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## Case Report

# Vaginal laceration during barium enema with extraperitoneal extravasation: Case report and literature review

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## ABSTRACT

Unrecognized vaginal intubation during the barium enema procedure with subsequent balloon inflation and contrast instillation is a potentially fatal complication of an otherwise common and routine procedure. We describe a patient who, while undergoing a routine barium enema, had misplacement of the enema catheter into the vagina, subsequent rupture of the superior/lateral vagina upon inflation of the catheter retention balloon, and injection of barium contrast into the retroperitoneum. The patient was admitted for surgical repair of the vaginal laceration and monitoring for chemical peritonitis; and was managed without exploratory laparotomy. We review the existing literature, summarize 18 reported cases from worldwide literature, detail potential complications and propose management and prevention strategies based on the mechanism of injury.

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## Case presentation

A 72-year-old female undergoing evaluation for hernia, underwent a double contrast barium enema study at a local community hospital. During the procedure, the rectal catheter (Miller enema air tip, 8816, Bracco UK, Ltd) was inadvertently placed into the vagina. Upon inflation of the retention balloon and gravity injection of contrast material

(Liquid Polibar Plus Barium Sulfate Suspension, 105% w/v, 58% w/w, E-Z-EM Canada Inc), the patient reported immediate pain. The injection was stopped, but the total amount of injected barium was not recorded. The balloon was deflated, the catheter was removed, and vaginal bleeding was immediately noted. When it was discovered that the patient had suffered vaginal damage, the procedure was aborted without obtaining rectal barium images. She was transported to the in-house emergency department for further evaluation and

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We acknowledge our patient for providing informed consent for this case report. The authors agree to make the raw data and materials described in our manuscript freely available. Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review.

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**Fig. 1 – Scout image of the pelvis shows the presence of barium contrast within the vagina and pelvis. There appears extraluminal air and extraluminal contrast within the lower pelvis consistent with perforation of the contrast from the vagina into the retroperitoneum.**

management. Emergency department evaluation following the injury included a pelvic ultrasound, which was indeterminate. A subsequent noncontrast CT scan of the abdomen and pelvis at the community hospital showed contrast visible in the vagina with extravasation of air and contrast into the extraperitoneal space (Figs. 1–4) with proximal extension toward the sacrum within the right broad ligament, involvement of the prevesical and rectovaginal spaces, and a small amount of contrast within the uterus. She was then further transferred to our hospital for potential emergent surgical management.

Upon arrival at our facility, the patient was examined by general surgery and gynecology teams. She was hemodynamically stable with a benign abdominal exam, the imaging did not suggest that barium was present intraperitoneally, and it was determined that we did not need to perform emergency surgical evaluation of the peritoneal cavity. The vaginal laceration did need to be explored due to ongoing vaginal bleeding. The patient was taken expeditiously to the operating room, where she underwent a pelvic examination under anesthesia, copious irrigation of the vaginal laceration, primary repair of vaginal wall defect, and cystoscopy. This defect was located in the right superior-lateral vagina, measured 4 cm in length and was repaired with braided absorbable suture in a running locked fashion. Hemostasis was observed at the end of the procedure. Cystoscopy was added due to the location of the vaginal wall defect and concern for a bladder wall injury but was found to be normal. After the procedure, the patient was admitted to an advanced care unit for continued monitoring. The patient did well postoperatively and was discharged home on hospital day 4.

Since discharge, the patient returned for evaluation in the office on 4 occasions for follow-up and continued to do well 6 months following the event. She denied any symptoms and her vaginal laceration healed well without evidence of fistula formation or infection. Telephone follow-up with the patient was performed 17 months after the initial event, and the patient reported that she continued to have no pain, discharge, bowel or bladder difficulty, or any other symptom related to the event. Follow-up imaging was not obtained due to the absence of symptoms and the concern that presence of retained retroperitoneal contrast would complicate interpretation.

