



Research Article

Diagnostic Accuracy of High-Pressure Distal Colostogram in Detecting Fistula in Male Infants with Anorectal Malformations: An Eight-Year Observational Study

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Abstract

Background:

In male infants, rectourinary fistulas frequently coexist with anorectal malformations (ARM). The most common preoperative imaging technique for defining the distal bowel anatomy and identifying fistulas is the high-pressure distal colostogram (HPDC). Its diagnostic precision is still uneven, though.

Objective:

Aim:

Over an eight-year period, assess the diagnostic precision of HPDC in identifying the presence and anatomical location of rectourinary fistulas in male infants with ARM.

Methods:

Over the course of eight years, 45 male infants with ARM who had HPDC before definitive surgery (posterior sagittal anorectoplasty, or PSARP) were included in this observational study. The accuracy of the diagnosis was assessed by comparing the HPDC results with the intraoperative findings.

Results:

In 23 out of 45 patients (51.1%), HPDC correctly detected the existence and location of rectourinary fistulas. The HPDC was incorrect in 22 patients (48.9%). Inadequate contrast injection ($n = 9$), obstruction of the fistula tract by inspissated stool or secretions ($n = 7$), and failure to create a high-pressure closed space ($n = 6$) were the most frequent reasons for misdiagnosis.

Conclusion:

Although HPDC is still a vital component of preoperative assessment for ARM, it should be acknowledged that it has limitations. Diagnostic yield can be increased by standardizing the procedure and making sure contrast is administered optimally.

Keywords: PSARP, pediatric imaging, rectourinary fistula, anorectal malformation, high-pressure distal colostogram, and diagnostic accuracy.

Introduction

Anorectal malformations (ARM) are congenital defects of the distal end of the anus and the rectum. They are frequently associated with genitourinary tract anomalies and neonatal anus/rectum in males [1]. Surgical management needs accurate identification of the fistula since PSARP is based on accurate anatomy [2].

The HPDC is a gold standard investigation for delineation of the distal rectum and any communication between the rectum and the lower urinary tract [3]. A water-soluble contrast is injected retrogradely through colostomy's mucous fistula under fluoroscopic guidance, and hand compression is applied to form a high-pressure closed compartment [4].

However diagnostic yield of HPDC is operator dependent and technically limited [5].

Although several studies have reported some conflicts between intraoperative findings and HPDC findings, HPDC has been considered to be less reliable [6–8].

False negative findings may occur with incorrect catheter position, inadequate contrast filling, and blocked fistula ducts by inspissated material [9]. Furthermore, small or high-located fistulas may simply not be visible if the distal bowel does not dilate enough out of the radiologic field of vision [10].

Better accuracy of HPDC is needed to improve the accuracy of monitoring for avoid surprises of surgery, and to improve the outcome of repairing of ARM [11]. The aim of this research is to evaluate the practical diagnostic yield of HPDC in detecting recto-urinary fistulas over an eight-year period and identify the causes of diagnostic inaccuracy. We predict that HPDC can continue to be a dependable tool when properly executed.

Patients and Methods

Study Design and Population

This observational study was carried out in a tertiary pediatric surgical center over a period of eight years, from 2015 to 2023. We looked over the medical records of forty-five male ARM patients who had HPDC and PSARP-assisted definitive surgical correction.

Imaging protocol

Through the distal mucous fistula, HPDC was performed on each patient. To occlude the stoma, a balloon was inflated and a Foley catheter was inserted. Fluoroscopic images were taken while a water-soluble contrast agent (diatrizoate meglumine) was manually injected. High intraluminal pressure was attained by maintaining a sealed system.

Surgical confirmation

PSARP was then performed on each patient. The HPDC results were compared with intraoperative findings regarding the presence and anatomical location of any fistula.

Data Analysis

The accuracy of HPDC was defined as the concordance between imaging and surgical findings. Inaccuracies were classified based on probable causes identified during imaging review.

Results

Diagnostic Accuracy

Out of 45 patients, HPDC accurately identified fistulas in 23 cases (51.1%). In the remaining 22 patients (48.9%), there were discrepancies between imaging and surgical findings.

