

CASE REPORT

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Massive pneumoperitoneum and subcutaneous emphysema after transanal resection of a rectal tumor: Case report and comprehensive review of the literature

P Bretcha Boix, Marie Stephanie Nunez Duarte, A Dieter, R Silver

ABSTRACT

Introduction: Transanal excision (TAE) is increasingly used to treat malignant polyps and early-stage rectal tumors due to its minimally invasive nature, which facilitates quicker recovery and fewer postoperative complications compared to traditional abdominal approaches. However, while TAE is generally safe, rare complications—such as pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema—can occur, likely related to insufflation pressures during the procedure.

Case Report: We report the case of a 72-year-old woman who underwent TAE for a rectal adenocarcinoma. The procedure was completed without evidence of intraoperative perforation. Nonetheless, on postoperative day one, the patient developed respiratory distress, fever, and abdominal discomfort. Imaging studies revealed the presence of air in the retroperitoneum and soft tissues. She was managed conservatively with intravenous antibiotics and supportive care, leading to full recovery by day four without the need for additional surgical intervention.

Conclusion: This case underscores that, although TAE offers significant benefits in terms of reduced morbidity, clinicians should remain vigilant for rare but dramatic

complications. In the absence of peritonitis or sepsis, conservative management appears effective, supporting the continued use of TAE as a safe and minimally invasive option for rectal tumor excision.

Keywords: Pneumoperitoneum, Pneumoretroperitoneum, Rectal adenocarcinoma, Subcutaneous emphysema, Transanal excision

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INTRODUCTION

Colorectal cancer is the second most commonly diagnosed cancer in both men and women in the United States, with colon polyps being a common precursor [1–3]. While many polyps are benign, those with cancerous cells penetrating the muscularis mucosae are classified as malignant polyps, categorized as T1NxMx in the TNM staging system. Transanal excision (TAE) is a minimally invasive treatment for select low rectal cancers, offering quicker recovery and fewer postoperative complications compared to traditional surgical approaches [3]. However, complications such as bleeding, perforation, infection, and stricture may occur, with rare cases of pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema also reported. These rare complications are believed to stem from insufflation pressures during surgery, which can allow air to track through tissue planes and highlight the complex

anatomical continuity between the retroperitoneal, mediastinal, and subcutaneous spaces.

Understanding these mechanisms is vital as they often present with dramatic radiological findings but resolve with conservative management, avoiding the need for surgical intervention. This report describes a rare case of pneumoperitoneum, pneumoretroperitoneum, and emphysema following TAE for a rectal tumor, while exploring the clinical implications and management strategies based on a review of the literature.

CASE REPORT

A 72-year-old woman with a positive fecal occult blood test underwent a colonoscopy, which identified a 1 cm flat lesion located 5 cm from the anal margin. An en-bloc mucosectomy was performed. Histopathological analysis revealed a tubular adenoma with moderate epithelial dysplasia and a focus of moderately differentiated infiltrating adenocarcinoma extending beyond the muscularis layer into the submucosa, with an artifacted margin at 1.1 mm. Preoperative imaging, including computed tomography (CT) of the chest, abdomen, and pelvis, as well as pelvic magnetic resonance imaging (MRI) showed no significant alterations.

The patient subsequently underwent a transanal full-thickness resection using an ultrasonic scalpel (harmonic). Intraoperative rectoscopy up to 25 cm confirmed the site of the previous polypectomy scar, located on the posterior rectal wall, 5 cm from the anal verge. No tumor was detected on digital rectal examination. The excision encompassed the entire rectal wall, and the defect was closed using a running absorbable V-Loc suture. No peritoneal breach or intraoperative perforation was observed.

On postoperative day one, the patient became drowsy and developed dyspnea, fever, and abdominal discomfort. A CT scan revealed pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema extending to the cervical and thoracic regions. She was transferred to the Intensive Care Unit (ICU) for 48 hours of close monitoring. Conservative management with intravenous meropenem (800 mg every 8 hours) and teicoplanin (400 mg every 12 hours) was initiated, along with analgesic therapy.

The patient remained hemodynamically stable throughout her ICU stay, with gradual resolution of the emphysema. She was subsequently transferred to a general ward, and by postoperative day four, all symptoms had resolved. She was discharged home on oral antibiotics without complications. Postoperative histopathological examination of the resected specimen confirmed the absence of residual neoplastic tissue. The final diagnosis for the patient was pneumoperitoneum and subcutaneous emphysema after transanal excision of a rectal adenocarcinoma, without evidence of peritoneal perforation or residual malignancy.

