Figure 3: Pie diagram showing overall predictive accuracy of Goodsall's rule in comparison to intra operative findings

Out of 29 patients having anterior fistula in ano (Table 3), Goodsall's rule could very well predict the course of the tract in 22 patients (75.86%).

Distance from anal verge	Clinical examination		Intra-operative findings
	Straight tract	Curved tract	
<3cm (n=18)	12 (66.67)	-	Straight
	6 (33.33)	-	Curved
>3cm (n=11)	-	1 (9.1)	Straight

Table 3: Showing number of anterior fistula (n=29) obeying Goodsall's rule as per intra operative findings

Out of the total 38 patients with posterior fistula in ano (Table 4), it was found that Goodsall's rule was found to be accurate in 26 patients(68.42%).

Distance from anal verge	Clinical examination		Intra-operative findings
	Straight	Curved	
<3cm (n=26)	-	11 (42.3)	Straight
	-	15 (57.7)	Curved
>3cm (n=12)	-	1 (8.3)	Straight
	-	11 (91.7)	Curved

Table 4: Showing the number of posterior fistula (n=38) obeying Goodsall's rule as per intra operative findings

In the case of the 42 patients with simple fistulas in the group, Goodsall's rule could accurately predict the course of the fistulous tract in 25(59.52%). For the 25 patients who had a complex fistula in ano, 23 patients(92%) had the course of the fistulous tract as per Goodsall's rule. (Table 5)

Goodsall's rule	Type of Fistula, n (%)	
	Simple	Complex
Accurate	25(59.52%)	23(92%)
Not accurate	17(40.48%)	2(8%)
Total	42	25

Table 5: Showing a comparison between the type of Fistula and Goodsall's Rule

In patients with anterior fistula in ano, the course of the fistulous tract depicted by Magnetic Resonance Imaging (MRI) was found to be accurate in the case of 27(93.1%) patients. (Table 6)

Magnetic Resonance Imaging (MRI)	Location, n (%)		Total	P-value
	Anterior	Posterior		
Accurate	27 (93.1)	35 (92.1)	62 (92.5)	>0.99
Not accurate	2 (6.9)	3 (7.9)	5 (7.5)	

Table 6: Showing the accuracy of Magnetic Resonance Imaging(MRI) with respect to the location of the fistula in ano

*- Chi square/Fisher's exact test; P-value < 0.05 was considered significant

MRI was found to be accurate in case of 38(90.48%) patients with simple Fistula. Out of 25 complex fistulas, the course of 24(96%) fistulae were accurately delineated pre-operatively by MR fistulogram . (Table 7)

Magnetic Resonance Imaging (MRI)	Type of Fistula, n (%)		Total	P-value
	Simple	Complex		
Accurate	38 (90.5)	24 (96)	62 (92.5)	0.643
Not accurate	4 (9.5)	1 (4)	5 (7.5)	

Table 7: Showing accuracy of Magnetic Resonance Imaging(MRI) with respect to Type of Fistula in ano

*- Chi square/Fisher's exact test; P-value < 0.05 was considered significant

Goodsall's rule was found to be well correlating with MR fistulogram in 45 patients(67.16%). In 17(25.37%) patients, Goodsall's rule was inaccurate, but MR fistulogram accurately delineated the course, and in 3(4.47%) patients, MR fistulogram failed to delineate the tract, but Goodsall's rule was found to be accurate. Both Goodsall's rule and MR fistulogram were inaccurate in 2(3%) patients. MR fistulogram had a sensitivity of 93.8% (95% CI) - 93.8% (91.4% - 96.2%)(Table 8)

Magnetic Resonance Imaging (MRI)	Goodsall's rule, n (%)	
	Accurate	Not accurate
Accurate	45 (93.8)	17 (89.5)
Not accurate	3 (6.3)	2 (10.5)
Total	48	19

Table 8: Showing correlation between Goodsall's rule and Magnetic Resonance Imaging (MRI)