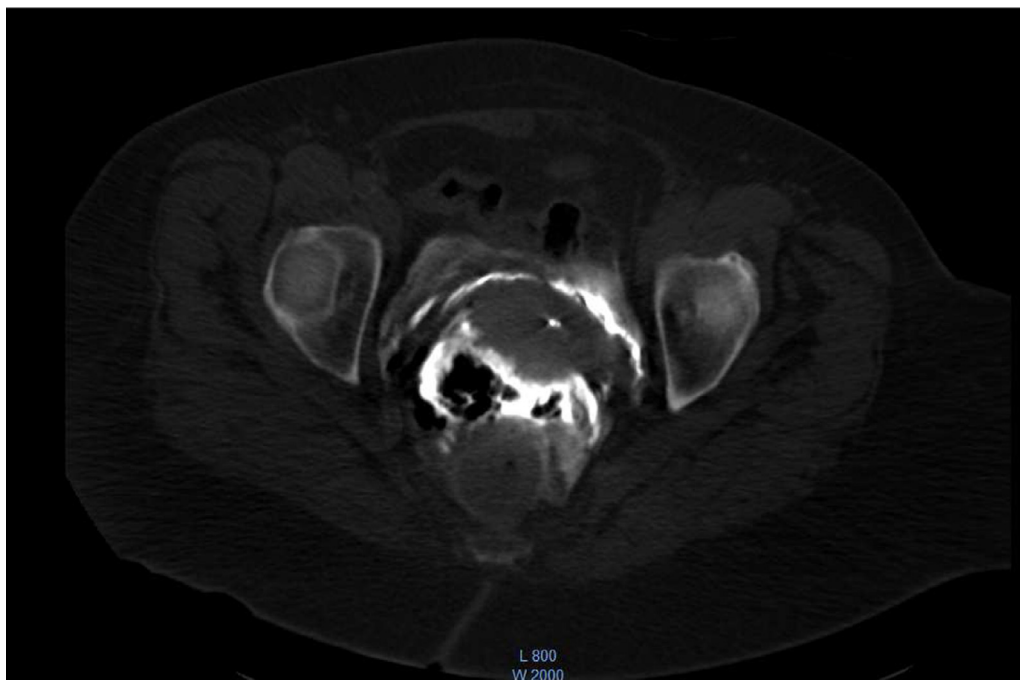
## Discussion

Misplacement of a barium enema catheter into the vagina is not rare, but is usually recognized by either the patient, the treatment team, or both [1]. If misplacement is not recognized, however, catastrophic complications can result. Extravasation or embolization of barium contrast can produce devastating local and systemic effects, protracted complications, and death. Extravasated barium is radiologically persistent, making subsequent imaging extremely difficult to interpret. Although aggressive surgical management has been nearly universally recommended for large barium burdens, either intraperitoneally or extra-peritoneally, the final clinical decision may be tempered by many factors, including the site of perforation, the source of perforation, the location of the extravasated barium, and the overall patient clinical condition [2]. We have presented a case of vaginal perforation following misplacement of a rectal balloon catheter, successfully managed with primary closure of the vaginal wall, local irrigation, antibiotic therapy, and observation.

The double contrast barium enema procedure is generally quite safe, with reported complication rate of approximately 1 in 9000 procedures and a reported mortality rate ranging from 1:56,000 to 1:70,000 [1,3]. Should a perforation of a viscus occur, however, the mortality rate is significant. The reported mortality rate ranges from 8%-10% in a large review of patients from the United Kingdom (15% if intraperitoneal contamination with barium occurs) to as high as 35% [1-3]. In addition to overall mortality, perforation complications may have other devastating outcomes including but not limited to sepsis, peritonitis, fistula formation, adhesion formation, intestinal obstruction, and urologic obstruction [4].

The literature describing barium enema complications predominantly addresses rectal perforations and sequelae. For this article, we limited comparison to those instances where vaginal intubation was specifically described and located a total of 18 identifiable cases dating from 1964. Table 1 lists the reported cases that were available for review for this study. Our case adds a 19th (listed last on the table).

There are conflicting data regarding the incidence of inadvertent vaginal intubation with the enema catheter tip. A survey of United Kingdom consultant radiologists from 1992 to 1994 implies that vaginal placement is not an uncommon occurrence but is typically recognized by the patient or radiology team prior to instillation of contrast medium [1]. Chan et al.



**Fig. 2 – Axial CT image of the pelvis shows the presence of barium contrast within the rectovaginal and prevesical spaces, as well as the uterus. There appears extraluminal air and extraluminal contrast within the lower pelvis consistent with perforation of the contrast from the vagina into the retroperitoneum.**

also indicated that administration of contrast into the vagina is not an uncommon occurrence [5]. Conversely, a United Kingdom survey of radiographers from 2004 reveals only 2 reports of vaginal catheter misplacement, for a rate of 1:175,000 [3]. Given such conflicting data, it is likely that inadvertent vaginal intubation, and even contrast administration into the vagina, is much more common than is reported.

