

Fistulography Technique and Diagnostic Image Quality in a 3-Month-Old Infant with Saccus Regio Colli: A Case Report

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ABSTRACT

Introduction: Parents brought a three-month-old infant to the radiology installation at RSJ Prof. Dr. Soerojo Magelang. The baby's general condition was good; the baby's temperature and weight were normal, but a fistula was found in the neck that continued to ooze fluid. After taking an anamnesis, it was discovered that signs of fistula had appeared when the baby was born. However, the symptoms became more obvious when the baby could reflexively straighten the neck and head at 1 to 2 months of age.

Objective: This case report aimed to describe the technical approach to fistulography and the resulting diagnostic image quality in a 3-month-old infant with saccus regio colli,

Method: This case report approach involved three informants, comprising two radiographers and one radiologist. Data were collected through direct observation, semi-structured individual interviews using interview guides, and document review. Ethical approval was obtained from the Research Ethics Committee (Ethical Clearance No. 45/KEH/VII/2022) prior to data collection.

Result: The fistulography examination was optimized through appropriate patient preparation, positioning, and projection selection. Because the patient was uncooperative, a single oblique exposure was performed, yielding adequate diagnostic image quality with clear visualization of the fistula while minimizing radiation exposure and avoiding repeat imaging.

Conclusion: Fistulography in a 3-month-old infant with saccus regio colli requires an examination technique tailored to the patient's condition and fistula location. In this case, appropriate preparation, patient comfort, positioning, controlled contrast administration, and selection of an oblique projection produced a diagnostically adequate image with clear visualization of the fistula despite limited patient cooperation. A single exposure was sufficient, avoiding repeat or additional exposures.

Keywords: *fistulography, saccus regio colli, pediatric*

Teknik Pemeriksaan Fistulografi Pediatrik dan Optimasi Kualitas Citra Diagnostik pada Bayi Berusia 3 Bulan dengan Saccus Regio Colli: Laporan Kasus

ABSTRAK

Pendahuluan: Dilaporkan terdapat orang tua yang membawa bayi berusia tiga bulan ke Instalasi Radiologi RSJ Prof. Dr. Soerojo Magelang. Kondisi umum bayi dalam keadaan baik, dengan suhu tubuh dan berat badan dalam batas normal, namun ditemukan adanya fistula pada bagian leher yang terus mengeluarkan cairan. Setelah dilakukan anamnesis, diketahui bahwa tanda-tanda fistula telah muncul sejak bayi lahir. Namun, gejala menjadi semakin jelas ketika bayi mulai mampu menegakkan leher dan kepala secara refleks pada usia satu hingga dua bulan.

Tujuan: Laporan kasus ini bertujuan untuk mendeskripsikan pendekatan teknis pemeriksaan fistulografi dan kualitas citra diagnostik yang dihasilkan pada bayi berusia 3 bulan dengan *saccus regio colli*.

Metode: Pendekatan laporan kasus ini melibatkan tiga informan, yang terdiri dari dua radiografer dan satu dokter spesialis radiologi. Data dikumpulkan melalui observasi langsung, wawancara individual semi-terstruktur menggunakan panduan wawancara, dan telaah dokumen. Persetujuan etik diperoleh dari Komite Etik Penelitian (Persetujuan Etik No. 45/KEH/VII/2022) sebelum pengumpulan data dilakukan.

Hasil: Pemeriksaan fistulografi dioptimalkan melalui persiapan pasien, pengaturan posisi, dan pemilihan proyeksi yang tepat. Mengingat pasien tidak kooperatif, dilakukan satu kali pengambilan gambar (*exposure*) dengan posisi oblik. Hal ini menghasilkan kualitas citra diagnostik yang memadai dengan visualisasi fistula yang jelas, sekaligus meminimalkan paparan radiasi dan menghindari pengulangan pengambilan gambar.

Kesimpulan: Optimalisasi teknik pemeriksaan melalui persiapan yang tepat, kenyamanan pasien, positioning, dan pemilihan proyeksi oblique memungkinkan diperolehnya citra diagnostik yang memadai pada pemeriksaan fistulografi pediatrik dengan satu kali eksposi. Pendekatan ini dapat meminimalkan paparan radiasi dan menghindari pengulangan pemeriksaan pada pasien pediatrik.