Causes of Diagnostic Inaccuracy

Cause of Inaccuracy	Number of Cases
Inadequate contrast injection	9
Fistula blocked by fecal material or secretions	7
Failure to create sealed high-pressure space	6

Table (1): Causes of Diagnostic Inaccuracy

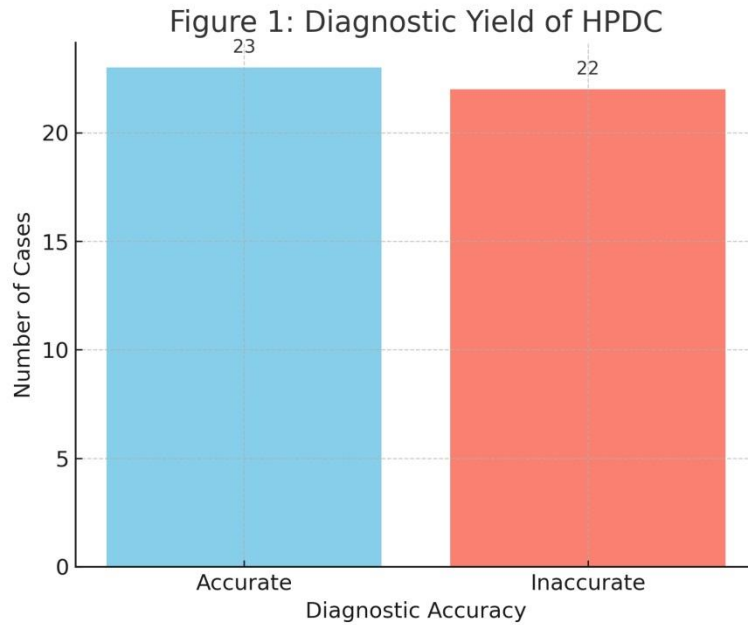


Figure 1: Diagnostic Yield of HPDC

A bar chart illustrating 23 accurate vs. 22 inaccurate HPDC cases.



Figure (2): High -pressure distal colostogram reveals fistula between the rectum and the urinary tract



Figure (3): Inadequate contrast injection (incomplete study)

Discussion

Our findings confirm apprehensions on HPDC's diagnostic efficacy, as it reported rectourinary fistula in just over half of male ARM cases it documented. Although HPDC is considered essential for preoperative planning, its sensitivity in our series was only 51.1%.

Inadequate contrast injection was a chief source of inaccuracy. The contrast might not be sufficient or may also not fill the distal rectum and reach the fistula opening if the pressure is inadequate or the catheter is incorrectly placed. Technical performance has also been recognized in previous publications as a key determinant of image quality and interpretation [12–14].

Another frequent problem was mucosal secretions or inspissated fecal material obstructing the fistula. Fistulas, particularly high or narrow ones, might go undetected unless the lumen is pushed out [15]. Pre-procedural rectal irrigation may be able to lessen this error.

It is especially problematic when a closed high-pressure environment is not established. For the pressure to sufficiently distend the rectum, a competent seal is required. The fistula might stay collapsed and undetectable during fluoroscopy if air or contrast leaks [16].

Our research supports previous findings that, depending on technique and patient anatomy, HPDC sensitivity can range from 45% to 75% [17–18]. To maximize outcomes, technical advancements in areas such as image guidance, pressure monitoring, and operator experience are crucial.

For complicated or unclear cases, some centers recommend the use of supplementary imaging techniques like endoscopy or MRI. These modalities do come with costs and sedation issues for neonates, and they are not always accessible [19–20].

Clinically, from a surgical management point of view, these findings, which are unsuspected before PSARP and can be a result of erroneous HPDC, are of significance as they may increase operating time, risk, and morbidity. Therefore, the limitations of HPDC must be kept in mind and managed by incorporating them into surgical planning and management. On the other hand, standardization of the technique (training of staff on the optimal technique of injection, ensuring closed-loop systems, and use of a pressure-sensitive syringe) can improve its accuracy and may be a subject of further study.

The study limitations include its single-center, limited sample-size nature. On the other hand, the strength of this study is the confirmation of imaging findings with direct observation during surgery, which provides strong internal validity.

It should be noted that the margin of error that is permissible in pharmaceutical formulation, especially in pediatrics, is analogous to the use of imaging and reliance on the accuracy of diagnosis in pediatric surgery. For example, in anorectal malformations, a surgeon cannot operate on a given fistula (known or suspected) without clear evidence of its exact location on anatomical grounds, lest serious complications arise [22]. So too a recent paper on the formulation design and evaluation of a hydrocortisone gel for topical use stresses the value of precision in both dose delivery and dose localization [21]. There is no need to explain why such a parallel is drawn between the importance of administering drug to a specific layer of skin or mucosa and the importance of image-guided localization of a fistula in pediatric surgery. It is the translational methodology of the type of research described above that is relevant to pediatric surgical and diagnostic standards.

Predictive factors for HPDC accuracy should be further examined, and explore the role of complementary imaging or modified protocols for the elusive fistulas.

Conclusion

An effective, if imperfect, way to assess fistulas in male infants with ARM is the high-pressure distal colostogram. In our series, the diagnostic accuracy was only 51.1%. To increase yield, we must work on improved technique, appropriate use of contrast, and the development of a high-pressure closed system. We must also be mindful of the tool's limits and be ready to deal with unexpected outcomes during surgery.

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