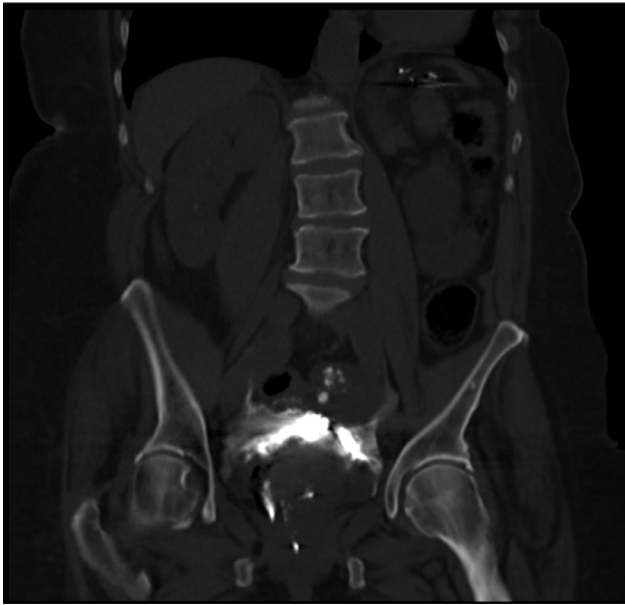
A complication from vaginal intubation may be particularly concerning, given that the contrast material is injected under pressure into an enclosed space, and may put the patient at particularly high risk for intravascular injection of barium and subsequent fatal outcome [5]. In their review, Chan et al. found a total of 8 patients with barium intravasation following vaginal intubation and laceration, for whom the mortality rate was 75% [5].

Risk factors for vaginal intubation may include postmenopausal status, increased parity, attenuation of the perineal body, pelvic surgery, or previous episiotomy [1]. An uncooperative or obtunded patient may also increase the risk for misplacement, as the patient cannot indicate misplacement to the radiology team [6]. Postmenopausal status is associated with vaginal atrophy and decreased lubrication which may make the vagina more susceptible to trauma [7–9]. In our experience, obesity also increases the difficulty of performing an appropriate pelvic examination, particularly if conditions are not ideal for direct visualization of anatomy (including adequate lighting, appropriate instrumentation, and ability to position the patient to examine the perineum) and may contribute to intubation of the incorrect orifice. Risk factors present in this particular case included postmenopausal status, increased parity, perineal attenuation,

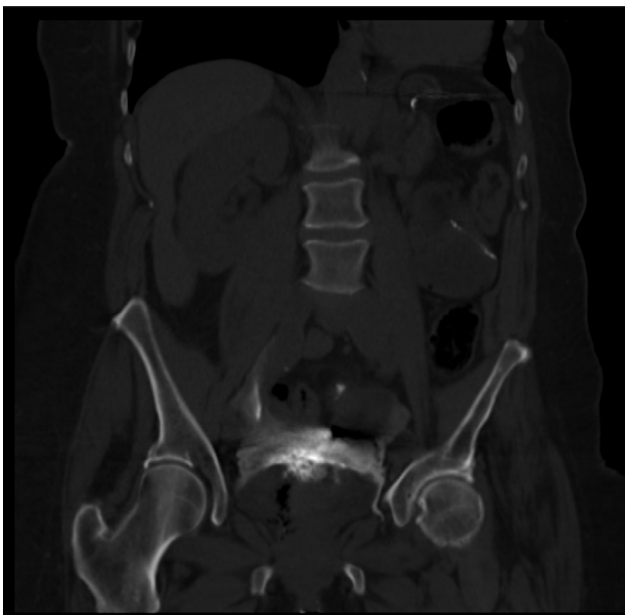
and obesity. If vaginal intubation is not recognized, traumatic rupture can occur either with the catheter tip itself or with inflation of a retention balloon, allowing entry of barium contrast into the retroperitoneum, other pelvic organs such as the uterus or fallopian tubes, into the peritoneal cavity, or into the pelvic vasculature.

