

Pictorial Essay

Imaging of Retained Surgical Sponges in the Abdomen and Pelvis

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Retention of surgical sponges or swabs in the abdomen or pelvis occurs with a frequency of one in 100–5000 operations and accounts for 50% of

malpractice claims for retained foreign bodies [1, 2]. A retained surgical sponge or swab is also known as a gossypiboma, derived from *gossypium* (Latin, cotton) and *boma* (Swahili,

place of concealment). Clinically, retained sponges may be asymptomatic or result in a granulomatous response with abscess development, intestinal obstruction, or fistula

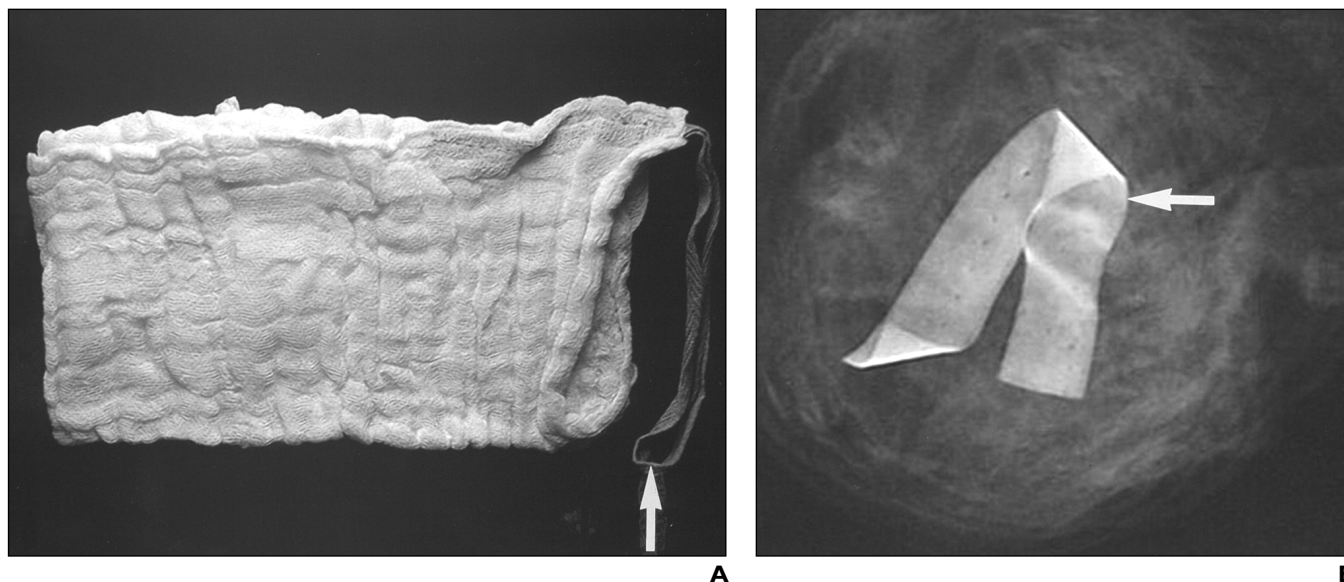


Fig. 1.—Photographic and radiographic appearances of typical laparotomy sponge.

A, Photograph of laparotomy sponge shows that attached strip of material (*arrow*) is radiopaque.

B, Radiograph of laparotomy sponge shown in **A** reveals that body of sponge is only faintly radiopaque, but marker (*arrow*) is easily seen.