Kata Kunci: *fistulografi, saccus regio colli, pediatrik*

INTRODUCTION

Colli, or the neck, is the anatomical region connecting the cranium and thorax and contains various soft-tissue structures. Anomalies of colli or the neck, can result in common congenital neck masses, which may present as cysts, sinuses, or fistulas. A fistula is an abnormal tract that connects internal organs that do not normally communicate with one another, or establishes a connection between an internal organ and the external surface of the body.

Several imaging modalities can be used in the evaluation of fistula, including fistulography, ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI). In the evaluation of a fistula, delineation of the fistulous tract is essential for determining its anatomical course, location, and extent (Omri et al., 2024). Fistulography enables direct visualization of the fistulous tract

through the administration of radiopaque contrast material into the fistula, allowing assessment of its course, location, and extent, particularly in small or superficial tracts. Penaranda et al. (2025) reported that fistulography can be used to identify and characterize atypical or recurrent fistulous tracts, including small tracts that may not be optimally characterized on conventional CT or MRI (Penaranda et al., 2025).

Clinical manifestations of a fistula may include swelling or the presence of a mass, pain in the affected area, and the formation of a *saccus* (sac or pouch) (Ertandri, 2016; Maryanto et al., 2024). *Saccus regio colli* is a fistula located in the cervical (colli) region. Early diagnosis and appropriate management can help minimize complications and ensure favorable long-term outcomes (Penaranda et al., 2025). Fistulography may be performed by

introducing radiopaque contrast into the fistulous tract to delineate its course and extent, providing important anatomical information for the evaluation and management of saccus regio colli (*Branchial Cleft Anomalies*, 2025).

In the context of fistulography for saccus regio colli, understanding the anatomy of the neck is essential for delineating the fistulous tract and determining its extent and anatomical relationships. This examination therefore plays an important role in providing diagnostic information regarding the location and course of the fistula (Singh, 2020; Utara et al., 2026). The routine techniques used in fistulography include anteroposterior (AP), lateral, and oblique projections. Before the administration of contrast media, a preliminary plain radiograph is typically obtained using an anteroposterior (AP) projection. (Lampignano & Kendrick, 2018; Masrochah, Siti Trihadijaya, Agi Febrian Putri, 2018).

The implementation of fistulography in pediatric patients presents distinct challenges compared with adult patients. Limited patient cooperation, a greater tendency to move during the examination, and increased sensitivity to radiation exposure require appropriate modifications to the examination technique. Therefore, optimizing the examination technique is essential to obtain diagnostically adequate image quality while avoiding repeat exposures. Factors such as patient preparation, patient comfort and immobilization, contrast media administration, accurate positioning, and appropriate selection of radiographic projections may influence both the success of

the examination and the quality of the resulting images.

In pediatric radiographic examinations, optimal image quality is not necessarily determined by the number of projections or exposures performed. The selection of an appropriate technique based on the patient's condition and the location of the abnormality can produce sufficiently informative images for diagnostic purposes while keeping the number of exposures to a minimum. This approach is particularly important in implementing radiation protection principles in pediatric patients, especially to avoid repeat examinations.

3-month-old infant was brought It was reported that a 3-month-old infant was brought by the parents to the Department of Radiology, RSJ Prof. Dr. Soerojo Magelang. The patient was in good general condition, with body temperature and body weight within normal limits; however, a fistula was identified in the cervical region, accompanied by continuous discharge. According to the medical history, signs of the fistula had been present since birth but became more apparent when the infant began to reflexively hold the head and neck upright at approximately one to two months of age. Cervical fistulas in pediatric patients are relatively uncommon at the Department of Radiology, RSJ Prof. Dr. Soerojo Magelang, while evidence regarding adaptations of fistulography techniques for congenital cervical fistulous lesions in very young infants remains limited, particularly concerning projection selection in patients with limited cooperation.