Of the 19 reported cases of unrecognized vaginal intubation in this report, laceration occurred in 18 patients (95%). The sole remaining case was identified when imaging revealed barium in the uterus and fallopian tubes, with a small amount of spill into the peritoneal cavity. This patient survived without long-term sequelae. Of the remaining 18 with a demonstrated injury to the vagina, documented barium embolization occurred in 13 (72%). Of these 13 cases of embolism, 9 died from embolic complications (69% mortality rate from embolism). One further patient died from peritonitis and sepsis after intraperitoneal spill, and 1 final patient died from unlisted causes. Overall, the mortality rate from all complications of unrecognized vaginal intubation appears to be as high as 58% (11/19).

In our case, although the patient did sustain a vaginal laceration, she did not have any clinical signs or symptoms of barium extravasation into the peritoneal cavity, nor did she have any radiographic evidence of barium in the pelvic vasculature. Her main indication for immediate surgical intervention was ongoing vaginal hemorrhage. Fluid sampling with paracentesis or diagnostic peritoneal lavage to examine intra-abdominal fluid contents for barium were considered, but ultimately not performed given patient's otherwise reassuring clinical status. Due to a large ventral hernia as well as existing medical comorbidities, we determined that the risks



**Fig. 3 – Coronal reformat CT image of the pelvis shows the presence of barium contrast within the vagina, uterus, and pelvis. There appears extraluminal air and extraluminal contrast within the lower pelvis consistent with perforation of the contrast from the vagina into the retroperitoneum.**



**Fig. 4 – Coronal reformat CT image of the pelvis shows the presence of barium contrast within the retroperitoneum of the pelvis. There appears extraluminal air and extraluminal contrast within the lower pelvis extending toward the sacrum within the right broad ligament.**

of abdominal surgical evaluation outweighed the potential benefits in this case.

Management of the vaginal wound is dictated by general surgical principles, and generally consists of wound exploration, hemostasis, irrigation, and possible closure [9]. Of the reported cases, only 2 mentioned the specific management of the vaginal wound. In 1 case, the wound was irrigated and packed [6]. In the second case the vaginal wound was sutured closed without further adverse sequelae [5]. Regardless of the management method employed by the care team, the crucial surgical goal is to control life-threatening hemorrhage.

In addition, evaluation of adjacent organs may be necessary, including cysto-urethroscopy, proctoscopy, and pelvic imaging; though radiographic evaluation of pelvic organs is difficult due to the presence of extravasated barium. Drainage of the surgical wound and colonic diversion in cases of retroperitoneal extravasation has been advocated in cases of rectal perforation but may be of little value in reducing the total barium burden [10]. As previously stated, noncolonic perforations tend to be less morbid and thus persistent surgical drainage may have little clinical yield [4]. Broad spectrum antibiotics are universally recommended, but in absence of bowel communication with the barium, no fecal diversion is necessary. Should there be any suspicion of barium within the peritoneal cavity, however, prompt intra-abdominal evaluation with laparotomy or laparoscopy, along with aggressive fluid resuscitation is mandatory [2].

Barium within the retroperitoneum tends to be persistent over years. In some cases, the barium causes no long-term adverse effects [11]. It has been shown that barium from extracolonic sources of perforation tends to be less morbid than barium from the colon, most likely due to the difference in bacterial contamination of the contrast [4,12,13]. However, regardless of the location of the perforation, long-term sequelae can include abscess formation, fistula formation, or retroperitoneal fibrosis leading to urologic obstruction [4,10,14–16].

As noted above, intravascular injection of barium contrast may result in particularly grave consequences. In addition to complications from pulmonary embolism, barium particles are small enough that they easily pass through the capillary bed of the lungs and may embolize systemically to various organs of the body. These particles are rapidly taken up by phagocytic cells and sequestered into the reticuloendothelial system, and have been demonstrated in diverse tissues histologically [5,8].