DISCUSSION

Transanal excision of rectal polyps is a minimally invasive procedure widely used to treat colorectal cancer in the distal rectum. Compared to open surgical approaches, TAE is associated with fewer postoperative complications, such as bleeding, pelvic sepsis, urinary retention, suture dehiscence, and fecal incontinence [4, 5]. Despite its overall safety, rare complications like pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema have been reported in the literature. A review of 13 studies, shown in Table 1, identified 17 cases involving these rare complications following full-thickness rectal wall resections [6–12]. These complications represent a small subset of the adverse events associated with these generally low-risk techniques, which include endoscopic micro-surgery (TEM) and transanal resection. Except for one case requiring surgical intervention involving a loop colostomy, all patients recovered fully with conservative management [13]. In other cases, management included antibiotics and close monitoring, with no long-term sequelae.

The mechanisms underlying these complications are thought to involve insufflation pressures during surgery, leading to air diffusion along tissue planes. The complete dissemination route is illustrated in Figure 1. During transanal excision, insufflation of CO₂ or room air into the rectal lumen is used to enhance visualization, increasing intraluminal pressure. Pressure can force air into adjacent tissue planes during full-thickness resection. Even without a peritoneal breach, air may escape and follow natural anatomical pathways. It accumulates in the perirectal space, then spreads posteriorly to the presacral space and anteriorly to the perivesical region. Air may then ascend through retroperitoneal fascial planes, reaching the perihepatic, perisplenic, pararenal, and perinephric areas. It tracks into the posterior mediastinum via the aortic or esophageal hiatus, dissecting cranially along major vascular structures. From the mediastinum, air moves superiorly through the prevertebral fascial planes and disseminates along the deep cervical fascia. This results in subcutaneous emphysema of the neck and thorax, with potential extension to the face and scalp in more severe cases. While radiologically striking, these patterns usually resolve with antibiotics, monitoring, and supportive care. Surgery is only necessary if clinical deterioration or peritonitis occurs.

This proposed pathway is supported by both anatomical continuity and clinical imaging findings. Peritoneal rupture was not observed in any of the reported cases, including the present one. Instead, insufflation of CO₂ or room air likely contributed to air dissemination, particularly when coupled with reduced tissue integrity following full-thickness resections [14, 15]. This hypothesis aligns with the findings in Figures 2 and 3 of this case report, which demonstrate the extensive presence of gas in the perihepatic, perisplenic, presacral, perirectal, perivesical, and retroperitoneal spaces. These

Table 1: Clinical data of sampled patients

Study	Year	Country	Sample size	Age	Gender	Procedure	Time frame	Symptoms	Size of lesion	Type of lesion	Diagnostic	Additional complications	Management	Long-term outcomes
Bonardi	1976	USA	1	44	F	Sphincter repair and rectoplasty	2 days	Low back and flank pain	N/A	N/A	X-ray	None	Conservative	N/A
Kriss	1990	USA	1	34	F	Hemorrhoidectomy	2 days	Fever and discomfort	N/A	N/A	X-ray	UTI	Conservative	N/A
Farmer	1993	USA	1	45	M	Transanal excision	Hours	Fever and discomfort	3×2cm	Recurrent sessile adenoma	X-ray	None	Conservative	Full recovery at 3 months
Petros	1996	USA	1	70	M	Transanal excision	Hours	Fever and discomfort	N/A	Superficial adenocarcinoma	CT scan	N/A	Conservative	N/A
Cantos	2009	Spain	1	71	M	TEM	1 day	Swelling neck	4 cm	Adenoma with low grade dysplasia	CT scan	None	Conservative	N/A
Bignell	2009	UK	4		N/A	TEM	1 day	Fever and discomfort	2 cm		CT scan	N/A	Conservative	N/A
Sato	2011	Japan	1	70	F	Endoscopic submucosal dissection	Hours	Hoarseness, swelling neck	4 cm	Adenoma with moderate dysplasia	CT scan	None	Conservative	N/A
Franken	2012	Netherlands	2	66/65	F(2)	TEM (2)	1 day (2)	Fever and abdominal pain	5.5 and 3.5×2.0 cm	Adenoma and adenocarcinoma	X-ray (2) and Diagnostic laparoscopy	Leukocytosis (2)	Conservative (2)	N/A (2)
Liang	2013	Taiwan	1	57	M	Transanal excision	1 day	Neck pain, stuffiness sensation	1.5 cm	Polypoid mass	CT scan	Hypoxia	Conservative, O ₂ therapy	N/A
Chandra	2014	UK	1	80	M	TEM	Intraoperative	Swelling neck	5 cm	Adenoma with high grade dysplasia	X-ray	None	Conservative	N/A
Simkens	2014	Netherlands	1	60	F	TEM	Immediately	Swelling neck and face	5 cm	Intramucosal carcinoma	X-ray	Pneumonia	Conservative	N/A
Alves	2017	Brazil	1	38	M	TEM	1 day	Abdominal pain	4 cm	Adenoma with high grade dysplasia	X-ray and CT scan	Sepsis	Laparotomy and loop colostomy	Stoma reversal at 6 months
Sunderland	2023	USA	1	69	M	Transanal excision	2 days	Fever	5–6 cm	Sessile polypoid adenoma	CT scan	Fever	Conservative, examination under anesthesia	N/A