The patient's young age and limited ability to cooperate during the examination presented challenges in performing fistulography. Therefore, an examination strategy tailored to the patient's condition was required to obtain optimal diagnostic information. Optimization of patient positioning, appropriate selection of radiographic projections, and careful execution of the examination procedure were expected to achieve diagnostically adequate image quality for visualizing the characteristics and course of the fistula while minimizing the number of exposures.

This case report aimed to describe the technical approach to fistulography and the resulting diagnostic image quality in a 3-month-old infant with saccus regio colli, with particular emphasis on examination preparation, patient comfort and positioning, the selection of appropriate radiographic projections, and efforts to obtain diagnostically adequate images quality while avoiding repeat exposure.

METHOD

This case report describes the fistulography examination of a 3-month-old infant with saccus regio colli. Data were collected through direct participatory observation, semi-structured face-to-face interviews with two radiographers and one radiologist, and document review. Interviews were conducted using predefined interview guides, audio-recorded with participants' consent, and transcribed verbatim. Documentary data included the fistulography radiograph, radiologist's report, examination procedure, and relevant examination

documentation. Data were analyzed thematically through coding, categorization, and interpretation, with findings compared across interview, observational, and documentary sources. Data credibility was strengthened through source and methodological triangulation by comparing information obtained from the three informants with direct observations, radiographic findings, the radiologist's report, and the examination SOP. Ethical approval was obtained from the Research Ethics Committee (Ethical Clearance No. 45/KEH/VII/2022) before data collection.

Diagnostic image adequacy was assessed by the radiologist using a structured evaluation form based on the clinical and anatomical objectives of the fistulography examination. Five predefined criteria were evaluated: (1) visibility of the fistulous opening, (2) visibility of the fistulous tract, (3) adequacy of contrast filling, (4) identification of relevant cervical anatomy, and (5) absence of significant motion artifacts affecting image interpretation. Each criterion was rated dichotomously as adequate (1) or inadequate (0). An overall assessment was subsequently made to determine whether the radiograph was considered suitable for diagnostic interpretation.

RESULTS

The main findings of the study are summarized in Table 1:

Table 1. The main findings if the study

Aspect	Research Findings
Patient	3-month-old infant
Clinical condition	Fistula in the right cervical region with

	persistent fluid discharge
Location of the abnormality	<i>Regio colli dextra, anterolateral aspect</i>
Patient condition during the examination	Non-cooperative and began crying
Comfort strategy	The patient remained in the mother's arms
X-Ray Unit Manufacturer	<i>Toshiba</i>
Type	<i>KXO-50XM</i>
Serial number	<i>K2D09X2957</i>
Patient position	<i>Left Posterior Oblique (LPO)</i>
Central Ray (CR)	<i>Vertikal tegak lurus</i>
Central point	<i>titik fistule di pertengahan colli</i>
Source Image Distance	<i>100 cm</i>
Image Receptor	<i>24X30 cm</i>
Kv	40 Kvp
mAs	4 mAs
Contrast medium	Iopamiro 300, water-soluble contrast medium (3 cc)
Number of exposures	One exposure
Fistula size	0.69 cm × 0.38 cm
Diagnostic Adequacy Assessment of the Fistulography Image Quality	1. fistulous opening visible; 2. fistulous tract visible; 3. contrast filling adequate; 4. relevant cervical anatomy identifiable; 5. no significant motion artifact; 6. image suitable for diagnostic interpretation
Repeat exposure	Not required
Optimization outcome	A diagnostically adequate image quality was obtained with a single exposure while avoiding repeat exposure

The results of the fistulography image quality assessment by the respondents are presented in Table 2.

Table 2. Diagnostic Adequacy Assessment of the Fistulography Image

Criteria	Adequate (1)	Inadequate (0)
Fistulous opening visible	✓	
Fistulous tract visible	✓	
Contrast filling adequate	✓	
Relevant cervical anatomy identifiable	✓	
No significant motion artifact	✓	
Overall diagnostic adequacy	Adequate ☒	Inadequate ☐

Additional radiologist assessment:

The image is suitable for diagnostic interpretation. Contrast material is seen extending to form a sac-like pocket measuring approximately 0.69 cm × 0.38 cm, with well-defined margins.