Given the potentially catastrophic sequelae from unrecognized vaginal intubation and instillation of contrast, preventive measures should be taken. Rectal examination is recommended prior to performing the enema to properly identify all perineal anatomy, as well as using a gloved hand to keep the catheter out of the vagina [17]. There is evidence that many physicians and ancillary personnel are uncomfortable with pelvic and rectal examinations, creating a barrier to proper placement and increasing the risk of malposition [18]. Personnel should be aware of this potential barrier, and consciously work to overcome this aversion through open conversation with patients and caregivers, informing them of the critical nature of these examinations. Additionally, informed consent should specifically state where the catheter should be placed, caution the patient to inform the care team if they feel the

**Table 1 – Summary of reported cases of barium enema complications involving vaginal intubation.**

Case	Age	Year	Findings	Intervention	Outcome
1 [19]	65	1964	Barium noted in pelvic vasculature at beginning of study, and procedure was terminated. Patient developed tachypnea and shortness of breath after 20 min, and had transient febrile morbidity and mild cough for 24 h. Three cm vaginal laceration noted on pelvic examination, and barium noted in vagina.	Supportive care	Survival
2 [20]	77	1967	Patient complained of abdominal pain during study. Right vaginal laceration 6.5 × 2.5 cm, extending to uterine cervix. Retroperitoneal extravasation of barium to level of lower left renal pole. No intraperitoneal perforation. Barium present in pulmonary arteries at autopsy.	Gynecologic Consultation, observation	Death after 3 d due to pulmonary embolism of barium
3 [21]	Unk	1971	Laceration of vaginal wall. Barium embolism.	Unknown	Death
4 [22]	69	1974	Perforation of posterior vaginal wall, immediate evidence of extravasation of barium into pelvic veins and retroperitoneum.	Unknown	Death after 15 h due to shock, embolization of barium.
5 [7]	72	1975	Patient complained of weakness and signs of shock. Vaginal hemorrhage was noted, as well as radiographic evidence of barium in vasculature. A 2.5 cm tear in posterior vaginal wall was noted with a ruptured 1-2 mm vein seen in the tear.	Unknown	Death after 30 min due to shock, embolization of barium.
6 [23]	78	1976	Patient complained of lower abdominal discomfort. Bleeding was noted that was initially thought to be rectal in origin, and the examination was stopped. Radiograph showed retroperitoneal barium. Diagnosis of vaginal perforation made later on day of examination, which showed a 4-5 cm tear in the posterior vaginal wall and vaginal atrophy. No intraperitoneal barium at laparotomy.	Surgical exploration with transverse colostomy.	Death 3 wk after event, cause not listed.
7 [23]	72	1976	Abnormal spread of barium noted during examination, and procedure was stopped. Radiographs showed venous intravasation of barium, along with extraperitoneal spread and barium in bladder. Profuse vaginal bleeding also noted. Barium in peritoneum, veins and lungs at autopsy.	Surgical repair of vaginal laceration.	Death after 24 h, cause not listed.
8 [23]	62	1976	Venous intravasation of barium seen during procedure, and procedure immediately stopped. Vaginal bleeding was noted on examination, with left-sided vaginal laceration.	Hospital observation, antibiotic therapy.	Survival. Discharged from hospital after 4 days, well at follow-up.
9 [24]	63	1980	No pain with initial balloon inflation, sudden sharp pain with barium instillation. Bilateral posterior vaginal tears, 5-6 cm long by 3 cm wide. Barium spill into retroperitoneum and vasculature, including bilateral internal iliac veins, inferior vena cava, right ventricle, pulmonary vasculature, and arterial presence in bowel and renal vasculature, spleen, liver and brain.	Immediate supportive care.	Death due to "irreversible heart failure" within 1 min.
10 [8]	74	1983	An unusual pattern of barium spread was noted at infusion, and procedure was stopped. Barium noted to be present in retroperitoneum, surrounding the bladder, vagina and rectum. The patient was not aware of the vaginal placement of the catheter. 1.5 cm laceration occurred at right posterior vaginal fornix, blood was present in the vaginal vault. Barium present in vaginal wall and vasculature, the pelvic cavity, and periuterine, periovarian perivesical soft tissue.	Immediate surgical consultation, attempted drain placement in vaginal tear (not successful as patient not cooperative), initiation of broad spectrum antibiotic therapy.	Fever and progressive pulmonary edema starting 1 d after event. Death 4 d after event.
11 [5]	36	1987	Vaginal hemorrhage, barium embolism, hypovolemic shock, disseminated intravascular coagulation, 6 cm laceration in left vaginal fornix, fever, barium in lungs, liver, spleen, spine and retroperitoneum.	Resuscitation, blood transfusion, fibrinogen, primary closure of vaginal laceration, intravenous antibiotics.	Survival
12 [25]	69	1987	Barium noted in uterus and fallopian tubes indicating vaginal placement of catheter. No pain, no laceration of vagina noted. Small amount of barium within peritoneal cavity. Peritoneal body atrophy.	Gynecologic consultation, observation.	Survival with no adverse sequelae after 2 wk and 3 mo.