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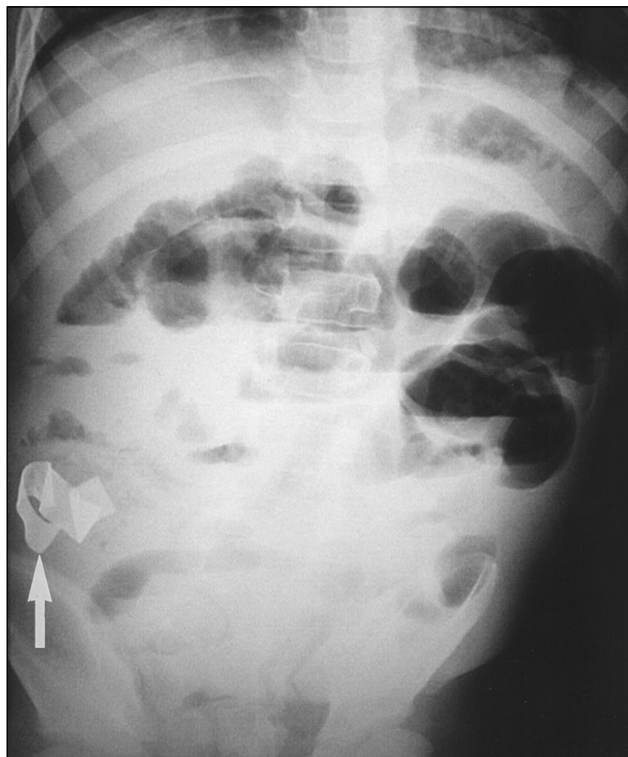
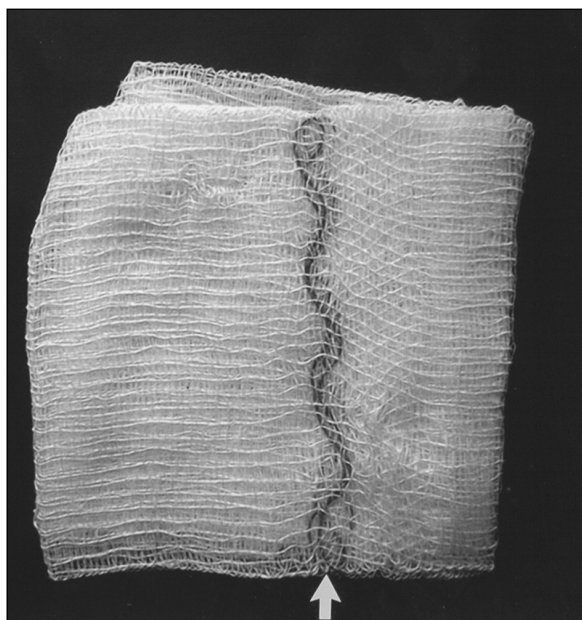


Fig. 2.—Abdominal radiograph obtained 5 days after surgical formation of antegrade continence enema (ACE Malone [10]) mechanism because of prolonged ileus in 10-year-old boy with spina bifida. Radiopaque marker (*arrow*) of laparotomy sponge is visible in right lower quadrant. Sponge was successfully removed by laparoscopy.



A

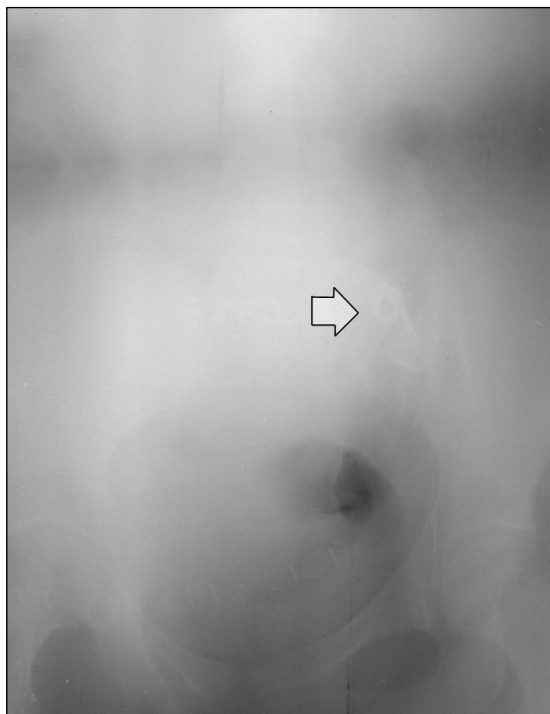


B

Fig. 3.—Photographic and radiographic appearances of 4 × 4 inch (10 × 10 cm) surgical sponge.
A, Photograph of surgical sponge shows that interwoven radiopaque marker (*arrow*) is visible.
B, Radiograph of surgical sponge shown in **A** reveals that body of sponge is only faintly radiopaque, but marker (*arrow*) is easily seen.

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Fig. 4.—Intraoperative radiograph obtained because of incorrect sponge count in 54-year-old woman who underwent urethral suspension. Radiopaque marker (*arrow*) of 4 × 4 inch (10 × 10 cm) laparotomy sponge is visible in pelvis. Sponge was identified and removed.



