

Rippled mesh: a CT sign of abdominal wall ePTFE prosthesis infection

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SUMMARY: Rippled mesh: a CT sign of abdominal wall ePTFE prosthesis infection.

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Background. Infection of polytetrafluoroethylene (ePTFE) prostheses for abdominal incisional hernia is a rare but serious complication that often makes meshes removal necessary. Instead serous collections (seromas) without signs of infection don't require surgical removal. Differential diagnosis between infected and non-infected fluid collections is difficult and sometimes impossible before surgical exploration.

Methods. We describe a new sign observed in two patients who underwent abdominal computed tomography for evaluation of a fluid collection without clear signs of prosthesis infection, complicating abdominal wall repair for incisional hernia in which an ePTFE mesh was used. In both patients an alteration of the mesh profile was demonstrated on imaging, and in both patients prostheses resulted infected at surgical exploration and at microbiological examination after removal. The sign we observed is not evident in computed tomography images performed in cases of seromas.

Conclusions. We discuss the possible mechanism of this finding and propose that this sign may be due to a "rejection" of the infected prosthesis from the surrounding neo-formed fibrous and inflammatory tissue.

RIASSUNTO: Ondulazione del profilo della rete: un segno TC di infezione di protesi della parete addominale in ePTFE.

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Introduzione. L'infezione delle protesi in politetrafluoroetilene (ePTFE) utilizzate nella plastica della parete addominale per ernia incisionale, rappresenta una rara ma seria complicanza che spesso rende necessaria la rimozione della rete. Al contrario le raccolte fluide sierose non infette (sieromi) non richiedono trattamento chirurgico. La diagnosi differenziale tra raccolte fluide infette e non infette è spesso difficoltosa e talvolta impossibile prima dell'esplorazione chirurgica.

Metodi. Viene descritto un nuovo segno radiologico osservato in due pazienti consecutivi sottoposti a tomografia computerizzata (TC) dell'addome per la valutazione di una raccolta fluida periprotetica, in assenza di chiari segni di infezione, comparsa in seguito ad intervento di plastica della parete addominale con protesi in ePTFE. In entrambi i pazienti è stata osservata all'esame TC un'alterazione del profilo della rete, ed in entrambi i pazienti la rete è risultata infetta sia all'esplorazione chirurgica che all'esame microbiologico eseguito sul materiale rimosso. Il segno radiologico osservato non è evidente nelle immagini TC in caso di sieroma.

Conclusioni. Viene discusso il possibile meccanismo fisiopatologico di questo segno, che può essere dovuto al tentativo di "rigetto" della protesi infetta da parte del tessuto fibro-infiammatorio neoformatosi intorno alla rete.

KEY WORDS: Incisional hernia - ePTFE - Abdominal wall prosthesis infection - Seroma. Laparocele - ePTFE - Infezione protesi addominale - Sieroma.

Introduction

Incisional hernia complicates from 2% to 13% of laparotomies (1, 2). Surgery for incisional hernia requires the use of prosthetic materials for "tension free"

closure. Synthetic materials characterized by good resistance and biocompatibility are now available. Expanded polytetrafluoroethylene (ePTFE) (Gore-Tex Dual-Mesh Biomaterial, W.L. Gore & Associates, Flagstaff, AZ, USA) prostheses are frequently preferred due to the possibility of direct positioning inside the peritoneum in contact with viscera, both in open and laparoscopic surgery.

Infection of the prosthetic material after implant is a serious complication and makes prosthesis removal necessary. An infected prosthesis is invariably associa-

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ted with the presence of surrounding fluid collection. However, collections of non infected serous material (seromas) are not rare and do not require graft removal.

Differential diagnosis between infected and sterile fluid collections is important. Prostheses are visible by CT scan; we identified in two consecutive patients a radiological CT sign which can be useful in distinguishing infected prostheses.

Patients

Case 1

A 51 year-old woman had a midline, laparotomic, incisional hernia repair with an intraperitoneal ePTFE 15x7 cm prosthesis. Seventeen days after surgery a fluid collection under the wound was suspected and confirmed by sonography. Bacterial exams on needle drained fluid were negative.

Two weeks later a serum-like discharge opened in the wound and, after a one month attempt of conservative treatment with aspiration drainage, an abdominal CT scan was performed. The study demonstrated a modified prosthesis profile, which appeared abnormally undulated (like ripples in the water): the prosthesis appeared retracted and lifted upwards in its central portion; the layer of underlying neoperitoneum was also visible (Fig. 1). The graft was surgically removed and bacterial exams of the prosthesis resulted positive for *Staphylococcus aureus*.

