The British Journal of Radiology, 77 (2004), 261–265
DOI: 10.1259/bjr/63333975

Pictorial review

Prosthetic mesh used for inguinal and ventral hernia repair: normal appearance and complications in ultrasound and CT

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Abstract. The use of prosthetic mesh has now become accepted practice in the treatment of patients with both inguinal and ventral hernias. This pictorial review illustrates the various radiological appearances of these meshes and also demonstrates the post-operative complications associated with their implantation.

The development of new biological materials has led to a change in the approach to the treatment of both ventral and inguinal hernias [1]. Hernia repair now frequently includes implantation of a prosthetic mesh, and this may be done either during open surgery or, increasingly, laparoscopic repair [2]. The radiologist must therefore become familiar with the appearances of these types of material as visualized by various diagnostic imaging techniques as well as the radiological findings of related post-operative complications.

Types of mesh and radiological appearance

Two different meshes according to their composition will be shown in this pictorial review: the polypropylene (PP) meshes (Marlex®; C R Bard, Inc., NJ, Prolene®; Ethicon, Inc., Somerville, NJ and Surgilene®; Sherwood Medical, St Louis, MO) and the expanded polytetrafluoroethylene (e-PTFE) mesh (Gore-Tex MicroMesh, W. L. Gore & Associates, Inc, Flagstaff, AZ). The PP meshes are a monofilament polypropylene mesh, non-absorbable, inert, sterile and porous with a thickness approximately of 0.44 mm. The e-PTFE mesh is 1 mm thick mesh made from strong, soft inert and conformable e-PTFE with an structure that ensures early fixation to host tissue with minimal foreign body reaction.

In plain film radiographs neither the PP nor the e-PTFE meshes are visible, we can only see surgical staples in those cases where they are used to fix the mesh to the abdominal fascia (Figure 1).

On ultrasound, both the PP and the e-PTFE meshes appear as hyperechoic lines (Figure 2). With CT, probably because of their different composition and thickness, the PP and the e-PTFE meshes have different appearances, the PP meshes are visible as lines with a density similar to the adjacent muscles in only a small proportion of patients (20% in our experience) and the e-PTFE mesh appears as a line of increased density (Figure 3) visible in all patients.

Post-operative complications

Fluid collections

The presence of fluid collections in the inguinal canal or in front of the mesh in patients with inguinal hernia repair and in front of the mesh in patients with ventral hernia repair is a frequent finding in the immediate post-operative period [3]. These collections, usually haematomas or seromas, should not be mistaken for recurrence of the hernia, which can often appear clinically similar [4] (Figure 4).

In the inguinal canal the incidence of fluid collections following surgery for inguinal hernia has been reported at between 0 and 17% [5]. They are usually the result of surgical trauma or accumulation of fluid in the empty hernial sac and generally do not require treatment, unless they give rise to symptoms or persist for more than 6–8 weeks, in which case drainage is necessary [6]. It must be kept in mind that in open surgery (compared with laparoscopic) the hernial sac is usually excised therefore fluid collections cannot occur within a sac.

In patients having ventral hernia repair, as in inguinal hernia patients, fluid collections are the result both of the porous property of the mesh and the accumulation of fluid either inside the empty hernial sac in patients with laparoscopic surgery or in the potential space created during surgical manipulations [4]. Generally, none of these patients require drainage since such collections usually disappear spontaneously.

Usually ultrasound [3] and/or CT [4] can differentiate between haematoma or seroma and hernia recurrence. There are however some cases, especially those in which septa or air is noted inside the collection, where it is difficult to make this distinction [4]. In these difficult cases, observation of the mesh and its relationships to the collection [3], the lack of ancillary features associated with true hernia such as presence of hernial sac, herniated mesentery or bowel obstruction [4] can help to differentiate them (Figures 5 and 6).

Mesh infections

Septic complications of the prosthesis have been reported to occur in 0.2–0.8% of patients [3, 6]. Two types of infection must be distinguished in patients with prosthesis repair: superficial subcutaneous infections and infections around the mesh [6]. The first usually has no clinical significance. In the second, vigorous treatment is always necessary [7]. In these cases, apart from antibiotic therapy, puncture and drainage of these infected collections under ultrasound control have been described although in most cases prosthesis removal is inevitable [3] (Figure 7).

Received 10 February 2003 and in final form 8 October 2003, accepted 18 December 2003.