Conservative management consisted of antibiotics, supportive care, and close monitoring. M: Male; F: Female; USA: United States of America; UK: United Kingdom; TEM: Transanal endoscopic microsurgery; TAE: Transanal excision; SRR: Sphincter repair and rectoplasty; ROID: Hemorrhoidectomy; ESD: Endoscopic submucosal dissection; N/A: Not available.

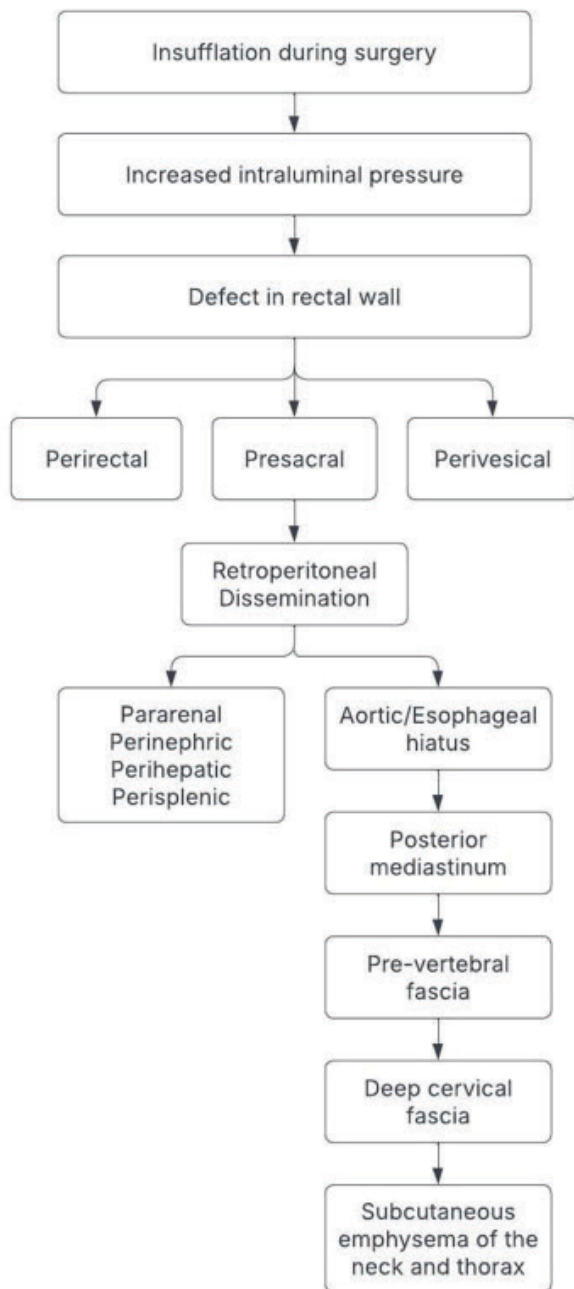


Figure 1: Air dissemination pathway following transanal excision of rectal masses.



Figure 2: CT showing perihepatic, perisplenic, and retroperitoneal gas.

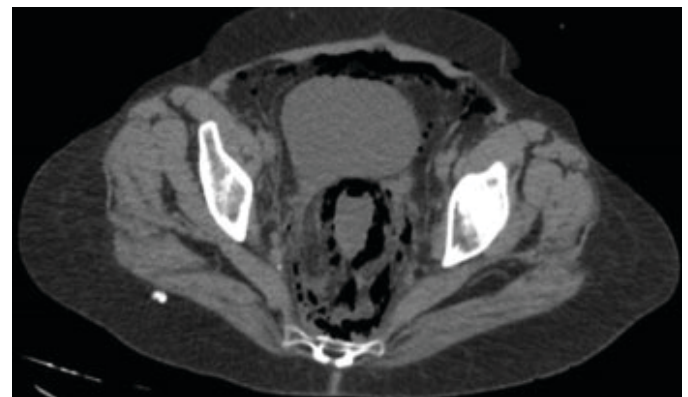


Figure 3: CT showing presacral, perirectal, perivesical, and retroperitoneal gas.