(continued on next page)

Table 1 (continued)

Case	Age	Year	Findings	Intervention	Outcome
13 [6]	81	1988	Vaginal hemorrhage noted after third catheter insertion attempt, procedure immediately stopped. Patient disoriented and febrile to 101 degrees Fahrenheit in the emergency room; radiologic evaluation showed barium obscuring the lower half of the abdomen. 1 × 2 cm tear was noted in the posterior vaginal fornix, with visible rectosigmoid colon but no perforation of colon. 50 cc of barium found within peritoneal cavity, but much greater amount in retroperitoneum. Late abscess formation requiring re-exploration.	Exploratory surgery, vaginal irrigation and packing, laparotomy with attempted intraperitoneal and retroperitoneal irrigation, loop colostomy, antibiotic therapy. Second-look laparotomy one month later with adhesiolysis and drainage of 50 cc purulent fluid (positive culture for <i>Streptococcus fecalis</i> ).	Protracted fever and abscess formation. Death 54 d after vaginal perforation, due to sepsis, localized peritonitis and aspiration pneumonia.
14 [1]	60-75	1992-1994	Prior pelvic surgery listed as risk factor. Balloon catheter used. Hemorrhage. Vaginal laceration noted. Unknown whether barium was instilled.	Surgery for vaginal repair, hysterectomy due to persistent hemorrhage.	Survival with no late sequelae.
15 [1]	>75	1992-1994	Presumed vaginal rupture, extraperitoneal instillation of barium. Complication recognized immediately.	Details not available.	Death 3 wk after event.
16 [26]	68	1993	Initial failure of contrast to advance beyond catheter tip, so pressure was increased to clear presumed catheter blockage. Twelve cm posterior, diagonal vaginal tear noted with extraperitoneal barium, as well as intravasation and barium embolus to pulmonary vasculature.	Immediate supportive care.	Death due to barium pulmonary embolism and peritoneally induced vagal shock.
17 [25]	85	1996	Pelvic pain noted by patient after balloon inflation. Venous intravasation of barium into iliac veins was observed, the procedure was terminated and barium drained from the vagina. The patient complained of vaginal bleeding, and a vaginal tear was noted at the right fornix. Widened vaginal introitus and attenuated perineal body was noted.	Intravenous fluid resuscitation, intravenous antibiotic therapy, hospital observation over several days.	Survival, no long-term adverse effects.
18 [27]	42	2007	No history of gynecological disorders. Patient became suddenly unconscious during procedure, developed treatment-resistant hypotonic shock. Fluoroscopy showed contrast within the uterus, pelvic veins and inferior vena cava, and later imaging showed contrast material in lungs, right cardiac chambers and kidneys. Examination immediately discontinued. Estimated 20-30 ml of barium entered the circulation. Bilateral lateral vaginal lacerations 6 cm × 2 cm and 3 cm × 0.5 cm, as well as gross barium noted within vagina, cervix, uterus, and pelvic venous plexus.	Immediate resuscitation and supportive care.	Death within 20 min, due to hypotonic shock.
19	72	2017	Subject case. Pain noted at balloon inflation and barium instillation. 5 cm right superior-lateral vaginal laceration with extraperitoneal barium spill. Bladder and rectum intact.	Surgical exploration of vaginal wound with irrigation and primary closure. Broad-spectrum antibiotic therapy and hospital observation.	Survival without long-term sequelae.

catheter is misplaced, and empower the patient to speak up. Examination should not be cursory, but thorough enough to ensure proper placement. Relying solely on the patient to inform of misplacement is not adequate, as patients cannot be expected to fully understand the nature of the examination, even after informed consent is obtained.

### Teaching point

Vaginal intubation during barium enema is likely very common, but usually recognized prior to instillation of contrast. If unrecognized, however, there is a substantial risk for

vaginal injury and potentially fatal sequelae including barium embolization, inadvertent perforation of the vagina during attempted barium enema remains a rare complication, but if barium is contained preperitoneally, close observation is a viable treatment option. At the time of catheter placement, and prior to instillation of contrast, the placement of the catheter should be definitively verified by physical examination and communication with the patient.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.radcr.2019.04.017](https://doi.org/10.1016/j.radcr.2019.04.017).

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