



ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Intraluminal hyperdense appearance of the small bowel on high resolution computed tomography of the abdomen and pelvis secondary to use of Calcium Carbonate tablets (Tums) mimicking a small bowel fistula

Marlon P. Coelho, MD*, Atin Goel, MBBS, Matthew Klumpp, MD, Marissa Mincolla, MD

SUNY Upstate Medical University, Department of Radiology, 750 E. Adams Street, Syracuse, NY 13210, USA

ARTICLE INFO

Article history:

Received 2 July 2020

Revised 16 July 2020

Accepted 17 July 2020

Keywords:

Hyperdense

Small-bowel

Calcium Carbonate

Fistula

Mimic

Colon

ABSTRACT

Hyperdensity within the small bowel is most commonly seen with positive oral contrast agents, intraluminal hemorrhage and less likely an abnormal fistulous connection with the colon containing rectally administered contrast. We present the case of a 57-year-old female with a complex history of breast cancer and multiple abdominal surgeries presenting with intraluminal hyperdense small bowel on computed tomography (CT) performed with rectal contrast. Postsurgical CT with rectal contrast, and no oral contrast, showed multifocal regions of intraluminal hyperdensity with the small bowel anterior to and close to the surgical anastomosis. This raised concerns for a fistula between the colon and small bowel; however, surgical exploration demonstrated an intact anastomosis without a coloenteric fistula. Additional history notes that the patient consumed an increased dose of calcium carbonate tablets for a few days prior to obtaining the scan and this intraluminal hyperdense appearance of the small bowel was then attributed to this. We conclude that ingested over the counter medications can pose an imaging dilemma for radiologists as their appearance on CT could falsely mimic pathology. It is imperative to obtain a thorough clinical history in such cases to provide accurate diagnoses and decrease unwanted imaging and clinical intervention. It is also important for radiologists to be aware of the appearances of commonly consumed over the counter medications that can mimic pathology as demonstrated by this case.

© 2020 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license.

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

Intraluminal small bowel hyperdensity on computed tomography (CT) scans are most commonly attributed to acute gastrointestinal hemorrhage or the use of positive

* Corresponding author.

E-mail address: coelhom@upstate.edu (M.P. Coelho).

<https://doi.org/10.1016/j.radcr.2020.07.044>

1930-0433/© 2020 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license. (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

oral contrast agents to distend the bowel. In some cases, commonly ingested over the counter medications may lead to a hyperdense appearance of the bowel that may falsely mimic pathology. Our case presented depicts a hyperdense appearance of the small bowel leading to a false positive mimic of a coloenteric fistula secondary to increased dose of calcium carbonate tablets in a 57-year-old female with a complex medical and surgical history.

Case report

A 57-year-old female with a complex history including stage IV breast cancer with metastasis to bone, who developed a rectovaginal fistula secondary to recurrent sigmoid diverticulitis. Surgical history includes laparoscopic sigmoid colectomy, colovaginal fistula status post fistula take down, and lysis of adhesions. Imaging on postoperative day 2 with CT abdomen pelvis with intravenous contrast showed expected postoperative changes and a complex fluid collection adjacent to the surgical anastomosis staple line, which was deemed to likely represent a postoperative fluid collection however anastomotic leak was not excluded. Follow-up scan 2 weeks later with rectal contrast confirmed an anastomotic leak and a persistent rectovaginal fistula as contrast was detected with the vaginal vault. No surgical intervention was performed at this time. Follow-up imaging 6 weeks later was performed as a CT Pelvis with rectal contrast, without oral contrast, to evaluate the rectovaginal fistula. The scan demonstrated a linear tract of contrast extending laterally from the anastomosis into the presacral space consistent with a new leak at the surgical staple site. There was, however, no evidence of contrast within the vaginal vault to suggest a persistent rectovaginal fistula. In addition to this, multifocal regions of intraluminal hyperdensity were noted in small bowel loops anterior to and in close approximation to the distal colon and surgical site. Due to the lack of oral contrast, this finding raised the concern of a new fistulous connection between the distal colon and the small bowel.