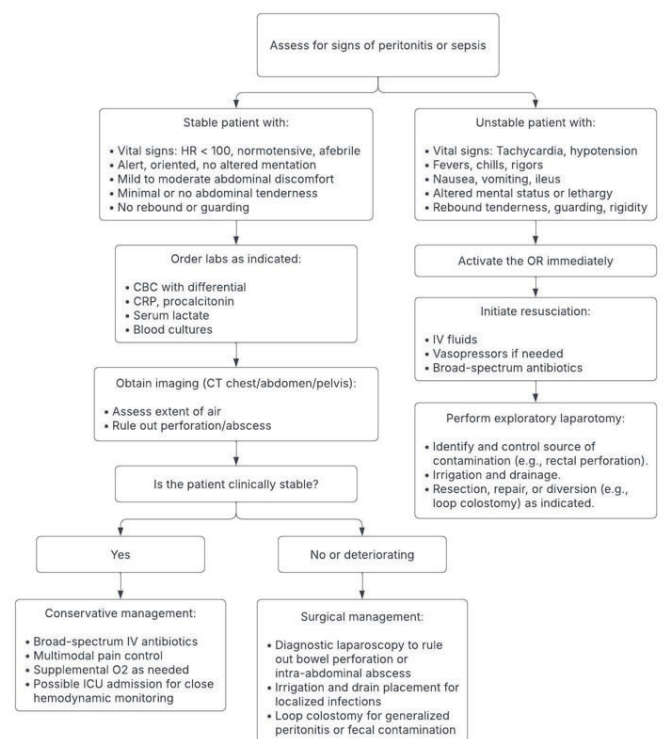


Figure 4: Clinical management algorithm for suspected pneumoperitoneum and subcutaneous emphysema following transanal excision of rectal masses.

findings highlight the anatomical continuity between retroperitoneal, mediastinal, and subcutaneous spaces, providing a clear pathway for air to traverse without requiring direct peritoneal breach [16, 17]. Similar imaging patterns have been observed in other reports, such as the cases described by Chandra in 2014, where insufflation led to intraoperative hypercarbia, which resolved spontaneously without additional intervention.

Management of pneumoperitoneum and subcutaneous emphysema following transanal excision is largely dictated by the patient's clinical stability. Patients who are hemodynamically stable, without signs of peritonitis or systemic infection, and who have reassuring labs and imaging, can be safely managed with intravenous

antibiotics, supportive care, and close monitoring. However, the presence of hemodynamic instability, fever, leukocytosis, elevated lactate, or imaging findings suggestive of bowel perforation or abscess warrants immediate surgical evaluation. Operative intervention may involve diagnostic laparoscopy, repair of a defect, drainage of localized infection, or fecal diversion if contamination is extensive. This stepwise clinical decision-making process is outlined in Figure 4, which serves as a practical reference for triaging patients with these rare but potentially serious postoperative complications. Prompt recognition and appropriate escalation are critical to optimizing outcomes while avoiding unnecessary surgical intervention.

As severe complications remain exceedingly rare, these findings should not dissuade the use of TAE or TEM as safe and effective approaches for rectal tumor excision. The observed radiological findings, while dramatic, typically resolve with conservative management in the absence of sepsis or peritonitis. Surgical intervention should remain a last resort, reserved for cases with significant clinical deterioration, which remains exceedingly rare. The current case and supporting literature emphasize that close observation, antibiotic therapy, and dietary restrictions, when indicated, are sufficient to manage these complications effectively while ensuring favorable outcomes. Long-term outcomes are less clear due to lack of reporting in the literature; however, all but one patient had nearly complete resolution of their symptoms at their postoperative evaluations within a month after the surgery. Only one complication—a loop colostomy due to sepsis—required long-term follow-up, and it was successfully reversed six months later. This supports the continued use of TAE as a safe and minimally invasive approach for rectal tumor management.