Small bowel related complications

Bowel related complications such as laceration of large or small bowel or bowel adhesions to the mesh are infrequent findings with incidences between 0.06% and 0.2% [6]. Pneumoperitoneum after laparoscopic surgery is normal, and can persist for several days; however, if it persists longer than expected or appears as a new finding, a laceration of large or small bowel must be ruled out. In patients post-laparoscopic surgery, this laceration has usually occurred at one of the trocar entry sites [6].

It is known that all prostheses form adhesions within the peritoneal cavity [6]. Therefore, in patients with occlusive or periodic episodes of a subocclusive ileus without evidence of hernia recurrence, adherence of the small or large bowel to the mesh must be suspected (Figure 8).

Spermatic cord and testicles

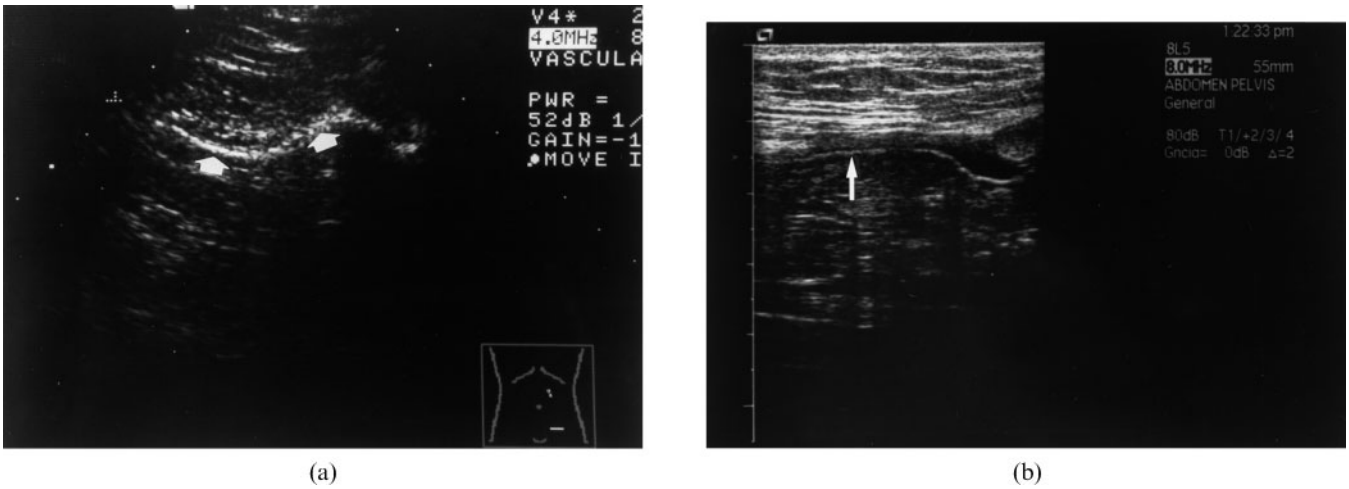
A thickened spermatic cord is a relatively frequent finding in patients with inguinal hernia repair when studied with ultrasound in the immediate post-operative period. This is probably the result of surgical manipulation and a return to a normal size is usually seen on follow-up (Figure 9).

Testicular ischaemia and posterior atrophy occur rarely following primary inguinal hernia repair (0.03–0.5%), although these complications are more common after surgery for recurrent inguinal hernia with an incidence between 0.8% and 5% [8]. In our experience and in others [3], the incidence appears to be less in patients with laparoscopic inguinal hernia repair. Furtschegger et al [3] in 193 patients with recurrent hernias treated with laparoscopic surgery found no cases of testicular atrophy.