The patient was on active chemotherapy for metastatic breast cancer; the discussion to interrupt the chemotherapy regimen for surgical intervention was not without risk. The surgical team then provided additional clinical history regarding patient judicious use of calcium carbonate (Tums) tablets due to chemotherapy induced nausea and reflux. This altered the potential differential causes of the new intraluminal hyperdensity within the small bowel. This differential in addition to a fistula, included hyperdensity secondary to medication use. Due to limited research regarding the appearance of calcium carbonate on noncontrast CT of the abdomen and the high pretest probability of a fistula in this specific patient, the surgical team elected to perform a diagnostic laparoscopy with cuff-leak testing of the surgical anastomosis. Per the operative note, the cuff-leak test was performed with saline after insufflating the rectum. There was no evidence of an air bubbles. The device was then tested at the original surgical anastomosis and again there was no evidence of a small bowel fistula or an anastomotic leak. The patient underwent enterolysis of adhesions and reversal of the diverting loop ileostomy.

This case is an example of an unusual case of intraluminal hyperdense appearance of the bowel on imaging secondary to medication ingestion of calcium carbonate tablets. We believe that our case showing small bowel intraluminal hyperdensity as a result of calcium carbonate consumption mimicking a small bowel fistula may be the first of its kind given the complex medical and surgical history in this patient.

Imaging findings

CT pelvis with rectal contrast and no oral contrast.

Discussion

Intraluminal hyperdensity within the small bowel is most commonly secondary to the use of oral positive contrast agents for diagnostic purposes [1]. A second frequent cause is acute gastrointestinal hemorrhage [1]. Rarely, diffuse focal or segmental bowel wall inflammation, edema, ischemia or infection may provide a false appearance of intraluminal hyperdensities, however, these can be adequately delineated with the use of oral contrast agents [1]. At times, foreign body ingestions may appear as intraluminal hyperdensities [2]. In the setting of trauma or recent surgery, an abnormal fistulous connection between the bowel may appear similarly. However, a potential cause of unanticipated intraluminal bowel hyperdensity is medication use such as calcium carbonate (Tums), amiodarone, kayexalate, bismuth subsalicylate (Pepto-Bismol) [3,4]. If not reported in the clinical history, these agents can pose a serious diagnostic dilemma for interpreting radiologists due to their appearance on routine noncontrast imaging studies. These agents may lead to false positive results, obscure surrounding structures and may be mistaken for acute gastrointestinal hemorrhage or fistula which leads to unwanted hospitalization, expansive diagnostic workup, and at times possible surgical intervention.

There are limited resources that outline the impact of ingested medication on imaging scans [3,4]. Case report by Yee Sin et al tested 11 medications which showed a hyperdense appearance on a noncontrast CT scan [4]. Many of the tested medications are over the counter medications used in everyday medical conditions such as peptic ulcer disease, gastroesophageal reflux disease, arrhythmias, and hemorrhoidal treatments [3]. Phantom analysis of calcium carbonate tablets in this study show a mean Hounsfield unit of 1042 and 1023 HU, respectively on 2 separate phantoms [4]. Quantitative analysis of contrast filled bowel loops in a separate study with Iohexol enteric contrast shows the median range of Hounsfield units for the small bowel range between 175 and 400 HU [5]. Thus, the presence of nonabsorbed intraluminal calcium carbonate can lead to a hyperdense appearance on CT examinations due to high mean attenuation values than would be expected for positive oral contrast agents such as Iohexol. Phantom analysis of amiodarone revealed a mean Hounsfield unit of 2262 and 1868 HU, respectively, resulting in a hyperdense appearance on a noncontrast CT of the abdomen and pelvis. Bismuth compounds have also been used in over the counter medications and as contrast agents. The most commonly

