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EVALUATION OF NON-FLUOROSCOPY LOPOGRAPHY TECHNIQUE USING WATER-SOLUBLE CONTRAST IN POST-COLOSTOMY COLON CARCINOMA: A CASE REPORT FORM INDONESIA

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ABSTRACT

Background: The lopography examination using barium sulfate contrast media which injected through the stoma using fluoroscopy. The lopography examination at radiology installation of Prof. Dr. Margono Soekarjo Purwokerto Hospital using a non-ionic water-soluble contrast media mixed with NaCl injected into the proximal stoma and anus without using fluoroscopy. The examination using series photo, such as plain photo abdomen and AP post-contrast. This case was different from the reference that uses barium sulfate contrast media and fluoroscopy. . This research aims to understand the advantage of non- fluoroscopy lopography procedure, to identify the reasons for using non-ionic water-soluble contrast media with a ratio of 1:5 and a volume of 600 cc, and to gather diagnostic information from the AP projection. **Case Presentation:** A 67-year-old male patient has one stoma at the sigmoid colon caused by adenocarcinoma that was found in the rectosigmoid colon. The lopography examination was done to evaluate colon after chemotherapy **Conclusion**: The lopography examination used non-ionic water-soluble mixed with NaCl in a ratio of 1:5 and volume 600 cc, because non-ionic water-soluble is inherently safer than barium sulfate. Non-fluoroscopy lopography was done by gradually injecting the contrast media. Non- fluoroscopy lopography generated lower dose compared to fluoroscopy.

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INTRODUCTION

The colon is a part of the gastrointestinal (GI) tract. It is approximately 1.5 m long[1]. The main function of the colon is forming and propelling feces and store them until they are expelled through the anus[2]. The pathologies of the colon can be aggressive, such as rectosigmoid carcinoma. Rectosigmoid carcinoma is a malignant tumor that grows in the epithelial tissue of the colon or the rectum[3]. The prevalence of cancer patients in Indonesia according to the Global Cancer Observatory 2022, rectosigmoid carcinoma reached 35,676 patients with an overall percentage of 8.7% of the total number of cancer diagnoses. There were 21,903 male patients and 13,773 female patients. The risk of rectosigmoid carcinoma in male patients is higher than in female patients[4]. This is because in female patients, there is a protective effect of the hormone estrogen, which reduces the risk for rectosigmoid carcinoma in women[5]. Rectosigmoid carcinoma can block the gastrointestinal tract, requiring a medical procedure called colostomy[6].

Colostomy is a surgical procedure forming an artificial opening (stoma) in the colon so that feces from the body come out through the stoma[7]. To evaluate the structure of the colon after colostomy and to determine the following medical procedure, a radiographic examination known as lopography is required. Lopography examination is a radiologic examination to analyze the structure of the colon using contrast media[8].

The lopography examination procedure involved patient preparation such as having a stoma irrigation, low-fiber diet, fasting, and carrying an additional colostomy bag[8]. Fasting is performed 10 hours before the examination in order to clean the colon from feces

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that can interfere with the radiograph results[9]. The lopography examination begins with taking a plain photo abdomen, followed by the insertion of contrast media using fluoroscopy[8]. Fluoroscopy provides a direct dynamic view of the anatomical structures, enabling direct observation of contrast media entering the colon[10].Contrast media can be inserted through the proximal stoma and anus because the patient only has one stoma opening[11]. The lopography examination is performed with Antero Posterior (AP) or Postero Anterior (PA), Lateral, Oblique (RAO), and Post Evacuation projections[8].

The lopography examination using barium sulfate contrast media or water-soluble contrast media is used if there is an indication of colon perforation or obstruction[8]. The lopography examination can use water-soluble contrast media mixed with NaCl using a ratio of 1:4 and a volume of 650 cc[9]. A lopography examination uses water-soluble contrast media mixed with NaCl at a ratio of 1:3[12]. This study presents non- fluoroscopy lopography using water soluble in post-colostomy patient with one opening stoma in sigmoid colon and proves that the lopography examination can be perform without the use of fluoroscopy due to reduce the radiation of the patient and staff, thereby further improving occupational safety and health.