A



B

Fig. 5.—Value of soft-copy image manipulation is illustrated in radiographs obtained because of incorrect sponge count in 24-year-old woman who underwent cesarean delivery. **A**, Original image settings result in generally underpenetrated radiograph, and questionable density (*arrow*) is faintly identified over left sacral ala. **B**, Radiograph shows that after digital manipulation of window width and window level, marker (*arrow*) of 4 × 4 inch (10 × 10 cm) sponge is identified.

formation. Radiologically, gossypibomas may be confused with postoperative collections or tumors, particularly with the increasingly common surgical use of absorbable hemostatic materials to control hemorrhage. To provide an accurate interpretation, radiologists need to be familiar with the imaging findings of both inadvertent and intentional postoperative surgical sponges. The aim of this pictorial essay is to provide an updated review of the radiologic findings of retained surgical sponges in the abdomen and pelvis.

Radiography

Radiographs are the most commonly used method to detect retained sponges. One cannot rely on the clinical history to indicate the correct diagnosis; a normal sponge count does not exclude the possibility of a retained

sponge. In one series, the sponge count was reported as correct in 22 (76%) of 29 patients with retained sponges in the abdomen [2]. Most sponges are detectable because of an incorporated radiopaque marker (Figs. 1–4). The body of the sponge itself may be faintly radiodense on ex vivo radiographs but is unlikely to be seen in vivo (Figs. 1–4). Intraoperative or portable early postoperative radiographs may be of suboptimal quality, and hot lighting of hard-copy radiographs or digital magnification and manipulation of soft-copy images may facilitate detection (Fig. 5). The adequacy of the field of view should also be evaluated, with particular attention to partially imaged sponges at the periphery of the image (Fig. 6). In cases complicated by fistula formation, radiographic contrast material instillation may be helpful to define the anatomy and extent of

the abnormality (Fig. 7). Not all sponges have visible radiopaque markers. In one series, three of 29 retained sponges lacked a visible radiopaque marker [2]. Sponges without visible radiopaque markers may be identified by radiographic visualization of mottled radiolucencies, presumably due to air trapping [3], or by cross-sectional imaging.

CT

On CT, retained sponges are typically seen as a soft-tissue density mass and may show a whorled texture or a spongiform pattern with contained gas bubbles [4]. Sterile gas bubbles may be persistent and can still be seen at 6 months after placement of surgical sponges in bath water [5]. Inspection of the scout radiograph may be helpful (Fig. 8A) because beam-hardening artifacts on the axial images may

