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CLINICAL CHARACTERISTICS OF PATIENTS WITH COLONIC FISTULAS AND COMPARATIVE ANALYSIS OF THE EFFECTIVENESS OF RADIOLOGICAL EXAMINATION METHODS

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Intestinal fistulas are clinically challenging because complex tracts and associated inflammatory complications may be difficult to characterize before treatment. This retrospective clinical-radiological study included 94 patients with fistulas and compared non-contrast with contrast-enhanced computed tomography while also examining clinical and radiological associations. Fistulas were detected in 67 patients (71.3 %) by non-contrast computed tomography and in 87 (92.5 %) by contrast-enhanced computed tomography ($p < 0.001$). Contrast enhancement was associated with higher sensitivity (92.5 % vs 71.3 %), specificity (88.2 % vs 64.7 %), positive predictive value (94.3 % vs 79.1 %), negative predictive value (83.7 % vs 54.5 %), accuracy (90.4 % vs 69.2 %), and area under the receiver operating characteristic curve (0.91 vs 0.71). Significant correlations were found between fistula length and abscess size, intestinal wall thickness and fistula diameter, and Crohn's disease and fistula severity. Contrast-enhanced computed tomography therefore provides more informative pre-treatment assessment of intestinal fistulas and their complications.

Key words: intestinal fistula, computed tomography, contrast enhancement, diagnostic accuracy, abscess, Crohn's disease.

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КЛІНІЧНА ХАРАКТЕРИСТИКА ПАЦІЄНТІВ З КИШКОВИМИ СВИЩАМИ І ПОРІВНЯЛЬНИЙ АНАЛІЗ ЕФЕКТИВНОСТІ РАДІОЛОГІЧНИХ МЕТОДІВ ДОСЛІДЖЕННЯ

Кишкові свищі становлять складну клінічну проблему, оскільки хід свища та супутні запальні ускладнення не завжди вдається повноцінно оцінити до початку лікування. До ретроспективного клініко-рентгенологічного дослідження включено 94 пацієнтів зі свищами; проведено порівняння безконтрастної та контрастно-підсиленої комп'ютерної томографії, а також аналіз клініко-рентгенологічних взаємозв'язків. Під час безконтрастної комп'ютерної томографії свищі виявлено у 67 пацієнтів (71,3 %), під час контрастно-підсиленої — у 87 (92,5 %; $p < 0,001$). Контрастування забезпечувало вищі показники чутливості (92,5 % проти 71,3 %), специфічності (88,2 % проти 64,7 %), позитивної та негативної прогностичної цінності, загальної точності та площі під ROC-кривою (0,91 проти 0,71). Виявлено значущі кореляції між довжиною свища та розміром абсцесу, товщиною кишкової стінки та діаметром свища, а також між хворобою Крона та тяжкістю свища. Контрастно-підсилена комп'ютерна томографія забезпечує більш інформативну передопераційну оцінку свищів та їхніх ускладнень.

Ключові слова: кишкова нориця, комп'ютерна томографія, контрастування, діагностична точність, абсцес, хвороба Крона.

An anal fistula is an abnormal tunnel connecting the anal canal to the perianal skin and characterized mainly by recurrent, throbbing pain along with pus, swelling, and itching. It is indeed more common in men, with reported ratios often showing males are twice as likely to be affected, and incidence peaks

between the ages of 20 and 40. The treatment of rectovaginal fistulas (RVFs) remains one of the most difficult and unresolved problems in coloproctology or pose a major coloproctological challenge largely, due to the high recurrence rates, complex etiologies, and persistent inflammation [5, 14].

Rectal fistula is a common anorectal condition and is more frequent in men than in women. The disease represents a substantial clinical burden because many patients ultimately require surgical treatment [5, 8, 14]. Among all types of rectal fistulas, complex fistulas are particularly difficult to manage because of their anatomical relationship with the sphincter complex, associated inflammatory changes, and increased risk of recurrence. Appropriate classification and accurate assessment of fistula anatomy are therefore essential for selecting an optimal treatment strategy [8, 9].