CASE

Lopography is the most frequently performed examination at the radiology installation Prof. Dr. Margono Soekarjo Purwokerto Hospital. The frequency of patients' lopography examinations during the period from December 2024 to February 2025 totaled 44 examinations (30.98%) out of the total 142 conventional radiography examinations using contrast media.

Table 1. The incidence of lopography examinations from December 2024 to February 2025 (Prof. Dr. Margono Soekarjo Purwokerto Hospital)

Month	Conventional radiography examinations using contrast media		Percentage (%)
	Conven-sional	Lopography	
December	62	21	33,87
January	37	15	40,54
February	43	9	20,93
Total	142	44	30,98

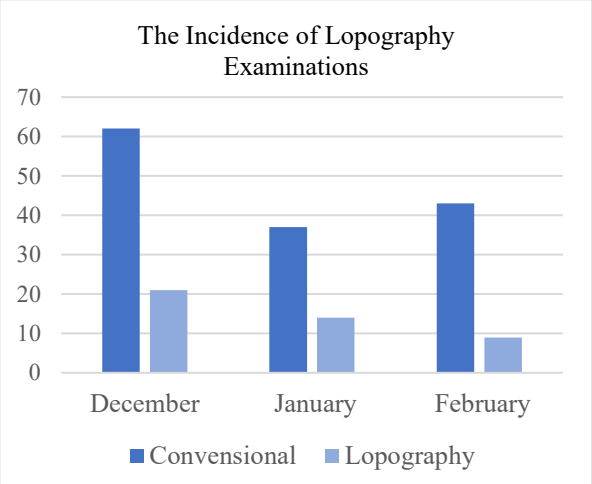


Figure 1. Graph of the incidence of lopography examinations from December 2024 to February 2025 (Prof. Dr. Margono Soekarjo Purwokerto Hospital)

Table 2. Patient Profile

Name	:	Mr. M
Age	:	67 years old
Gender	:	Male
No. RM	:	0229xxxx
Examination Date	:	17 February 2025
Referring Doctor	:	dr. MY, Sp. B(K)Onk
Examination	:	Lopography
Clinical	:	rectosigmoid carcinoma post-colostomy

Colonoscopy was taken, showing the mass in the rectosigmoid suspecting malignancy. The results of Pathology Anatomy (PA) indicated the presence of adenocarcinoma in the rectosigmoid region. The stoma opening was created. The patient returned to the surgical oncology specialist after completing the colostomy and chemotherapy twelve times, with a schedule every two weeks. Then, the oncological surgeon referred the patient to the radiology installation for a lopography examination. The patient only had one stoma for fecal discharge in the sigmoid colon.

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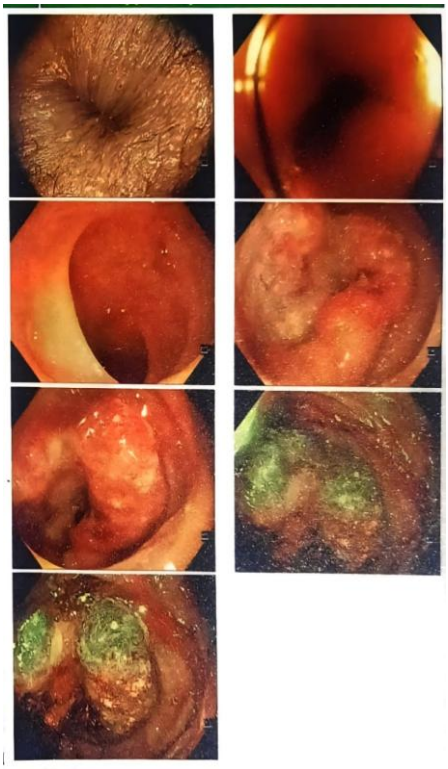