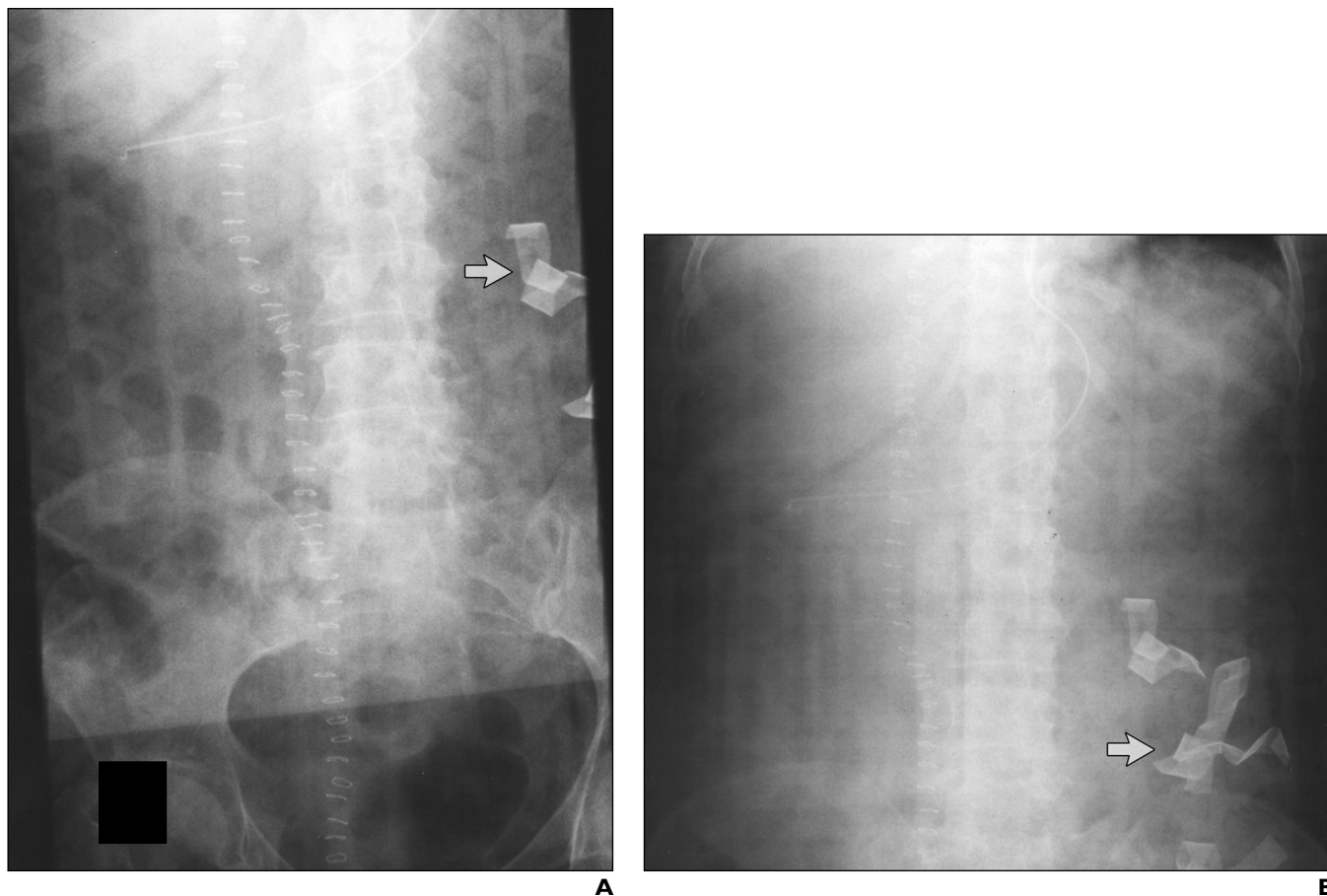


Fig. 6.—Importance of scrutinizing periphery of image is illustrated in radiographs obtained in 62-year-old woman after abdominal aortic aneurysm repair. **A**, Initial radiograph shows partially imaged laparotomy sponge marker (*arrow*) at edge of image. **B**, Second radiograph centered to include more of left side of abdomen shows three additional sponge markers (*arrow*). Sponges were surgically removed.