Hernia recurrence

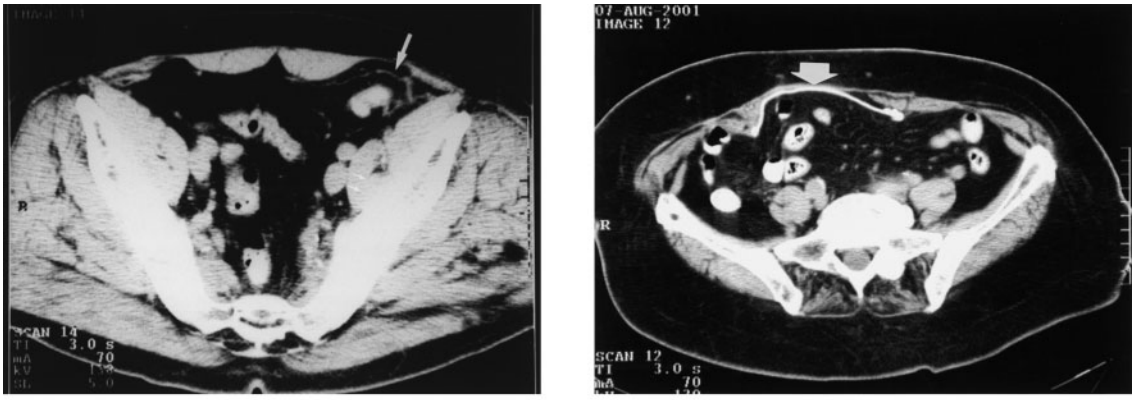
Hernia recurrence remains the most frequent complication in patients with hernia repair with an incidence between 2.3% and 20% for inguinal hernias [6] and 10% and 20% for ventral hernias [9]. Although ultrasound and CT have both been used for diagnosis, CT is probably more widely used because it provides adequate visualization of the herniated bowel and the abdominal wall [10] (Figure 10). CT also appears to be superior to physical examination in the diagnosis of hernia relapse in patients with ventral incisional hernia repair when an e-PTFE mesh has been inserted [11].

Figure 1. Plain film radiograph in a patient with ventral hernia repair. Only the staples (arrows) that fix the mesh to the abdominal fascia are seen with this technique.



(a) (b)

Figure 2. Normal appearance of the polypropylene (PP) and expanded polytetrafluorethylene (e-PTFE) meshes on ultrasound. (a) Transverse ultrasound at the level of the left inguinal canal in a patient with a laparoscopic repair. The PP mesh appears as an echogenic line (thick arrows). (b) Transverse ultrasound at the level of the hypogastrium in a 69-year-old woman with laparoscopic surgery for ventral hernia and an e-PTFE mesh located intraperitoneally. The e-PTFE mesh (long arrow) appears as an echogenic line.



(a) (b)

Figure 3. Normal CT appearance of the polypropylene (PP) and expanded polytetrafluorethylene (e-PTFE) meshes. (a) CT scan of the same patient showed on Figure 2a. The PP mesh (long arrow) appears as a line with a similar density to the adjacent muscles. (b) Same patient of Figure 2b: the e-PTFE mesh (thick arrow) appears on CT as a hyperdense line behind the abdominal wall muscles.

Figure 4. Fluid collections. Haematoma (*) above the mesh in a 68-year-old woman with laparoscopic surgery for ventral hernia and expanded polytetrafluorethylene (e-PTFE) mesh inserted. The e-PTFE mesh is visible as a line of high density (arrow).