The equipment and materials prepared for the examination included a Toshiba X-ray unit (KXO-50XM), a 24 × 30 cm imaging plate, SID 100 cm. The central ray was directed vertically and perpendicular to the imaging plate, with the central point positioned at the fistula site in the right anterolateral neck (colli dextra). A CR reader, gloves, adhesive tape, scissors, gauze, a kidney dish, one 22-gauge Abbocath, one 19G winged needle, alcohol swabs, a 3 mL syringe, and Iopamiro 300 contrast medium. The equipment and materials used for the fistulography examination are shown in Figure 1.



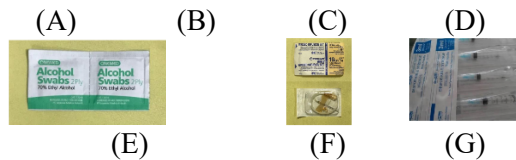
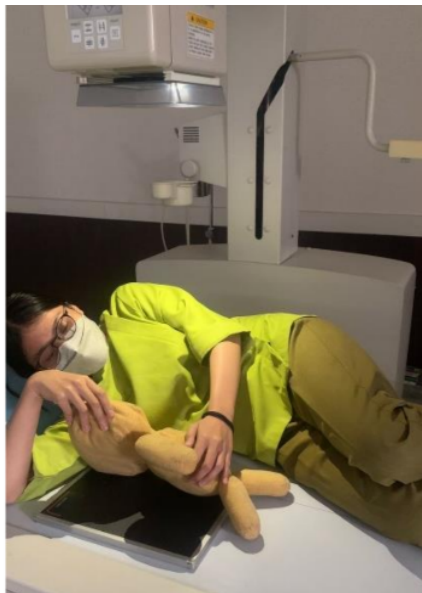


Figure 1. Equipment and materials used for the *saccus regio colli* fistulography examination: (A) X-ray unit; (B) Abbocath connected to a winged needle; (C) contrast medium; (D) Abbocath; (E) alcohol swabs; (F) winged needle; and (G) syringe.



DISCUSSION

Fistulography in pediatric patients presents distinct challenges compared with examinations in adult patients, particularly because young children may have difficulty maintaining the required position throughout the procedure (Tofft et al., 2021; Передереев et al., 2024). In this case, the patient was a 3-month-old infant who began crying and became uncooperative during the examination. This condition was a major consideration in determining the examination strategy, particularly regarding patient positioning and the number of exposures. In pediatric

Figure 2. Illustration of patient positioning for fistulography in a patient with *saccus regio colli*.



Figure 3 Image Radiograph

radiography, examination optimization primarily aims to achieve diagnostically adequate image quality while keeping radiation exposure as low as reasonably achievable. (Mohammed et al., 2019).

Patient comfort is an important aspect of optimizing image quality in pediatric examinations. In this case, the patient remained in the mother's arms during the positioning process because the infant began crying and was unable to maintain the required position independently. This approach helped keep the patient in a relatively stable position, thereby facilitating image acquisition. In pediatric

radiographic examinations, the ability to maintain proper positioning is essential because patient movement may cause *motion artifacts* and compromise radiographic image quality. Therefore, strategies that enhance patient comfort and minimize movement play an important role in obtaining diagnostically adequate images (Hulmansyah et al., 2024).

In addition to patient comfort, accurate positioning and the selection of the appropriate projection are crucial components in optimizing image quality. In this case, the fistula was located on the anterolateral aspect of the right cervical region (*regio colli dextra*) consequently, an oblique projection was selected. The oblique projection allowed the fistula to be precisely positioned within the area of interest and clearly visualized. This approach demonstrates that selecting a projection for pediatric patients does not always require the use of standard AP and lateral views or the entire range of available projections; rather, the choice can be tailored to the location of the abnormality and the patient's clinical condition. Based on interviews, the radiologist noted that the fistula's location corresponded to the oblique position, whereas AP or lateral positioning would not have optimally captured the fistula. The informant further stated that positioning decisions are made on a case-by-case basis, aiming to identify the view that provides the most informative visualization of the abnormality.

