



# Absorbable Hemostatic Agents Mimic Gossypiboma or Infected Collection on Imaging

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## Abstract

### Keywords

- ▶ hemostatic agents
- ▶ Surgicel
- ▶ Gelfoam
- ▶ gossypiboma
- ▶ postoperative collection

Absorbable hemostatic agents are commonly used in clinical practice and their imaging appearance is less known. In our case series, we demonstrate how absorbable hemostatic agents can masquerade as other clinically and medicolegally significant conditions such as gossypiboma and infected collections. Through our report, we aimed to describe the imaging features of absorbable hemostatic agents, to compare them with their imaging mimics, and provide a comprehensive review of the available literature.

## Introduction

Hemostasis plays a key role in positive surgical outcomes. Topical agents, such as oxidized regenerated cellulose (such as Surgicel, manufactured by Ethicon) and absorbable gelatin compressed sponge (such as Gelfoam, manufactured by Pfizer), are widely used; however, their imaging appearance is poorly described. They are bioabsorbable thrombogenic agents and are rarely detected on postoperative imaging. The quantity and size of usage determine the absorption, which varies between 2 and 6 weeks.<sup>1</sup>

In the following cases, topical hemostatic agents were found to closely mimic retained surgical gauze, known as gossypiboma or an infected postoperative collection. These entities are characterized by spongiform morphology due to localized lesions with punctate air foci.<sup>2–4</sup>

This is a significant diagnostic dilemma, as it determines notable variation in management. Four cases are described that raised the possibility of gossypiboma on imaging, which, on further evaluation, were found to be hemostatic material.

## Case 1

A 69-year-old lady underwent aortic aneurysm repair with a Dacron graft. On the third postoperative day, computed tomography (CT) angiogram revealed a lesion with mottled air lucencies in the proximal aspect of the graft and imaging features were reported to be suspicious for gossypiboma (▶ Fig. 1A). A discussion with the operating surgeon revealed the use of oxidized regenerated cellulose for achieving hemostasis. A repeat imaging on the 15 postoperative day showed complete resolution of the lesion (▶ Fig. 1B).

## Case 2

A 60-year-old lady underwent a hysterectomy and was readmitted with abdominal pain. A CT on the ninth postoperative day demonstrated a collection containing irregularly shaped mottled air lucencies along the anterior aspect of the collection (▶ Fig. 2A). The possibility of gossypiboma was considered. There was documented use of oxidized regenerated cellulose

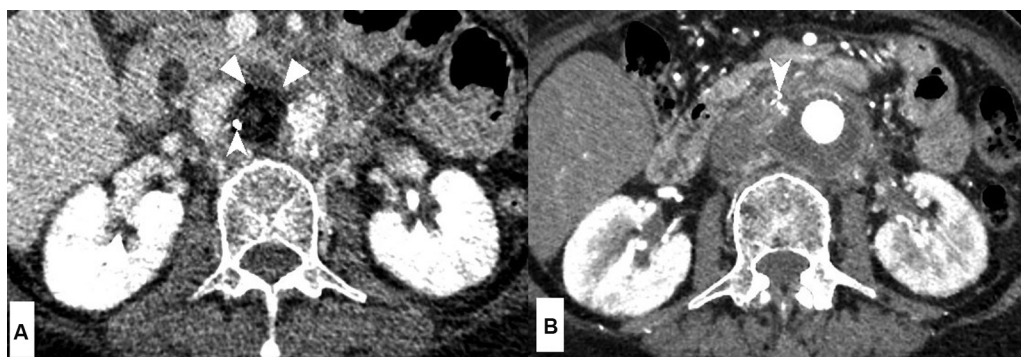
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**Fig. 1** (A) Postoperative computed tomography (CT) axial sections on day 3 show a localized well-defined lesion with mottled air lucencies (*arrowheads*) near the proximal aspect of the graft in the aortocaval region and surrounds the suture (*arrowhead with indent*). (B) A follow-up CT done 12 days later showed a new perigrraft collection, but the previously noted lesion with air pockets had completely resolved. The radiodense suture is shown with an *arrowhead*.

in the location of mottled air lucencies. The patient was managed conservatively, and a follow-up CT done 10 days later showed near-complete resolution of the spongiform content (**Fig. 2B**).