A

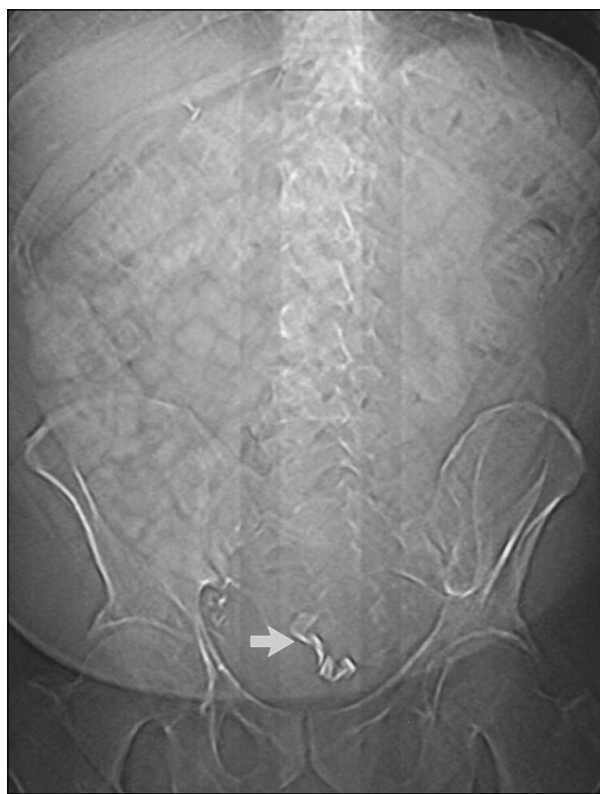


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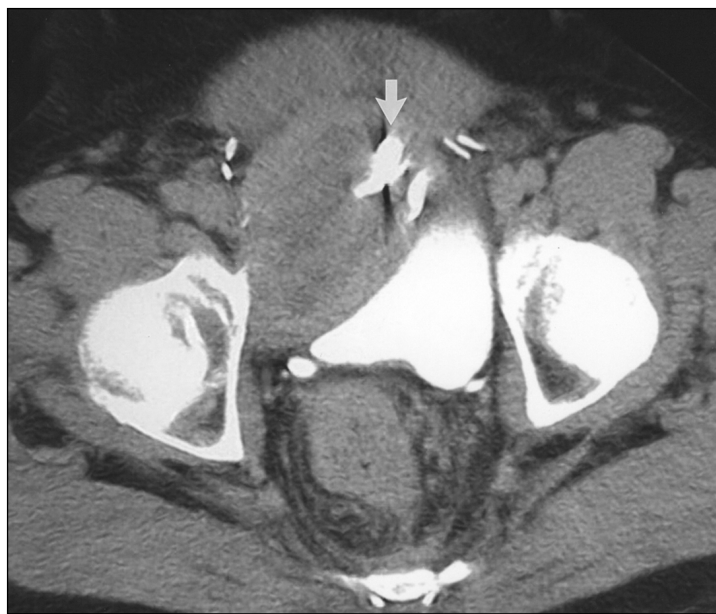
Fig. 7.—Retained sponge in 30-year-old woman after right hemicolectomy and partial small-bowel resection for Crohn's disease. Fistulograms were requested 2 weeks after surgery because of wound dehiscence and discharge.

A, Image shows contrast material flowing into small opening in lower part of wound and fistula passing superiorly around marker (*straight arrow*) of retained 4 × 4 inch (10 × 10 cm) surgical sponge, ending in communication with biliary tract, and draining to duodenum (*curved arrow*).

B, Magnified image of retained sponge shown in **A** reveals sponge marker in greater detail.



A

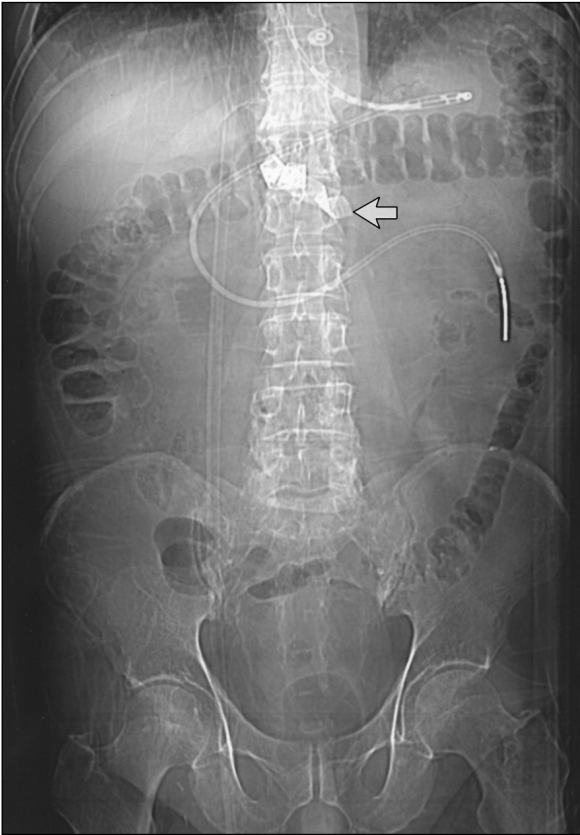


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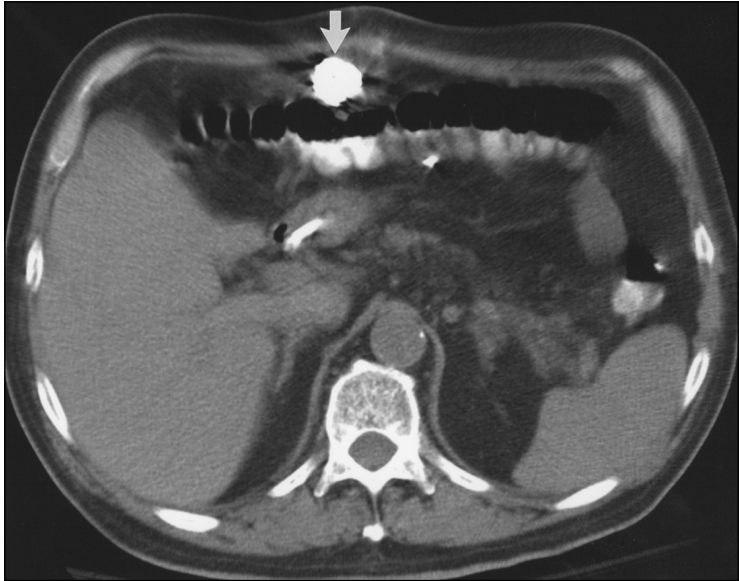
Fig. 8.—Retained laparotomy sponge in 56-year-old man after radical prostatectomy.