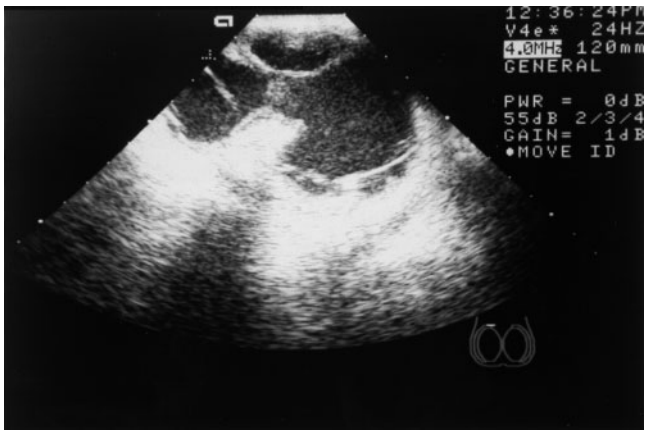
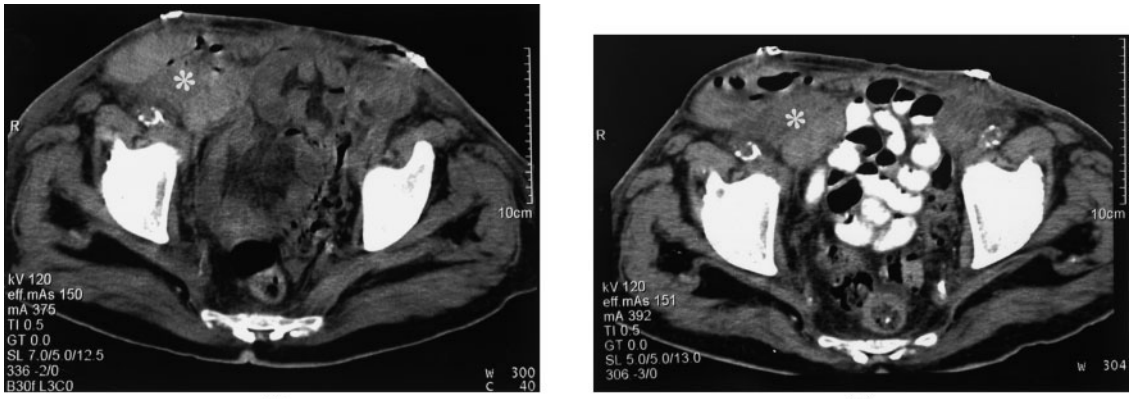
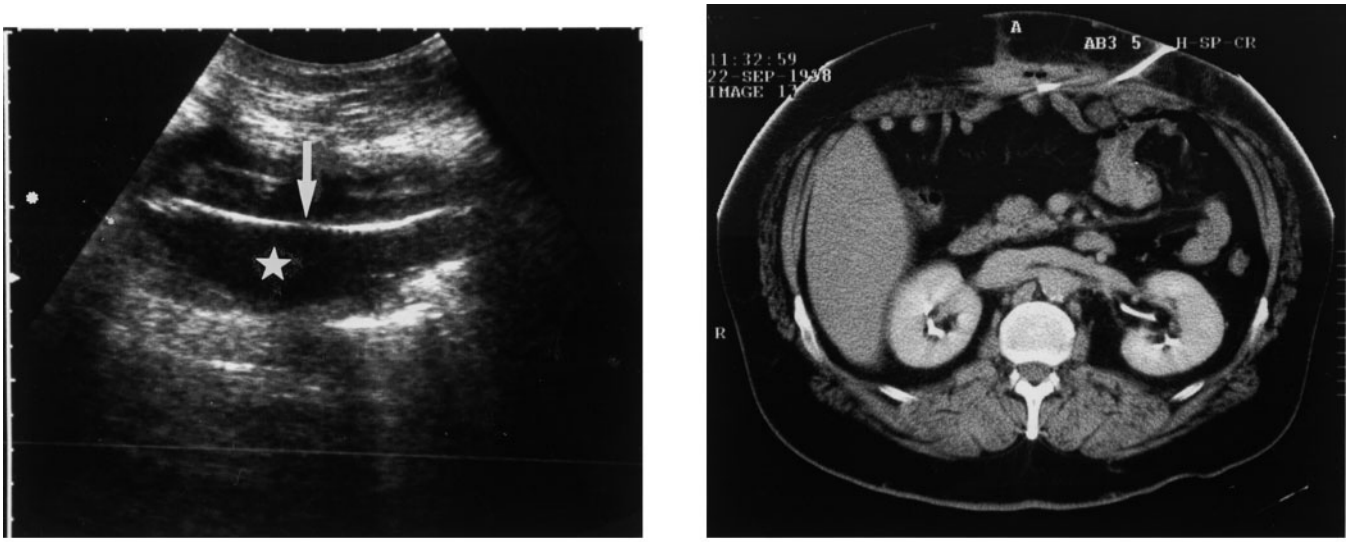


Figure 5. Atypical haematoma. A 35-year-old man with right inguinal hernia surgery 25 days before, developed a painful mass in the right inguinal canal. The ultrasound performed, showed an anechoic mass with thick septae, which made difficult to differentiate haematoma and hernia recurrence. In this case, the clinical findings and a CT performed after the administration of oral contrast excluded hernia recurrence. In addition, due to pain persistence, a surgical drainage of the collection was performed and serohematic fluid was extracted.



(a) (b)