### Case 3

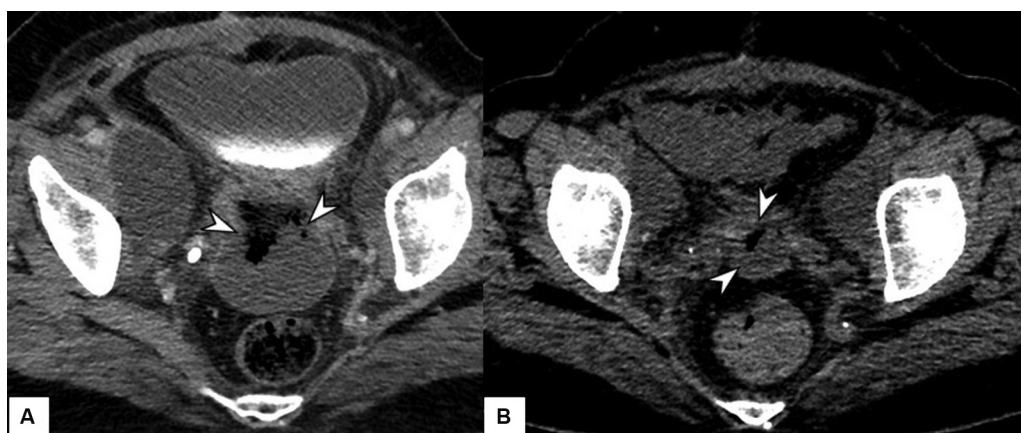
A 4-year-old girl underwent a postoperative CT following pelvic ganglioneuroma excision due to loose stools 3 days after surgery. CT revealed left-sided loculated pelvic collection with ill-defined low-density areas and mottled air lucencies (**Fig. 3A**). Based on the imaging findings, possibilities of postoperative collection or gossypiboma were considered. A conversation with the operating surgeon revealed the use of oxidized regenerated cellulose to achieve intraoperative hemostasis and the child was afebrile. Thus, the patient was diagnosed with pelvic hematoma, and was managed conservatively. Follow-up CT after 19 days revealed an unchanged mildly hyperdense loculated collection in the left side of the pelvis (**Fig. 3B**). But there was near-complete resolution of air pockets within the collection.

### Case 4

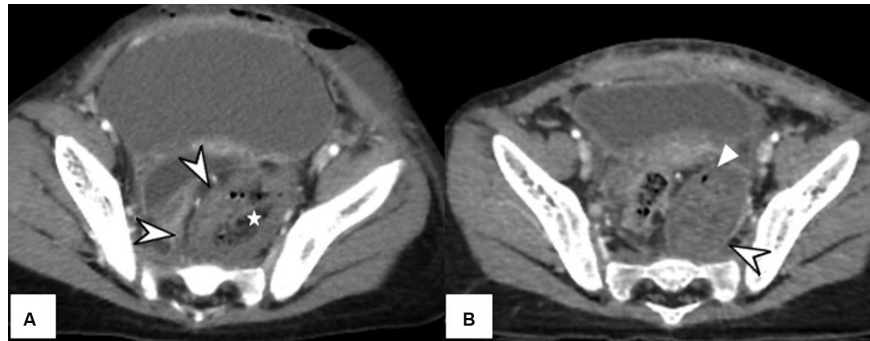
A 24-year-old lady presented with postpartum fever and abdominal pain following cesarean section. CT showed a rectangular low-density area with mottled air lucencies and was reported as an infected collection (**Fig. 4**). On exploratory laparotomy, the lesion was confirmed to be hemostatic material. However, the peritoneal cavity was filled with infected ascites, and peritoneal washing was done. After treatment with intravenous antibiotics in the postoperative period, the patient had an uneventful recovery.