The diagnostic adequacy assessment demonstrated that all predefined criteria were

fulfilled, including visualization of the fistulous opening and tract, adequate contrast filling, identification of relevant cervical anatomy, and absence of significant motion artifacts. The radiologist considered the image suitable for diagnostic interpretation, with contrast material extending into a well-defined sac-like pocket measuring approximately 0.69×0.38 cm. These findings indicate that the selected oblique projection provided sufficient anatomical delineation for identifying the cervical saccus in this specific pediatric case.

Adequate visualization of the fistulous tract is essential in contrast fistulography because the diagnostic value of the examination depends on delineating the abnormal tract or sac and its anatomical relationship with adjacent structures. In this case, the contrast-filled sac was clearly demonstrated with well-defined margins, suggesting adequate opacification and localization of the lesion. The oblique projection may have contributed to improved visualization by altering the geometric relationship between the lesion and surrounding cervical structures, thereby reducing potential superimposition. Previous radiographic research has demonstrated that oblique positioning can improve lesion conspicuity when anatomical structures overlap on conventional projections, although such evidence cannot be directly extrapolated to pediatric cervical fistulography (Lin et al., 2019).

In this case, the use of an oblique projection served as a strategy to alter the

geometric relationship between the fistula and surrounding anatomical structures. Unlike the AP projection, which projects neck structures primarily in an anterior-posterior direction or the lateral projection, which superimposes structures from the right and left sides onto a single plane, rotating the body into an oblique position changes the angle of the structures relative to the image receptor. This change in angle allows structures that previously lay along the same beam path to become more distinct in the projection, making it easier to differentiate structures or abnormalities located on the anterolateral aspect of the neck. The principle of using oblique projections to reveal structures that are obscured in standard projections is a general concept in radiography. Radiographic literature indicates that specialized projections may be employed when AP/PA and lateral projections result in structural superimposition that hinders the visualization of specific areas (Kathy McQuillen Martensen, 2023). The radiologist considered the oblique projection more appropriate for demonstrating the contrast-filled fistulous sac. In addition, the infant was uncooperative and had started crying, making additional projections less feasible and potentially increasing the need for repeat exposure.

Ali et al. (2019) demonstrated that technical factors in radiographic examinations can have varying effects on image quality and radiation dose. Therefore, the selection of examination parameters and the determination of the number of exposures should be carefully

optimized to obtain diagnostically adequate images. Meanwhile, Ghorbani et al. (2021) reported that the optimization of radiographic parameters in pediatric patients can maintain or improve image quality while simultaneously reducing radiation dose. In the present case, the optimization strategy was primarily reflected in the decision to perform a single exposure using an *oblique* projection. This decision was based not only on the patient's non-cooperative condition but also on the consideration that the resulting image provided adequate diagnostic information. This approach is particularly important in pediatric patients because repeat exposures may result in additional radiation exposure without providing further diagnostic benefit when the initial image has already fulfilled the requirements for interpretation.

The findings of this study demonstrated that a single exposure using an *oblique* projection was sufficient to produce an image considered adequately informative by the radiologist. The shape and size of the fistula were clearly visualized, measuring 0.69×0.38 cm and located in the anterolateral aspect of the right cervical region (*regio colli dextra*). Therefore, the image quality in this case can be considered diagnostically adequate based on its ability to clearly demonstrate the relevant anatomical structures and pathological abnormality targeted by the examination. This is important because diagnostic image quality should primarily be assessed according to its adequacy in answering the clinical question rather than solely on the technical

characteristics of the image (Delis et al., 2021; Pengpan et al., 2022)

Cho et al. (2019) demonstrated that motion control during pediatric fluoroscopy examinations can improve image quality while reducing the number of exposures and radiation dose. This approach also aligns with recommendations for pediatric imaging optimization, which view image quality and radiation exposure as two critical components that must be evaluated concurrently. Ideally, the optimization process encompasses identifying examination requirements, evaluating image quality and radiation dose, implementing appropriate technical interventions, and reassessing the obtained results (Id et al., 2019; Maryanto et al., 2024)

This approach is also consistent with recommendations for optimizing pediatric imaging, which consider image quality and radiation exposure as two essential components that should be evaluated simultaneously. Ideally, the optimization process involves identifying the examination requirements, evaluating image quality and radiation dose, implementing appropriate technical interventions, and subsequently reassessing the outcomes obtained (Maryanto et al., 2024).