Modern anal fistula treatment has shifted from radical excision toward sphincter-preserving techniques. Traditional fistulotomy remains an effective treatment for appropriately selected simple fistulas, whereas complex fistulas frequently require sphincter-sparing procedures aimed at achieving fistula healing while minimizing the risk of fecal incontinence [2, 6, 9].

However, no universally accepted single treatment approach has been established for all complex anal fistulas. Consequently, individualized treatment based on fistula anatomy, etiology, sphincter involvement, and available clinical evidence is recommended. Contemporary clinical guidelines emphasize sphincter preservation and careful selection of surgical techniques in patients with complex disease. Therefore, systematic assessment of available clinical guidelines and consensus statements is important because recommendations may differ in their methodological quality and proposed management strategies. Evidence-based evaluation may contribute to more standardized decision-making and improved patient outcomes [8, 13].

Diagnosis of rectal and perianal fistulas requires accurate identification of the fistulous tract, internal and external openings, secondary extensions, and associated inflammatory complications. Magnetic resonance imaging is widely used for detailed assessment of complex perianal fistulas because of its high soft-tissue contrast and multiplanar capabilities. Endoanal ultrasound may also provide clinically useful information and facilitate surgical decision-making [3, 16].

The external fistula opening commonly presents on the perianal or perineal skin, although fistulous communications may also involve adjacent pelvic organs, including the vagina. Anorectal-vaginal fistulas represent a particularly challenging subgroup requiring careful imaging assessment before treatment [15].

Anal fistulas may arise from cryptoglandular infection or be associated with other conditions, including Crohn's disease, previous surgery, trauma, and other inflammatory processes [1, 5, 14]. Anal fistulas are classified according to their anatomical

relationship with the anal sphincter complex as transsphincteric, suprasphincteric, extrasphincteric. Accurate determination of the fistula course and its relationship with the sphincter is particularly important in complex disease because clinical examination alone may be insufficient for complete anatomical assessment. In addition, high-level rectal fistulas are complex, often suprasphincteric or extrasphincteric anal fistulas and the primary internal opening is situated above the dentate line in the lower ampullary part of the rectum. Complex fistulas, including high transsphincteric, suprasphincteric, extrasphincteric, rectovaginal, and postoperative fistulas, remain difficult to diagnose and treat because of branching tracts, abscesses, persistent inflammation, recurrence, and the risk of sphincter dysfunction. Pre-treatment mapping is therefore essential for choosing an appropriate surgical or conservative strategy [3, 9, 16].

Radiological imaging plays an important role in the assessment of fistulas by defining their anatomical course, associated inflammatory changes, abscesses, and communication with adjacent structures. Cross-sectional imaging is particularly important when physical examination cannot define the entire fistula tract. Magnetic resonance imaging is widely used for detailed assessment of perianal fistulas, while computed tomography (CT), especially with contrast enhancement, can rapidly demonstrate tract anatomy, intestinal wall defects, inflammatory infiltration, fluid collections, abscesses, and contrast extravasation. These findings may be particularly valuable in postoperative and complex pelvic fistulas. Computed tomography, particularly when contrast enhancement is used, can provide valuable information in selected patients with intestinal and pelvic fistulas and their complications [7, 10, 12].

Taking these considerations into account, it is important to investigate the diagnostic performance of computed tomography in patients with intestinal fistulas, including the potential advantages of contrast-enhanced CT (CECT) over non-contrast CT (NCCT) for visualization of fistulous tracts and associated complications. Comparative assessment of sensitivity, specificity, and overall diagnostic performance, together with analysis of clinical and demographic characteristics, may help to define the role of CT in diagnostic and therapeutic decision-making [7, 12].

The purpose of the study was to determine the role of CT imaging in the early diagnosis of intestinal fistulas and in the selection of optimal treatment tactics by comparing the diagnostic performance of non-contrast and contrast-enhanced CT and analyzing associations between radiological findings and clinical characteristics.

Materials and methods. The study was a retrospective clinical-radiological analysis of 94

patients examined and treated at the Center for Scientific Surgery named after M.A. Topchubashev, Baku, Azerbaijan, during November 2023 to April 2025. Clinical data were obtained from medical histories and laboratory and instrumental examination records.