Topical hemostatic agents, however, are identified only on studies within the early postoperative period. As a result, imaging appearance is not widely known. Absorbable hemostatic materials have been described as low-density lesions with punctate or linear air foci.<sup>11,12</sup>

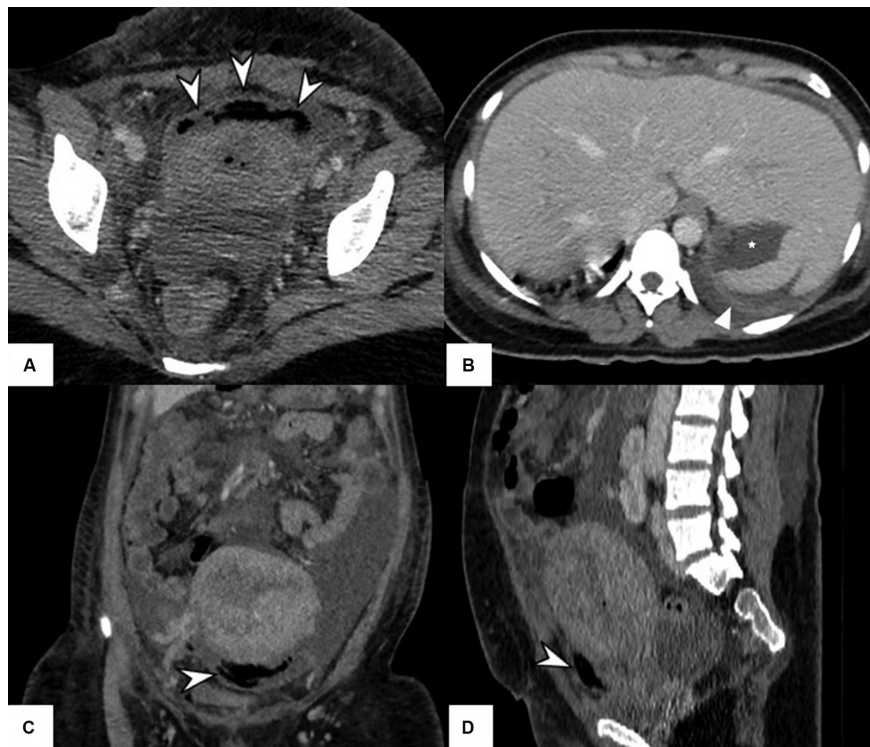
This appearance is likely due to the compressed space between the sponge, which helps absorb blood by capillary action. Three of our four cases demonstrate that further imaging may show minimal to no remnant of the hemostatic material, thus resolving any diagnostic doubt, as a gossypiboma will not



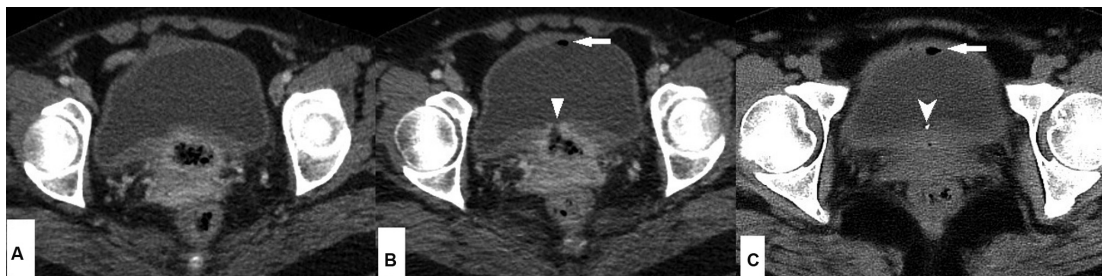
**Fig. 2** (A) Collection posterior to the urinary bladder containing irregular spongiform foci with mottled air lucencies (*arrowheads*). (B) Computed tomography (CT) done after 10 days shows a significant interval reduction in the size of both the collection and the spongiform foci within.



**Fig. 3** (A) Axial computed tomography (CT) section through the pelvis on the third postoperative day showed a lentiform well-defined low-density collection containing air foci (\*) located within a hyperdense hematoma in the left side of the pelvis (arrowheads). (B) Repeat imaging demonstrates a persistent hematoma. However, the component containing air foci had almost completely resolved.