A, Scout radiograph shows marker (*arrow*) of retained sponge in pelvis.

B, Axial CT image shows sponge anterior to bladder. Beam-hardening artifact is noted around marker (*arrow*).



A



B



C

Fig. 9.—Retained sponge in 69-year-old man 4 weeks after aortofemoral bypass.
A, Radiograph obtained to check position of feeding tube shows marker (*arrow*) of retained laparotomy sponge in central abdomen.
B, Axial CT image confirms presence of retained sponge (*arrow*) anterior to transverse colon.
C, Axial CT image obtained at level inferior to **B** shows fluid collection (*arrow*). Sponge was removed surgically, and adjacent collection was drained and found to be an abscess.

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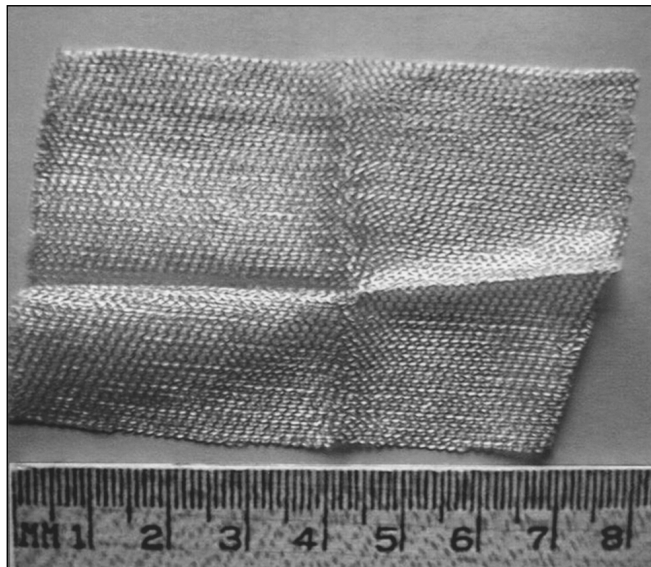


Fig. 10.—Photograph of absorbable hemostatic sponge made of oxidized reabsorbable cellulose (Surgicel; Ethicon, Somerville, NJ).



Fig. 11.—CT scan obtained because of fever 3 months after bilateral salpingo-oophorectomy for tuboovarian abscess in 43-year-old woman. Axial CT image shows ill-defined soft-tissue density mass (*arrow*) with mottled lucent center in left lower quadrant. Review of operative note confirmed absorbable hemostatic sponge (Gelfoam, Pharmacia and Upjohn, Kalamazoo, MI; Surgicel, Ethicon, Somerville, NJ) had been used to control bleeding in left pelvis. Mass was considered to represent residual absorbable sponge and gradually resolved on subsequent serial CT scans (not shown).

make the characteristic appearances of the marker less obvious (Fig. 8B). A retained sponge should not be misinterpreted as fluid collection, although adjacent abscess formation may be seen (Fig. 9). The described CT appearances of absorbable hemostatic sponges, which

may be made of gelatin sponge (Gelfoam; Pharmacia and Upjohn, Kalamazoo, MI) or oxidized reabsorbable cellulose (Surgicel; Ethicon, Somerville, NJ) (Fig. 10), are of mixed or low-attenuation masses containing focal central collections of gas [6, 7] (Figs. 11 and 12), al-