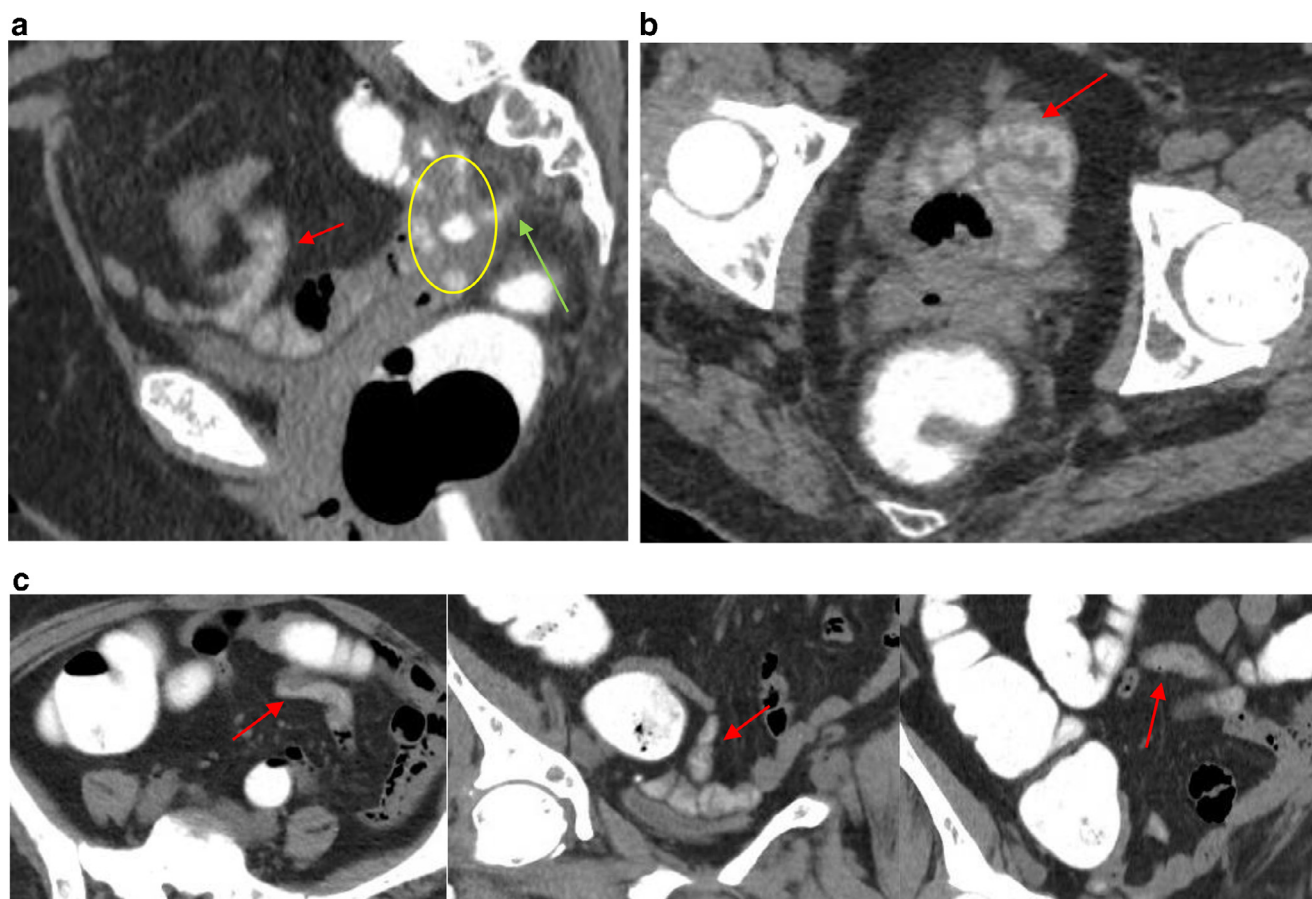


Fig. 1 – (a) – Sagittal reformatted image at the level of the surgical anastomosis (yellow oval) shows an anastomotic leak into the presacral space (green arrow). There are multifocal regions of intraluminal hyperdensity within small bowel loops that were anterior and in close approximation to the colon near the anastomotic site (red arrow). (b) – Axial images just superior to the level of the surgical anastomosis shows multiple loops of ileum within the pelvis in close approximation with the anastomotic site raising concern for an abnormal fistulous connection between the colon and the small bowel. (c) – Axial and coronal sections show loops of hyperdense small bowel loops (red arrows) at multiple levels of the pelvis, many of which are in close approximation with loops of contrast opacified colon. Given this patient's extensive medical and surgical history and the provided history of calcium carbonate use, fistulous connection to the small bowel was not excluded and required surgical exploration. (Color version of figure is available online).

used bismuth compound is Pepto-Bismol, a bismuth subsalicylate used for nausea, indigestion, heartburn, and diarrhea. Bismuth has an atomic number of 83 and a K-edge energy level of 81 keV. A study by FitzGerald et al shows a 32% increase in the image contrast of bismuth versus iodine at a 120 kVp tube voltage and no filter and a 69% increased image contrast compared to iodine at 120 kVp with a 1.0-mm thick copper filter. The high atomic number guarding patient judicious use of Bismuth results in the radiodense properties of the compound creating the hyperdense appearance. There are concerns regarding the toxicity profile of bismuth however it has been used for a long period of time as an oral and topical agent and may potentially be used a contrast agent due to its physical properties. Fig. 1 images are obtained from the patient's CT scan performed with rectal contrast. No IV contrast was used.