CONCLUSION

Transanal excision of rectal polyps is a minimally invasive procedure that has demonstrated fewer postoperative complications compared to open surgical approaches, making it a widely adopted technique for treating distal colorectal cancer. Common complications such as bleeding, pelvic sepsis, urinary retention, and suture dehiscence are well documented. However, rare complications like pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema have been reported in a small number of cases.

In these cases, understanding the anatomical pattern of air dissemination is essential for guiding diagnosis and management. We describe this pattern of spread from the rectum through retroperitoneal, mediastinal, and subcutaneous planes in our discussion. We have documented the findings of air dissemination radiographically in our case, with gas seen in the perihepatic, perisplenic, presacral, perirectal, perivesical, and retroperitoneal spaces. Closely mirror prior reports

and support the role of insufflation pressure, rather than gross perforation, as the primary mechanism of spread. Our review of the literature reveals that these complications have been documented in ten studies involving fourteen patients, all of whom underwent full-thickness rectal wall resections using techniques like transanal endoscopic microsurgery (TEM) or transanal resection. Except for one case requiring surgical intervention with a loop colostomy, all other cases resolved with conservative management, indicating the typically benign nature of these events. Lastly, to aid in determining when surgery is warranted, We have presented a structured management algorithm based on patient stability, physical exam findings, and radiologic patterns. This guidance may help clinicians recognize when conservative care is appropriate and avoid unnecessary operative intervention.

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Author Contributions

P Bretcha Boix – Conception of the work, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Marie Stephanie Nunez Duarte – Design of the work, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

A Dieter – Acquisition of data, Analysis of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Guarantor of Submission

The corresponding author is the guarantor of submission.

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Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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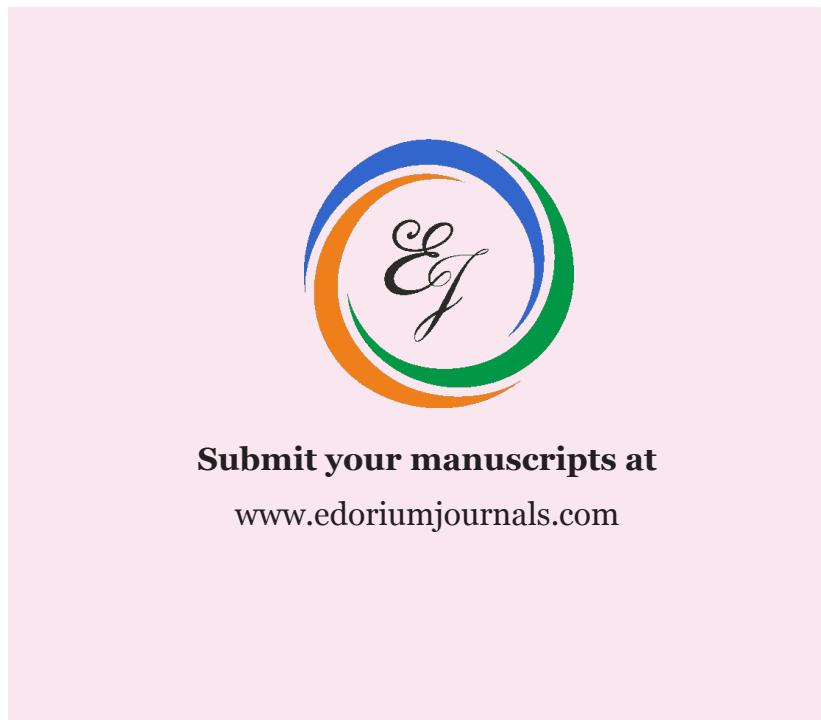
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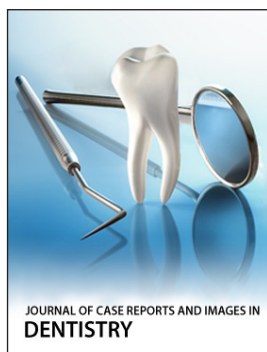
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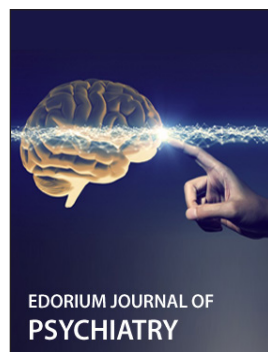
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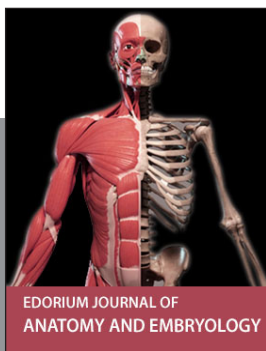
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