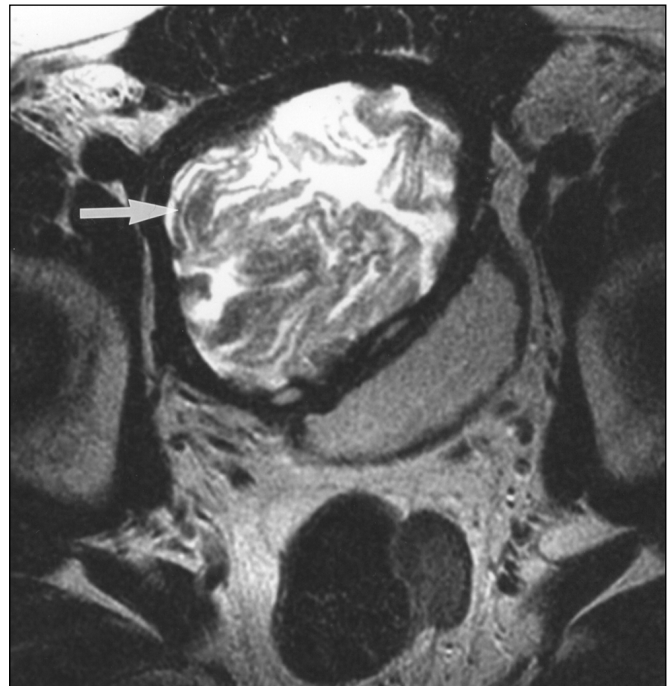
though we have also observed peripheral gas collections (Fig. 13). Abscess formation can coincidentally complicate a surgically packed operative site [7]; therefore, the knowledge that absorbable hemostatic sponges have been used should not deter the radiologist from further



Fig. 12.—CT scan obtained because of fever 8 days after total abdominal hysterectomy, bilateral salpingo-oophorectomy, and debulking of stage III ovarian cancer in 43-year-old woman. Mixed gas, fluid, and soft-tissue density mass (*arrows*) with appearance similar to bowel are seen in right pelvis, but no communication with bowel could be established on contiguous images (not shown). Review of operative note confirmed absorbable hemostatic sponge (Surgicel; Ethicon, Somerville, NJ) had been used to control bleeding in pelvis. CT-guided aspiration yielded sterile serosanguineous fluid. Mass was considered to represent residual absorbable sponge.



Fig. 13.—CT scan obtained because of pain 5 days after total abdominal hysterectomy for leiomyomata in 35-year-old woman. Mixed gas, fluid, and soft-tissue density mass (*arrows*) are seen in central pelvis. Review of operative note confirmed absorbable hemostatic sponge (Gelfoam; Pharmacia and Upjohn, Kalamazoo, MI) had been used to control bleeding in pelvis. Mass was considered to represent residual absorbable sponge and was not visible on CT scan obtained 6 weeks later.



A

B

Fig. 14.—MR images of retained sponge obtained in 56-year-old man who complained of urinary frequency 5 months after radical retropubic prostatectomy. **A**, Axial spin-echo T1-weighted MR image (TR/TE, 500/15) after injection of contrast material shows that sponge is identified as low-signal structure anterior to contrast-filled bladder. Peripheral enhancement of thick-walled capsule (*arrow*) is noted. **B**, Axial fast spin-echo T2-weighted MR image (4000/105) shows "whirled" configuration of sponge body (*arrow*). Sponge was surgically removed.

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investigation in the appropriate clinical setting. Differentiation of absorbable hemostatic sponges from other surgical sponges is facilitated by the usual presence of a radiopaque marker in the latter. The use of absorbable sponges varies with local surgical practice, but they are typically used by urology, gynecology, or general surgeons to arrest bleeding or oozing that cannot be controlled by suturing.

MR Imaging

On MR imaging, a retained sponge is typically seen as a soft-tissue density mass with a thick well-defined capsule and as a whorled internal configuration on T2-weighted imaging [8] (Fig. 14). The MR imaging appearances of retained absorbable hemostatic sponges have been described in a series of five patients [9] and consist of intermediate T1 and high T2 signal intensity. A complex mixed signal internal pattern similar to the whorled appearance of other retained surgical sponges may be seen on T2-weighted images, as may an increased signal peripheral zone on T1-weighted images.

Conclusion

Awareness of the typical radiologic appearances is critical to the diagnosis of retained surgical sponges or swabs. Inadvertently retained sponges are often clinically unsuspected and may be first recognized by imaging. A high index of suspicion is required because a history of an incorrect sponge count is frequently lacking and because a radiopaque marker is not always visible. CT or MR imaging may be helpful in problematic cases. Radiologists need to be aware that intentional placement of absorbable hemostatic sponges is an increasingly common surgical technique because these sponges may mimic an abscess or collection on CT performed after surgery.

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