Our patient was prescribed 1000 mg tablets twice daily for her acid reflux, however, discussions with the team reveal that the patient consumed increased doses of her medication

due to worsening symptoms. Calcium carbonate is absorbed in the small bowel through an active and passive transporter mechanism [6]. There is no data to suggest the maximum intraluminal concentration of calcium carbonate required to saturate the receptors. Excess consumption of calcium carbonate over the daily-prescribed limit may overwhelm and saturate the active transporters and receptor binding ligands in the tract leading to a larger amount remaining within the lumen of the gastrointestinal tract, resulting in a hyperdense appearance. The recommended dose for calcium carbonate supplementation varies by manufacturer, however, 8 g/day is the recommended maximal daily dose limit for a 2-week period. There is, however, no clinical documentation regarding the total dose consumed by the patient in the days and week leading up to her imaging, however, it is evident from the imaging and surgical exploration that the quantity consumed was sufficient to appear hyperdense on her CT exam necessitating operative exploration.

This case highlights the importance of thorough medical history review including over the counter medication use prior to obtaining imaging. Although, this may lead to longer pre-screening examinations and increased workload for imaging staff, this additional history should decrease false positive diagnoses and reduce the need for additional work up or intervention. In addition, ordering clinicians should be aware of the imaging appearance of certain medications and their potential to obscure or confound imaging interpretation. Interpreting radiologists should also be aware of the routine appearance of over the counter medications and potential pitfalls mimicking more ominous pathology. The clinical context of these findings is, however, a key element in deciding the overall management of these patients. In our case, due to a complex medical and surgical history as detailed, the patient had a higher pretest probability for fistula development which made intervention warranted and necessary. However, in cases without such complex history, repeat noncontrast scans of the abdomen and pelvis should be performed after adequate cessation of medication use to confirm the etiology as medication use.

Conclusion

Intraluminal small bowel hyperdensity is most commonly secondary to use of positive oral contrast agents. However, there are many over the counter medications used for routine medical conditions that can create a false positive intraluminal hyperdense appearance on noncontrast CT imaging of the abdomen and pelvis. This leads to a diagnostic and clinical

dilemma that at times requires additional diagnostic and interventional workup. In our case scenario, the use of calcium carbonate tablets preceding a scan lead to a false positive appearance of a small bowel-colonic fistula. Thus, when intraluminal hyperdensity of the small bowel is encountered, medication induced hyperdensity must be considered in the differential diagnosis and assessment of medication use must be performed. This is paramount to improve differential diagnoses and reduce the need for further imaging, clinical workup or intervention.

REFERENCES

- [1] Macari Michael, Megibow Alec J, Balthazar Emil J. A pattern approach to the abnormal small bowel: observations at MDCT and CT enterography. *Am J Roentgenol* 2007;188(5):1344–55.
- [2] Tseng H, Hanna T, Shuaib W, Aized M, Khosa F, Linnau K. Imaging Foreign Bodies: Ingested, Aspirated, and Inserted. *Am Coll Emerg Phys* 2015;66(6):570–82 e5.
- [3] Tran NguyenVy. Unintended consequences of an over-the-counter medication. *Am J Gastroenterol* 2018;113:S1672. doi:10.1038/ajg.2018.346.
- [4] Sin Francesca Nga Yee, Tsang Jane Pui Ki, Siu Kwong Lok, Ma Johnny Ka Fai, Yung Alfred Wei Tak. Medications as causes of intraluminal hyperdensities: what radiologists need to know. *Eur J Radiol* 2012;81(7):1652–6 -07-01.
- [5] Winklhofer Sebastian, Lin Wei-Ching, Wang Zhen Jane, Behr Spencer C, Westphalen Antonio C, Yeh Benjamin M. Comparison of positive oral contrast agents for abdominopelvic CT. *Am J Roentgenol* 2019;212(5):1037–43.
- [6] Bronner Felix. Mechanisms of intestinal calcium absorption. *J Cell Biochem* 2003;88(2):387–93. doi:10.1002/jcb.10330.