Figure 2. The result of colonoscopy patient Mr. M

CASE MANAGEMENT

Standard Procedure	Hospital Procedure
Patient preparation: stoma irrigation, low-fiber diet, fasting, and carrying an additional colostomy bag, fasting (10 hours)	Patient preparation: fasting (10 hours), wear patient gown, removed the metal object in the examination area, and cleaned the area of stoma.
Contrast Media: barium sulfate, water-soluble if there is an indication of colon perforation or obstruction (ratio of 1:4/1:3 and volume of 650 cc)	Contrast Media: water-soluble (ratio of 1:5 and volume of 600 cc)
Use fluoroscopy	Non Fluroscopy
Projections: Antero Posterior (AP) or Postero Anterior (PA), Lateral, Oblique (RAO), and Post Evacuation projections	Projections: Antero Posterior (AP)

Figure 3. Table of Standard and Hospital Procedure

Lopography examination procedure at the radiology installation of Prof. Dr. Margono Soekarjo Purwokerto Hospital involved patient preparation two days before the examination, the patient ate porridge and then fasted for 10 hours. The patient arrived on the scheduled date with a new stoma bag. The patient was asked to change his clothes into the patient gown, removed the metal object in the examination area such as belts, and cleaned the area of stoma.

Preparation of equipments used were mobile X-ray modality, a 43x43 cm flat panel detector, an 18-gauge foley catheter, a 50 cc syringe, a 10 cc syringe, gloves, clamps, measuring cups, patient gown, bedpans, tissue, jelly, hypafix, and marker. The contrast media used non-ionic water-soluble contrast media with a total volume of 600 cc mixed with 100 cc of non-ionic water-soluble contrast media and 500 cc of NaCl to achieve a 1:5 ratio. The contrast media was divided into two portions: 400 cc for injections through the proximal stoma and 200 cc for injections through the anus.

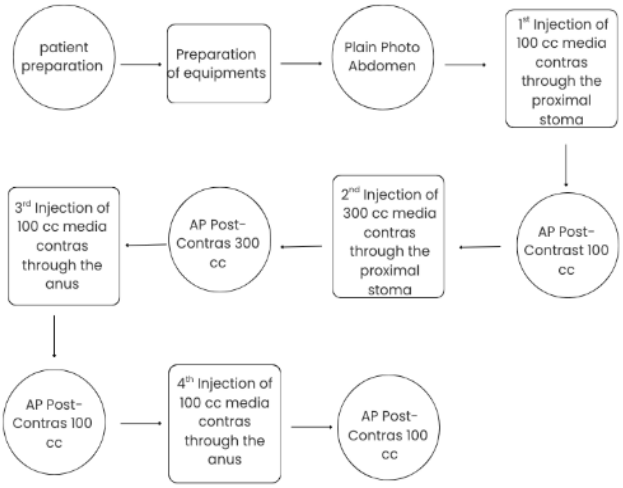


Figure 4. Flowchart of Non- Fluoroscopy Lopography at Radiology Installation of Prof. Dr. Margono Soekarjo

Contrast media was injected into the proximal stoma through a foley catheter connected to a 50 cc syringe that has been filled with a mixture of contrast media. The contrast media was injected 100 cc through the proximal stoma and was followed by an additional 300 cc. The injection of the contrast media was continued through the anus with 100 cc and was followed by an additional 100 cc. The projections used were AP supine projection for plain photo abdomen and AP post-contrast projections

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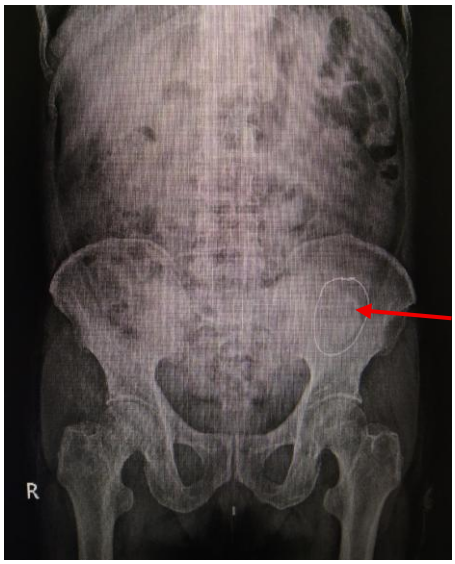


Figure 5. The Radiograph of Plain Photo Abdomen showing the contour of the colostomy before the administration of contrast media (red arrow)

The radiograph of the plain photo abdomen showed a normal gas shadow in the colon **(Figure 5).**



Figure 6. The Radiograph of 1st stage AP post-contrast 100 cc showing the sigmoid and descending colon (red arrows)

The radiograph of 1st stage AP post-contrast 100 cc through the proximal stoma showed the contrast media was filling the sigmoid colon and descending colon(**Figure 6)**.