The use of water-soluble contrast media, administered slowly through the fistula opening, also played an important role in achieving adequate visualization of the fistulous tract. In this case, the contrast medium was introduced using an Abbocath connected to

a winged needle and was injected gradually until the fistulous tract was adequately filled. Controlled administration of the contrast medium was necessary to ensure adequate filling of the fistula while minimizing potential patient discomfort. The literature on contrast fistulography also indicates that water-soluble contrast media can be administered directly through the external fistula opening to visualize the fistulous tract (Sharma et al., 2020).

In this study, successful optimization of Image quality was not determined by a single factor but rather resulted from the combination of several components, including patient preparation, patient comfort, positioning, projection selection, contrast media administration, and avoiding repeat exposure. This combination enabled the examination to provide adequate diagnostic information despite the patient's non-cooperative condition. Therefore, optimization of image quality in pediatric fistulography can be understood as the ability to adapt the examination technique to the individual patient's condition without compromising the diagnostic value of the resulting images.

Thus, optimizing image quality in this case does not mean obtaining images using as many projections as possible; rather, it means obtaining images that are sufficient to address the diagnostic requirements while keeping the number of exposures to a minimum. This approach is consistent with the principles of optimization in pediatric radiology, which emphasize maintaining diagnostically adequate image quality while avoiding unnecessary

radiation exposure (Chamdan, 2017; Ertandri, 2016).

In this case, optimizing image quality does not necessarily require increasing the number of radiographic projections. Adapting the examination technique to the patient's condition, selecting appropriate positioning and projections based on the location of the fistula, ensuring adequate contrast administration, and performing image acquisition efficiently and accurately can produce diagnostically adequate images with a single exposure.

This study has several limitations. The single-case design and absence of a comparator limit the ability to generalize the findings and preclude direct comparison of the oblique projection with AP and lateral projections. Quantitative radiation-dose measurements were not performed, and image quality was assessed subjectively based on the radiologist's interpretation rather than standardized quantitative metrics. Furthermore, the findings may not be generalizable to other pediatric patients because fistulous anatomy, lesion location, and patient cooperation may vary. Clinical or imaging follow-up was also unavailable to assess subsequent treatment response or clinical outcomes. Future studies with larger pediatric cohorts, comparative projection protocols, objective image-quality assessment, quantitative radiation-dose measurements, and appropriate clinical follow-up are needed to confirm and extend these findings.

CONCLUSION

Fistulography in a 3-month-old infant with *saccus regio colli* requires optimization of

the examination technique tailored to the specific conditions of pediatric patients to achieve diagnostically adequate image quality. In this case, optimization was achieved through appropriate examination preparation, efforts to maintain patient comfort, proper positioning, controlled administration of contrast media, and selection of an oblique projection based on the patient's condition and the location of the fistula. Despite the patient's non-cooperative condition and crying during the examination, a single exposure using an oblique projection produced an informative image with clear visualization of the shape and size of the fistula. These findings demonstrate that appropriate selection of examination techniques and radiographic projections can achieve optimal diagnostic image quality without the need for repeat or additional exposures. Therefore, optimization of fistulography in pediatric patients is not determined solely by the number of projections performed but rather by the ability to adapt the examination technique to the patient's condition and diagnostic requirements. In this case, an oblique projection with controlled contrast administration produced a diagnostically adequate image in a non-cooperative 3-month-old infant while avoiding repeat exposure.

AUTHOR'S CONTRIBUTION STATEMENT

The authors contributed to the conceptualization, methodology, data collection, analysis, interpretation of findings, and manuscript preparation. All authors

participated in the revision of the manuscript and approved the final version for publication.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES (WHEN USE AI)

The authors disclose the use of AI tools (ChatGPT) for language editing, structural editing, or other assistance during manuscript preparation. The authors remain fully responsible for the content, accuracy, and scientific integrity of the published manuscript.

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