Sensitivity (95% CI)– 93.8% (91.4%–96.2%)

Specificity (95% CI)– 10.5% (8.1%–12.9%)

Positive Predictive Value (95% CI)– 72.6% (70.5%–74.7%)

Negative Predictive Value (95% CI)– 40% (38.4%–41.6%)

Discussion

Fistula-in-ano, the history of which can be traced back to the days of Hippocrates, remains a distressing disease with reduced quality of life. A sound knowledge of the clinical anatomy of fistula in ano, added with a thorough clinical examination, and in cases of complex anal fistulae, an imaging modality that better delineates the complexity of the disease, helps the surgeon to select an appropriate procedure, thus ensuring a satisfactory outcome [11].

In this observational study, we prospectively studied 67 patients with fistula in ano. From our study, we found that the incidence of fistula in ano was more in middle-aged people (mean age was 43.2 years (+/-11.4), with a strong predisposition to male gender(83.6%).

Out of the study population, around 12% of the patients were diabetic. Nabiyah Bakhtawar et al. [12]. depicted in their literature that Diabetes Mellitus is one of the major comorbidities that increase the risk of recurrence of Fistula in ano. In our study, patients with Diabetes Mellitus accounted for about 12%.

Patients with posterior fistula(56.7%) were more as compared to those with anterior Fistula in ano(43.3%). In a study done by Sukhlecha A Get al., [13], with a study population of 50 patients, found that 42 patients(84%) had a posterior fistula in ano and 8(16%) had an anterior Fistula in ano.

It was seen that Goodsall's rule was more accurately applicable in anterior Fistula (75.86%) in ano as compared to posterior fistulae(68.42%). Among anterior fistulae, Goodsall's rule was found to be more accurate when the external opening was located at a distance more than 3cm from the anal verge(90.9%) as compared to anterior fistulae with external opening lying at a distance of less than 3 cm from the anal verge(66.67%). In the study done by Cuinas et al., [14] they found that Goodsall's rule was accurate in 43.1% of anterior fistulae and 66.8% of posterior fistulae, and the fistulae having an external opening closer to the anal verge is more likely to obey Goodsall's rule.

In this study the predictive accuracy of Goodsall's rule was significantly high for complex Fistula in ano(92%) as compared to simple Fistulae (59.52%), which was in contrary to the findings of the study done by Samaranayake G V P et al., [15], where Goodsall's rule was more applicable for simple fistulae. The discrepancy between the studies may be due to the lesser number of complex fistulae in the current study.

The accuracy of the MR fistulogram with regard to anterior (93.1%) and posterior Fistula (92.1%) was comparable. MRI could accurately delineate the course in 96% of complex fistulae and 90.5% of simple fistulae. In a study done by Annapurna Patwari et al., [16] they compared the MR fistulogram findings with intraoperative findings and found that the accuracy of the MR fistulogram was 90%. Ruchi Gupta et al., [17] conclude from their study that MR fistulogram is the investigation of choice in the case of Fistula in ano for delineation of perianal fistulas due to its excellent soft-tissue resolution and demonstration of the external sphincter and pelvic floor.

Conclusions

We conclude that, even though being an age old rule, the overall accuracy of Goodsall's rule in predicting the course of the fistulous tract is 72%. Also, the predictive accuracy was high for anterior fistulae and complex fistulae. Provided the high sensitivity and Positive Predictive Value of Goodsall's rule, in a resource low setting, Goodsall's rule can very well guide the clinician for the management of most of the patients with anterior fistulae and also can be used as a clinical tool for assessing the necessity of MR fistulogram in complex cases.

Thus, MR Fistulogram can be used selectively in case of complex Fistula in ano, as well as posterior fistulae which often have complex tracts. MR Fistulogram when clubbed with clinical examination findings, it helps accurately delineate the fistulous tract. It can clearly make out the percentage involvement of the sphincter complex so that the surgeon can very well customize the intervention required based on the complexity of the Fistulous tract.

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