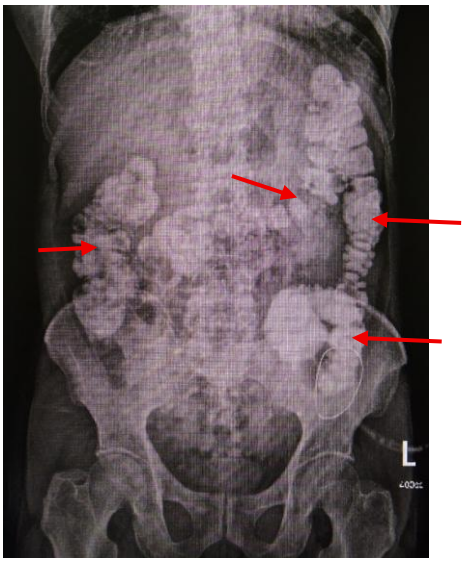


Figure 7. The Radiograph of 2nd stage AP post-contrast 300 cc showing the ascending colon, the transverse colon, the descending colon, and the sigmoid colon (red arrows)

The radiograph of 2nd stage AP post-contrast 300 cc through the proximal stoma showed the contrast media was filling the ascending colon, the transverse colon, the descending colon, and the sigmoid colon. No filling defects/additional defects or indentations are visible (**Figure 7)**.

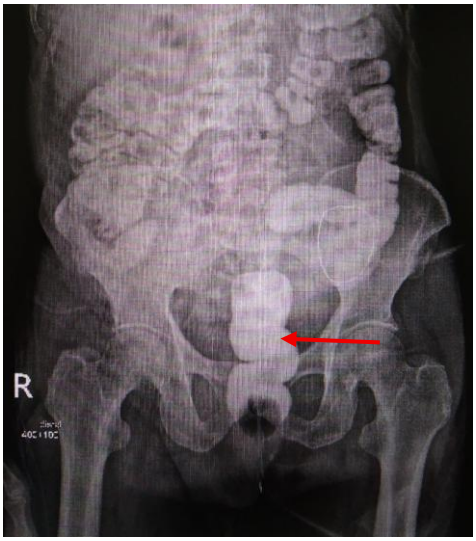


Figure 8. The Radiograph of 3rd stage AP post-contrast 100 cc showing some part of rectum (red arrow)

The radiograph of 3rd stage AP post-contrast 100 cc through the anus showed the contrast media was filling some part of the rectum (**Figure 8)**.

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Figure 9. The Radiograph of 4th stage AP post-contrast 100 cc showing the rectum (red arrow)

The radiograph of 4th stage AP post-contrast 100 cc through the anus showed the contrast media was filling the rectum. No intraluminal colonic masses were visualized with cut-off contrast in the distal sigmoid colon. No contrast extravasation was seen (**Figure 9)**.

Radiation protection involved radiation protection for patients, radiation protection for staff, and radiation protection for the community or surrounding environment. Radiation protection for patients was done by adjusting the collimation area according to the object being examined, adjusting the tube voltage (kVp), tube current and time (mAs) settings according to the patient's body condition and not repeating the photo. Radiation protection for staff was done by conducting exposures outside the examination room and using a TLD badge as a personal dosimeter. Radiation protection for the surrounding environment was done by closing the examination room door before conducting exposures and asking the patient's family to leave the examination room.