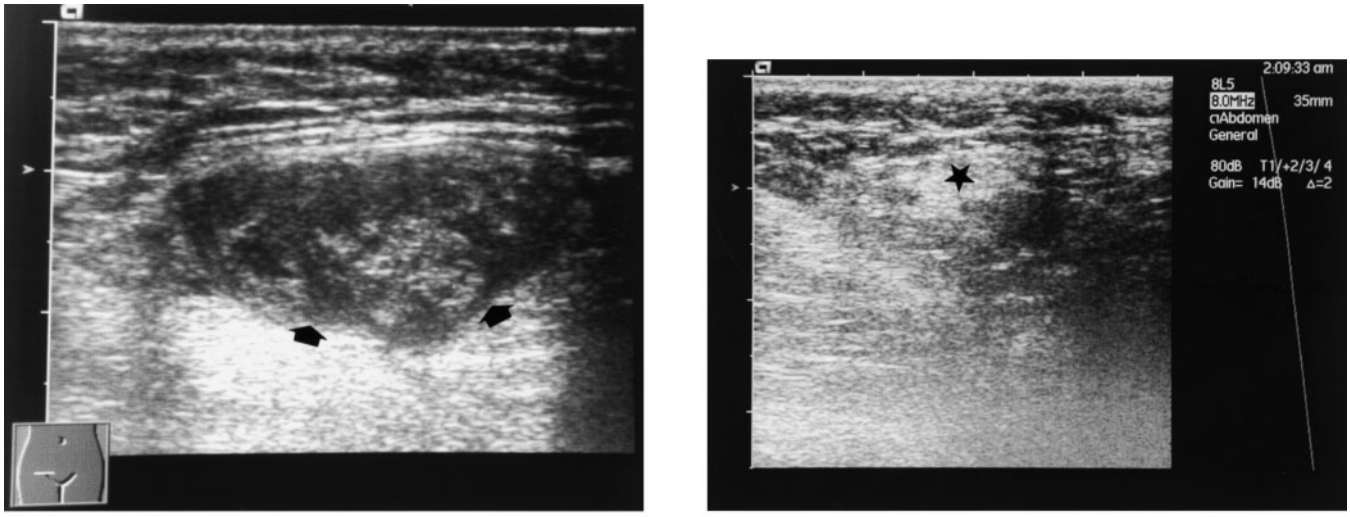
Figure 6. Atypical haematoma. A 58-year-old man with bilateral inguinal hernia repair, reduction in red blood cell parameters, and a painful mass in the right inguinal canal during the immediate post-operative period. (a) Conventional CT performed at this level, showed a ight mass (*) with bubbles of gas making difficult to differentiate between hernia recurrence and haematoma or seroma. (b) Conventional CT scan performed at the same level as (a) after administration of oral contrast. Important to note how the normal size bowel has been displaced by the mass (*). In this patient the clinical findings and the lack of ancillary features associated with true hernia excluded hernia recurrence.



(a) (b)

Figure 7. Mesh related infection. A 53-year-old man with ventral hernia repair and a polypropylene (PP) mesh inserted 7 years before. The patient was admitted to hospital due to epigastric pain and temperature. (a) Transverse ultrasound at the epigastric level. The PP mesh (long arrow) is surrounded by a purulent collection (*). In this patient apart from antibiotic treatment, puncture and drainage of the collection was performed under ultrasound guidance and an 8 French catheter was left under the PP mesh. (b) CT scan performed several days after drainage. Note the catheter in the abdominal wall. The PP mesh is not visible.

Figure 8. Bowel adherence to the mesh. A 71-year-old woman with a polypropylene (PP) and a posterior expanded polytetrafluorethylene (e-PTFE) mesh inserted for ventral hernia and successive episodes of subocclusive ileus. In CT the small bowel is seen in contiguity with the e-PTFE mesh (thick arrow). Surgical exploration confirmed adherence of the small bowel to the PP and e-PTFE meshes. Also noted small hernia on the left of the e-PTFE mesh.



(a) (b)

Figure 9. Spermatic cord complications. A 58-year-old man with inguinal hernia repair performed 30 days before, and a mass in the right inguinal canal. (a) The ultrasound performed showed a thicken spermatic cord (head arrows). (b) 1 year later the spermatic cord presents a normal size (*).

Figure 10. Hernia recurrence. A 55-year-old woman with epigastric pain during the immediate post-operative period after ventral hernia repair and an expanded polytetrafluorethylene (e-PTFE) mesh insertion. Recurrence of the hernia is seen in the inferior border of the e-PTFE (arrow). Staple failure was the reason for hernia recurrence.

Conclusion

Ultrasound is a useful method for identifying PP meshes. In patients with an e-PTFE mesh, either ultrasound or CT can be used, although CT seems to perform better in mesh visualization. The presence of collections in the inguinal canal and in front of the mesh is a fairly common event in the immediate post-operative period in patients undergoing hernia repair, and in most cases it requires no treatment unless the patient feels discomfort or the collection persists. In our experience, drainage of infected collections under ultrasound guidance can be useful in the management of patients with mesh related infections although removal of the mesh is usually inevitable. In patients with a history of occlusive or subocclusive ileus without evidence of hernia recurrence on ultrasound or CT, adherence of the bowel to the mesh must be considered.

Acknowledgment

We thank Dr Tomas Cobo Castro, FRCA, for his help in the preparation of manuscript.

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