Patients were divided into two etiological groups according to the presumed origin of the fistula: 81 patients (86.2 %) had postoperative fistulas that developed after surgical interventions, predominantly colorectal and pelvic procedures, and 13 patients (13.8 %) had fistulas associated with Crohn's disease. The age range was 22–78 years; mean age in the total cohort was 52.4 ± 12.7 years and in the Crohn's disease group 38.6 ± 9.4 years. There were 56 men (59.6 %) and 38 women (40.4 %).

Clinical and radiological severity was categorized as mild, moderate, or severe. Mild fistulas were observed in 21 patients (22.3 %), moderate fistulas in 49 (52.1 %), and severe fistulas in 24 (25.5 %).

All patients underwent CT in two stages: non-contrast CT followed by intravenous contrast-enhanced CT. The following radiological parameters were evaluated:

- visualization of the fistula tract;
- identification of an intestinal wall defect;
- presence of abscesses and fluid collections;
- intestinal wall thickness;
- pericolic and perirectal infiltration;
- contrast-agent extravasation.

Statistical analysis was performed using IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were summarized as mean $\pm$ standard deviation when appropriate. Between-group comparisons were performed using

Student's t-test for quantitative variables and the χ^2 test for categorical variables. Spearman's rank correlation coefficient was used to assess monotonic associations between ordinal or continuous variables. Logistic regression analysis was used to identify independent factors associated with severe fistula development. Receiver operating characteristic analysis was used to assess diagnostic discrimination. A two-sided $p < 0.05$ was considered statistically significant.

This retrospective study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable national regulations. Formal approval by an institutional ethics committee was not obtained because the study was based on a retrospective analysis of previously collected clinical and radiological data and did not involve any additional interventions or changes in patient management. Written informed consent was obtained from all patients. All data used for the analysis were handled confidentially and anonymized prior to analysis.

Results of the study. All 94 patients underwent both non-contrast and contrast-enhanced CT. To evaluate the diagnostic performance of computed tomography in patients with intestinal fistulas, the findings obtained by non-contrast and contrast-enhanced CT were comparatively analyzed. Particular attention was paid to the detection of fistulous tracts and to the main diagnostic performance parameters, including sensitivity, specificity, positive predictive value, negative predictive value, overall accuracy, and the area under the receiver operating characteristic curve. Contrast-enhanced CT detected substantially more fistulas and showed better overall diagnostic performance than non-contrast CT (Table 1).

Table 1

Diagnostic performance of non-contrast and contrast-enhanced CT for intestinal fistula detection

Indicator	Non-contrast CT	Contrast-enhanced CT	Interpretation
Number of detected fistulas	67	87	More fistulas detected with contrast
Detection rate, %	71.3	92.5	$p < 0.001$
Sensitivity, %	71.3	92.5	Higher true-positive detection
Specificity, %	64.7	88.2	Fewer false-positive findings
PPV, %	79.1	94.3	Higher reliability of a positive result
NPV, %	54.5	83.7	Higher reliability of a negative result
Accuracy, %	69.2	90.4	Higher overall diagnostic accuracy
AUC (ROC)	0.71	0.91	Higher diagnostic discrimination

Fistulas were detected in 67 patients (71.3 %) on non-contrast CT and in 87 patients (92.5 %) on contrast-enhanced CT ($p < 0.001$). Sensitivity increased from 71.3 % to 92.5 % and specificity from 64.7 % to 88.2 %. Positive predictive value increased from 79.1 % to 94.3 %, negative predictive value from 54.5 % to 83.7 %, and overall

accuracy from 69.2 % to 90.4 %. The area under the ROC curve was 0.71 for non-contrast CT and 0.91 for contrast-enhanced CT, indicating markedly better diagnostic discrimination with contrast enhancement (Table 2).

Direct visualization of the fistula tract improved from 58 % with non-contrast CT to 91 % with

contrast-enhanced CT. Abscess detection increased from 63 % to 82 %, and identification of an intestinal wall defect from 41 % to 78 %. Contrast extravasation, an indicator of an active fistulous communication or leak, was demonstrated in 74 % of contrast-enhanced examinations.