DISCUSSION

Patient preparation for lopography examination is done by having a stoma irrigation procedure[8]. Patient preparation in the radiology installation of Prof. Dr. Margono Soekarjo Purwokerto Hospital was done by eating porridge two days before the examination and fasting for 10 hours. The patient preparation above was sufficient as evidenced by the radiograph of the plain photo abdominal in **Figure 5**, which showed a normal gas shadow in the colon, thereby enabling the examination to continue. This is following the reference stating that fasting should be maintained for 10 hours before the examination[9].

The lopography examination uses fluoroscopy modality and a detector size of 35x43 cm[8]. In this case, fluoroscopy was not used and the detector size used was 43x43 cm. The function of fluoroscopy is to provide a direct dynamic view of the anatomical structures, enabling direct observation of contrast media entering the colon[10]. The use of a mobile X-ray modality was sufficient to perform the lopography examination by directly evaluating the radiograph after exposure to each stage of contrast media injections. The use of this mobile X-ray modality also has the advantage of lower radiation doses for both patients and staff, as patients did not require continuous X-ray exposure and staff could perform exposures outside the examination room. The use of a 43x43 cm flat panel detector was sufficient to cover the area being examined by adjusting the collimation area according to the object being examined. This was evidenced by the radiographic results, which clearly showed the entire required anatomy. The use of non-ionic water-soluble contrast media was preferred in the case of rectosigmoid carcinoma post-colostomy, as there was concern about post-colostomy adhesions, residual masses, and residual masses post-chemotherapy, which could cause obstruction. In this case, non-ionic water-soluble contrast media was safer to use. Adhesions occurring post-abdominal surgery are one of the causes of obstruction[13]. Water-soluble contrast media is used if there is an indication of perforation or obstruction[8]. Non-ionic water-soluble contrast media is easily excreted by the body, whereas barium sulfate contrast media is concerning due to the potential for adhesions in the colon[12]. Water-soluble contrast material is safe and non-irritant to the peritoneal cavity[14].

In other cases, without suspicion of obstruction or perforation, barium sulfate contrast media can be used in colonography examinations. This aligns with the theory stating that examinations of the digestive tract can use barium sulfate[15]. The use of barium sulfate contrast media can produce better image sharpness[16]. This showed in **Figure 7**, the radiograph

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of 2nd stage AP post-contrast 300 cc through the proximal stoma shows low contrast and sharpness.

The ratio of non-ionic water-soluble contrast media to NaCl solution is 1:5. This is different from the theory using a ratio of 1:4 and a ratio of 1:3[9,12]. The 1:5 ratio was used for a larger volume of contrast media to fill the entire colon. The post-contrast radiograph with a 1:5 ratio showed the contrast media filling the entire colon but had low sharpness and contrast. This lopography examination is better performed using a contrast media ratio of 1:3 and adjusting the contrast media volume according to the patient's colon capacity. The 1:3 ratio aims to reduce the contrast media concentration to avoid it being too concentrated while still producing the optimal images[12].

The total volume of the contrast media used was 600 cc, with 100 cc of contrast media and 500 cc of NaCl. The volume used was sufficient to fill the entire colon. This was evidenced by the post-contrast radiographic results, as shown in **Figures 7** and **Figures 9**, which demonstrated the contrast media filling the entire colon, thereby enabling a diagnosis to be established. The volume of contrast media used is adjusted according to the patient's colon capacity[12].

The contrast media was injected through two openings: the proximal stoma and the anus. Contrast media injection during lopography can be performed through the stoma and anus because the patient has only one stoma opening[9,12]. Contrast media injections without fluoroscopy are performed in stages: 600 cc through the anus in three stages, the first 100 cc, the second 100 cc, and the third 400 cc, while injection through the stoma is performed only once with a volume of 50 cc[9]. The injections of contrast media during a lopography examination for clinical rectosigmoid carcinoma post-colostomy at the radiology installation of Prof. Dr. Margono Soekarjo Purwokerto Hospital were 100 cc through the proximal stoma and an additional 300 cc. At the anus, 100 cc was injected and an additional 300 cc. There is a gap from the reference, where the stoma is located in the ileum and the patient's stoma in this case was located in the sigmoid colon, resulting in the need for a larger volume of contrast media to fill the proximal colon through the stoma. The stoma location is determined by the surgical procedure and the size of the resected intestinal segments[17].