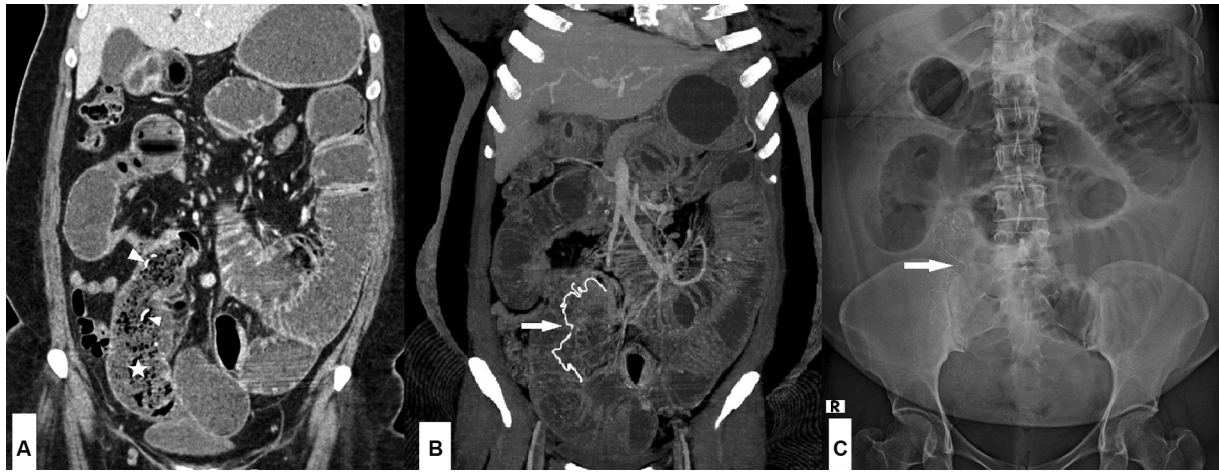


**Fig. 4** A 24-year-old female patient with postpartum fever. (A,C,D) Axial, coronal, and sagittal contrast-enhanced computed tomography (CT) images show a loculated low-density area with mottled air foci in a linear, folded pattern along the anterior aspect of the lower uterine segment (indented arrowheads), the location of the surgical wound on the uterus (B,D). There is generalized ascites (\*) with smooth peritoneal enhancement.



**Fig. 5** A 39-year-old female patient who underwent subtotal hysterectomy for postpartum hemorrhage 7 years ago presented with a history of postcoital bleeding for 7 years and burning micturition for 3 years. (A) Axial computed tomography (CT) images show a thick-walled lesion with mottled air lucencies at the vaginal vault. (B) There was fistula with the posterior wall of the bladder (arrowhead). (C) A radiodense focus is seen in the bladder trigone region (indented arrowhead) and air pockets were seen within the bladder lumen (arrows in B,C). At surgery, a vaginal vault gossypiboma was found fistulizing into the bladder.