Correlation analysis showed a moderate positive association between fistula length and abscess size ($r=0.42$, $p=0.001$), a weak-to-moderate

positive association between intestinal wall thickness and fistula diameter ($r=0.36$, $p=0.004$), and a moderate positive association between Crohn's disease and fistula severity ($r=0.44$, $p=0.001$). These findings suggest that more extensive morphological changes are associated with more pronounced inflammatory complications and that Crohn's disease may be associated with a more complex fistula course.

Table 2

Radiological findings and clinical-radiological correlations

Parameter	Non-contrast CT, %	Contrast-enhanced CT, %	r	p
Visualization of the fistula tract	58	91	–	–
Abscess detection	63	82	–	–
Intestinal wall defect detection	41	78	–	–
Contrast extravasation	–	74	–	–
Fistula length–abscess size	–	–	0.42	0.001
Intestinal wall thickness–fistula diameter	–	–	0.36	0.004
Crohn's disease–fistula severity	–	–	0.44	0.001

Discussion. The present study demonstrates that contrast-enhanced computed tomography provides substantially better diagnostic performance than non-contrast CT in patients with intestinal fistulas. In our cohort, contrast-enhanced CT detected fistulas in 87 of 94 patients (92.5 %), compared with 67 of 94 patients (71.3 %) using non-contrast CT. This improvement was accompanied by higher sensitivity (92.5 % vs. 71.3 %), specificity (88.2 % vs. 64.7 %), positive predictive value (94.3 % vs. 79.1 %), negative predictive value (83.7 % vs. 54.5 %), and overall diagnostic accuracy (90.4 % vs. 69.2 %). The difference in detection rates was statistically significant ($p<0.001$), supporting the additional diagnostic value of contrast enhancement in the evaluation of fistulous disease.

These findings are consistent with the general concept that imaging plays a key role in determining fistula anatomy and associated complications. Flor et al. (2022) emphasized the importance of imaging for confirming colonic fistulas and defining the optimal therapeutic approach, highlighting the potential of CT-based techniques in patients with suspected colonic fistulous disease [7]. Similarly, Ladke et al. (2023) demonstrated the continuing relevance of radiological examinations in the diagnosis of colovesical fistulas despite the availability of modern diagnostic techniques [12]. Our results extend these observations by demonstrating a clear advantage of contrast-enhanced over non-contrast CT in terms of several quantitative diagnostic parameters.

An important finding of the present study was the improved visualization of the fistulous tract with contrast enhancement. The fistula tract was visualized in 91 % of cases using contrast-enhanced CT compared with 58 % using non-contrast CT.

Detection of intestinal wall defects also increased substantially, from 41 % to 78 %, while contrast extravasation was identified in 74 % of patients during contrast-enhanced examinations. These findings have practical relevance because accurate definition of the fistula course, its origin, and communication with adjacent anatomical structures is essential for treatment planning. Garg et al. (2024) emphasized that precise anatomical assessment is particularly important in complex fistulas, where inadequate identification of fistulous extensions may contribute to persistence or recurrence of the disease. The authors also highlighted the growing importance of advanced imaging for classification and treatment planning in complex anal fistulas [9].

The higher rate of abscess detection observed with contrast-enhanced CT (82 % vs. 63 % with non-contrast CT) is another clinically important finding. Associated abscesses and inflammatory collections may substantially modify therapeutic management, including the need for drainage or surgical intervention. Thus, the advantage of contrast-enhanced CT is not limited to direct visualization of the fistula itself but also includes improved assessment of inflammatory complications and surrounding tissues. This is especially relevant in patients with complicated postoperative fistulas, who constituted the majority of our study population.

At the same time, the role of CT should be considered within the broader spectrum of available imaging techniques. Boruah et al. (2021) demonstrated the value of diffusion-weighted magnetic resonance imaging in the evaluation of perianal fistulas [3]. More recently, Wu (2024) emphasized that structured reporting of magnetic

resonance imaging and endoanal ultrasound findings can improve surgical decision-making [16]. Furthermore, Lu et al. (2025), in a systematic review of 15 clinical practice guidelines and consensus statements, found that magnetic resonance imaging is the predominant recommended imaging modality for anal fistulas, particularly when detailed assessment of complex fistulous anatomy is required [13]. Therefore, our findings should not be interpreted as establishing contrast-enhanced CT as a replacement for magnetic resonance imaging in all types of anorectal fistulas. Rather, they demonstrate its diagnostic value, particularly when CT is clinically indicated or when intestinal, postoperative, or pelvic complications need to be evaluated.