The lopography examination with clinical rectosigmoid carcinoma post-colostomy at the Radiology Department of Prof. Dr. Margono Soekarjo Purwokerto Hospital using the AP projection. This was done because the radiographic findings showed no abnormalities or masses in the colon. Lopography was performed to evaluate the structure and function of the colon post-colostomy and to determine further medical procedures[8]. This was evidenced by the radiographic results in **Figure 7**and **Figure 9**, which showed that the contrast media filled the colon without any contrast extravasation, adhesions, or visible masses.

Diagnostic information of the post-contrast colonography examination showed no visualized colonic masses with contrast cut-off at the distal sigmoid colon and no contrast extravasation. The carcinoma on radiographs may resemble an apple core sign[18,19], while on post-contrast AP radiographs, the contrast media filled the entire colon. Therefore, the results of this lopography examination were used to evaluate the structure of the colon following colostomy and chemotherapy and to determine further medical procedure.

Based on the Anatomic Pathology (AP) results of the patient's colonoscopy, the examination revealed adenocarcinoma in the rectosigmoid region. Adenocarcinoma is a carcinoma that develops in organs or glands and can spread rapidly[20]. There was a significant time interval between the initial colonoscopy performed in July 2024 and the colonography performed in February 2025, raising concerns about potential metastasis of the carcinoma to other parts of the colon. Therefore, additional projections such as lateral and oblique projections (RPO and LPO) were recommended. The oblique projection can show the flexure without superimposition, and the lateral projection can optimally show the rectum and distal sigmoid colon[12].

A lopography examination using water-soluble contrast media was performed with AP post-evacuation projection and the radiograph showed residual contrast media in the colon[9]. Post-evacuation projection was not performed in this examination because the water-soluble contrast media was considered easier for the body to absorb, making it safer. Post-evacuation projection is necessary to

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directly evaluate contrast media residue in the colon[8]. Post-evacuation projection was taken after the patient had sufficient time for adequate evacuation[8]. Coffeeor tea is sometimes administered as a stimulant for the evacuation process[8].

Radiation protection during the lopography examination aligns with the theory stating that radiation protection is implemented by protecting the patient, protecting the staff, and protecting the surrounding community or environment[21]. In this examination, the fluoroscopy modality was not used, allowing staff to perform exposure outside the room, thereby reducing the radiation exposure received by the staff. Patients also receive a lower radiation dose because they are not exposed to continuous X-ray radiation for a longer duration. This aligns with the theory stating that fluoroscopy use results in significantly higher radiation doses for patients compared to radiography examinations, as X-rays continuously illuminate the patient for a much longer duration[10]. However, the use of AP projection up to four stages still requires empirical validation regarding the radiation dose received by patients, as if the exposure could be performed in a single stage, the dose received by patients could be further reduced.

There are limitations of this study; only one case was included, non-fluoroscopy lopography does not allow real-time evaluation, and there is no dose measurement. Future research could be conducted to directly compare non-fluoroscopy and fluoroscopy-guided lopography and analyze empirical radiation dose.

CONCLUSION

Lopography examination in post-colostomy colon carcinoma has performed without the use of fluoroscopy and was capable of showing the the structure of the colon. Lopography examination is important to evaluate the structure of the colon following colostomy and chemotherapy. The result of lopography can be used by the doctor to determine further medical procedure. Non-fluoroscopy lopography can reduce radiation doses for both the patients and the staff. Future research could be conducted to directly compare non-fluoroscopy and fluoroscopy-guided lopography and analyze empirical radiation dose. This is the limitation of this study.

ETHICAL APPROVAL

The Ethics Committee of Prof. Dr. Margono Soekarjo Hospital, has permitted this research to be carried out with certificate number 420/02092.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization, AA and SM; methodology, AA and SM; writing—original draft preparation, AA and SM; investigation, AA, SM, and ADP; writing—review and editing, AA, SM, and ADP; supervision, SM and ADP.

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