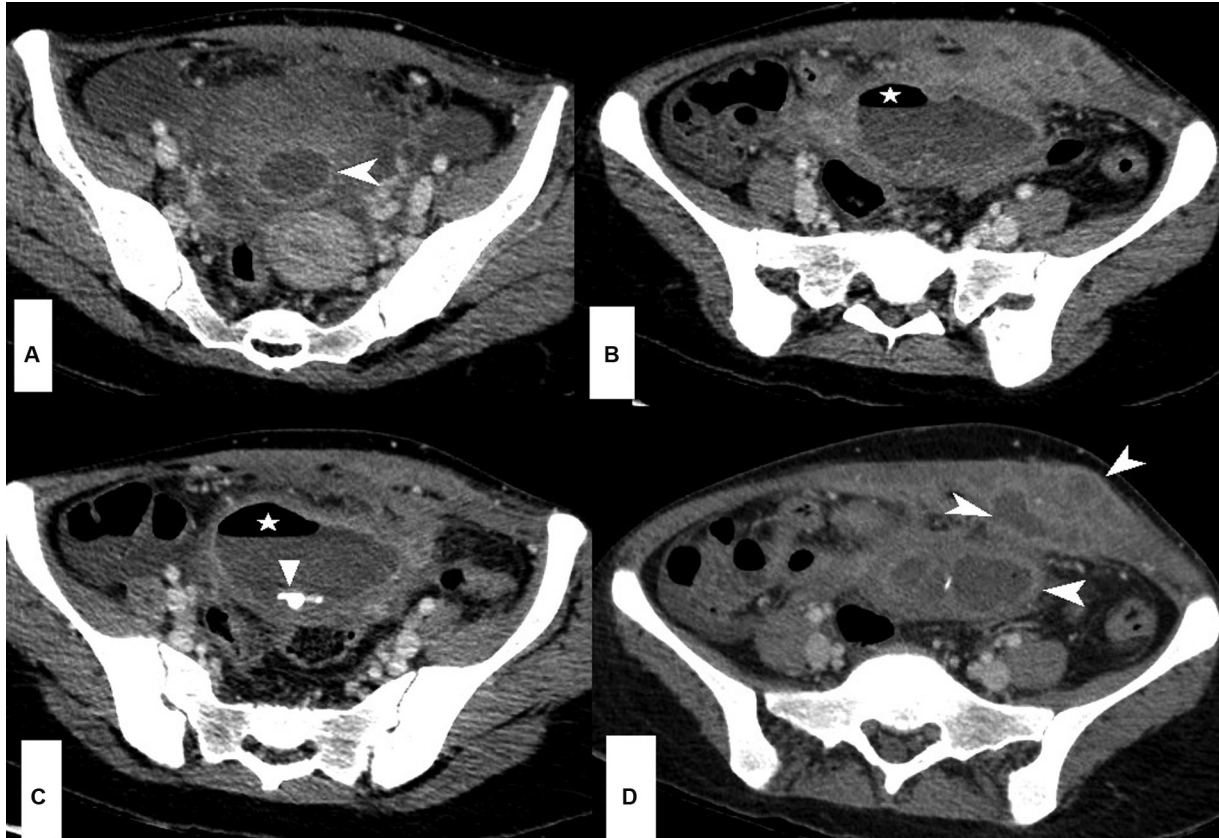


**Fig. 6** A 35-year-old male patient with a history of previous surgery presented with acute abdomen. (A) Coronal contrast-enhanced computed tomography ((CECT) image showed dilated small bowel loops with the transition zone in the right lower abdomen and the distal ileal loops collapsed. The small bowel proximal to the transition zone had mottled air lucencies (\*) and few radiodense foci (arrowheads). (B) Thick slab reconstruction revealed a thin serpiginous radiodensity within the bowel lumen (arrow). (C) Supine abdominal radiograph showed a similar radiodensity in the right lower abdomen (arrow). These findings were consistent with intraluminal gossypiboma in the mid-ileum with small bowel obstruction.

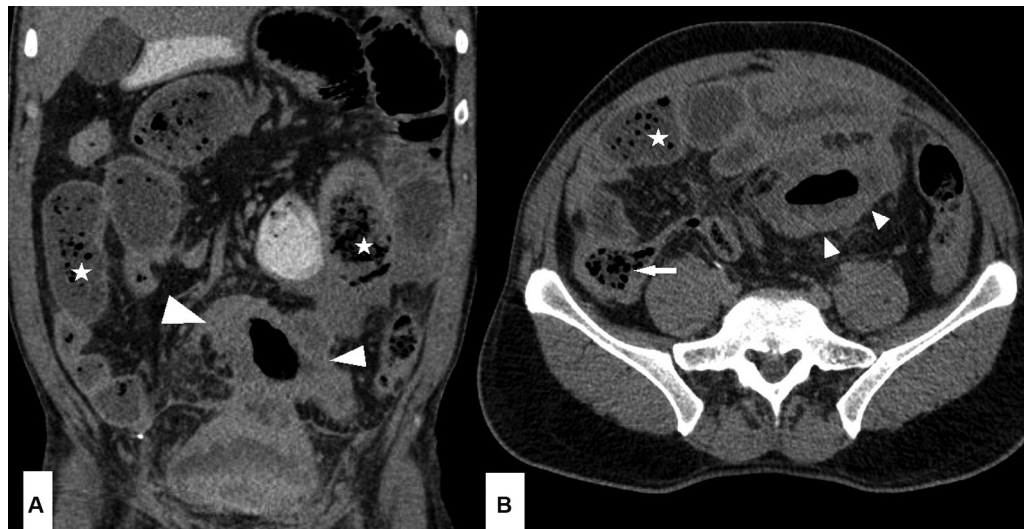
change in appearance. Oxidized regenerated cellulose has been found to absorb in 7 to 14 days and gelatin in 4 to 6 weeks.<sup>1,11</sup>