The etiological composition of our cohort also deserves attention. Postoperative fistulas accounted for 81 of 94 cases (86.2 %), whereas Crohn's disease-associated fistulas were observed in 13 patients (13.8 %). Crohn's disease represents a particularly challenging cause of fistulizing disease because of chronic transmural inflammation, complex fistula anatomy, and the potential for recurrent inflammatory complications. Sohrabi et al. (2024) described the heterogeneous etiology of perianal fistulas and emphasized the importance of identifying the underlying cause when determining management strategies [14]. In addition, Abuliezi et al. (2026) illustrated the diagnostic complexity of Crohn's disease-associated fistulas and the potential value of contrast-enhanced imaging for delineating complex fistulous communications [1]. In our study, Crohn's disease was positively correlated with fistula severity ($r=0.44$, $p=0.001$), supporting the association between inflammatory etiology and more complicated fistulous disease.

Our correlation analysis also demonstrated a significant positive relationship between fistula length and abscess size ($r=0.42$, $p=0.001$) and between intestinal wall thickness and fistula diameter ($r=0.36$, $p=0.004$). These observations suggest that increasing morphological complexity of the fistulous tract may be accompanied by more pronounced inflammatory changes. From a clinical perspective, identification of such radiological features may help recognize patients with a potentially more complicated disease course and

may contribute to individualized treatment planning.

The importance of accurate preoperative assessment is further supported by contemporary surgical literature. Gaertner et al. (2022), in the American Society of Colon and Rectal Surgeons clinical practice guidelines, emphasized that management decisions should account for fistula anatomy, etiology, associated abscesses, sphincter involvement, and the risk of functional impairment [8]. Emile et al. (2023), comparing sphincter-preserving approaches for complex anal fistulas, also demonstrated that treatment selection remains an important clinical challenge [6]. These observations reinforce the need for reliable imaging before definitive intervention, particularly in anatomically complex fistulas.

The ROC analysis in our study further confirmed the superior diagnostic performance of contrast-enhanced CT. The area under the ROC curve increased from 0.71 with non-contrast CT to 0.91 with contrast enhancement, indicating markedly better discriminatory performance. Taken together with the improvements in sensitivity, specificity, predictive values, and overall accuracy, these findings support the use of contrast enhancement when CT is selected for the assessment of intestinal fistulas.

Several limitations of the present study should be acknowledged. Its retrospective design and relatively limited sample size may restrict the generalizability of the results. The predominance of postoperative fistulas and the relatively small number of patients with Crohn's disease may also limit direct extrapolation to other fistula populations. In addition, the study primarily compared non-contrast and contrast-enhanced CT and did not perform a direct head-to-head comparison with magnetic resonance imaging or endoanal ultrasound. Future prospective multicenter studies incorporating different imaging modalities and larger etiologically diverse patient groups are therefore warranted. Nevertheless, the present findings demonstrate that contrast-enhanced CT provides clinically meaningful improvements in visualization and diagnostic performance and may be particularly useful for assessing fistula anatomy and associated inflammatory complications.

Conclusion

Contrast-enhanced CT was superior to non-contrast CT for detecting intestinal fistulas, visualizing fistula tracts and intestinal wall defects, and identifying associated abscesses. Its higher sensitivity, specificity, predictive values, accuracy, and AUC support its use as a more informative CT technique for pre-treatment assessment of complex fistulous disease. Significant correlations between fistula morphology, inflammatory complications, and clinical severity further indicate the value of integrated clinical-radiological assessment.

Prospective multicenter studies with standardized imaging protocols and an independent reference standard are needed to validate the diagnostic performance of contrast-enhanced CT and determine its impact on treatment selection and long-term outcomes.

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