These agents have been described on imaging to also mimic postoperative abscesses or recurrent/residual soft tissue. Other mimics include abscesses from anaerobic

infections (→Fig. 7) and feces in the bowel lumen (→Fig. 8), including small bowel feces sign seen in bowel obstruction (→Fig. 8). Differentiating features include the presence of an enhancing rim, larger air pockets, and air-fluid levels in infected collections. However, an enhancing



**Fig. 7** Contrast-enhanced axial computed tomography (CT) images of an infected mature dermoid cyst show (A) collection with enhancing thick wall (arrowhead), (B) large air pockets (\*) and air-fluid levels, (C) toothlike calcified focus (arrowhead), and (D) thick-walled parietal wall collections (arrowhead).



**Fig. 8** (A) Coronal and (B) axial contrast-enhanced computed tomography (CT) images of a patient with an obstructing sigmoid colon cancer show an irregular nodular bowel wall thickening in the sigmoid colon (*arrowheads*), dilated small bowel loops with mottled air lucencies (\*) suggestive of “small bowel feces” sign. Note the fecal residue in the cecum also has mottled air lucencies (*arrow* in B).

**Table 1** Comparison of our case series with previously published work

No.	Study	Mimic described	Observations
1	Sandrasegaran et al (10)	Postoperative abscess	Absence of enhancing wall and air–fluid levels, linear morphology of air foci, and stable position on further imaging pointing toward Surgicel
2	Turley BR et al (17)	Postoperative abscess	Surgicel mimics post operative abscess following laparoscopic cholecystectomy
3	Wang and Chen <sup>1</sup>	Recurrent GIST	Surgicel-induced granuloma can mimic soft-tissue lesions. Differentiated on PET by a “rim” of uptake
4	Tefik et al (18)	Recurrent mass after RCC resection	Surgicel-related granuloma, mimicking recurrent mass lesions in the kidney
5	Current series	Gossypiboma and postoperative abscess	Two of our patients had coexisting collections; two had rim enhancement; and an interval decrease in size could be demonstrated in three

Abbreviations: GIST, gastrointestinal stromal tumor; PET, positron emission tomography; RCC, renal cell carcinoma.

**Table 2** Comparison of hemostatic material, gossypiboma, and abscess

	Hemostatic material	Gossypiboma	Abscess
Clinical presentation	History of recent surgery; usually an incidental finding	History of surgery; may have fever or pain	Fever, pain, leukocytosis
Duration	Seen up to 6 wk postoperatively	Persistent; will be seen on delayed imaging	Evolves with clinical progression
Enhancing rim	Absent unless secondary to foreign body reaction	Present	Present
Content	Air pockets appear linearly arranged and packed; will not vary in position with repeat imaging	Mottled; radiodense marker usually seen within	Variable air pockets that change with repeat imaging. Often have air–fluid levels
Complication	Nil	Adhesions, fistulization, and abscess formation	Fistulization

rim can also form around a hemostatic agent due to a secondary foreign body reaction as seen in ►**Fig. 4**. Clinical features also contribute to differentiation, as patients with a postoperative abscess may have fever, pain, and leukocytosis.<sup>12</sup> It is also crucial to note that hemostatic agents can coexist with hematomas and abscesses as also

seen in two of our cases (cases 2 and 3).<sup>2,13–15</sup> ►**Table 1** summarizes previously published reports on hemostatic agents. Another mimic to consider is tumor residue/recurrence, as in the late post-op images there can be soft-tissue densities or calcification of hemostatic material and this can mimic tumor recurrence.

Key differences between hemostatic material, gossypiboma, and abscess have been elucidated in ► **Table 2**.

## Conclusion

Hemostatic agents are frequently used, and knowledge of their imaging appearances, complications, and mimics is critical. We have outlined clinical examples where hemostatic agents mimic gossypiboma or postoperative collections on CT imaging, of which there is minimal available literature. This differentiation has significant medicolegal and management implications. Awareness of the use of topical hemostatic agents and dialogue with the surgeons can avoid errors. Our case series also indicates that follow-up imaging plays a key role in the differentiation.

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### Conflict of Interest

None declared.

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