Case 2

A 36 year-old woman had similar surgery. A month after a fluid collection over the prosthesis appeared (sonography) and needle aspiration of the collection was performed twice (bacterial exams resulted negative).

Two months later, because of persistence of fluid collection, an abdominal CT scan was done. The profile of the mesh appeared rippled also in this case, with the prosthesis corrugated in the proximity of the midline (Fig. 2). Upon surgery for prosthesis removal, the graft appeared retracted and almost completely deta-



Fig. 1 - Case 1. Abdominal CT scan: the prosthesis is lifted upwards in its central portion, and its profile appears undulated.



Fig. 2 - Case 2. Abdominal CT scan: the prosthesis is dislocated towards midline; its profile is undulated.

ched from tissues, and surrounded by an infected collection (*Staphylococcus aureus*).

Discussion

The infection of the prosthetic implant for the incisional hernia repair represents an infrequent but annoying complication (i.e. incidence in literature ranges between 1.8 and 9%) (3-11). Infection of ePTFE prostheses seems lower in comparison to other materials (5, 6, 11, 12). Infection is less frequently shown when the prosthesis is positioned intraperitoneally (5), especially during laparoscopic surgery (6, 9, 11, 13, 14).

In the first month after surgery, non-infected fluid collections (seromas) surrounding the prosthesis are frequently found by sonography: the incidence can reach 16% in the various studies (4-17) and in most cases seromas become clinically evident as a soft floating collection under the surgical wound, sometimes with skin distension. Usually, the clinical signs take weeks to appear, even if the seroma is an immediate surgical complication. Seromas are more frequently found after ePTFE repair (4, 7, 9, 10, 14, 16-17) and this effect has been attributed to the low porosity of the material (4, 17). Since seromas generally subside in 2 to 4 weeks, spontaneously or after needle aspiration (4, 6, 8, 10, 14, 15, 17), differential diagnosis between seromas and infected collections is important.

Prosthesis infection generally starts with a similar appearance of fluid collection over the mesh. Fever and local signs of infection can be delayed, a cutaneous fistula in many cases opens later. Sonography and CT scan usually show the liquid collection over the prosthesis but bacterial growth from the fluid may not appear. In our cases, microbiologic exams on the needle-



Fig. 3 - Abdominal CT scan: in absence of infective complications, the prosthesis is well extended without profile alterations.



Fig. 4 - Abdominal CT scan: a seroma near the prosthesis does not modify mesh profile.

drained fluid did not show bacterial growth. Nevertheless, the infected prosthesis has to be removed (5-7, 10, 14, 15) and some comparative studies suggest that surgery should be performed as soon as possible (3) to avoid the intra-abdominal diffusion of sepsis (5).

In absence of infection, histopathological exam shows a good integration of the biomaterial in the newly formed tissues (17). The inflammatory cells (macrophages), that surround the mesh immediately after implant, are progressively replaced by mature fibroblasts which are the predominant cell type within 40 days from surgery.

The CT scan appearance of the uninfected ePTFE mesh is that of a well extended layer, loosely encapsulated in the surrounding tissues and without profile alterations; the peripheral areas appear in continuity with the nearby tissues and sometimes the prosthesis margins are indistinguishable from the muscular and aponeurotic layers of the abdominal wall (17) (Fig. 3). The presence of the seroma in continuity with the prosthesis does not modify the mesh profile on the CT scan (Fig. 4).

When infection occurs, pathological exam shows a different pattern of collagen tissue: a less compact neoformed tissue on both surfaces of the prosthesis is evident with a great number of inflammatory cells (especially lymphocytes) and microorganisms. Areas of fragmentation can be observed on the prosthesis

surface, and the small pores of the biomaterial permit accumulation of bacterial colonies (18). Both in infected and non infected implants encapsulation of prosthesis by compacted neoformed tissue occurs, but tissue integration of the infected ePTFE is generally scarce so the infected prosthesis “floats” in the surrounding fluid collection and can be retracted by inflammatory neoformed tissue (rippling effect on CT exam).

The CT-scan images of the infected prostheses were pathognomonic in our patients: the mesh appears not uniformly expanded, with an undulated profile, retracted in particular in the central portion and corrugated towards the midline. This undulated profile is probably the result of tissue retraction around the prosthesis due to the infected scar and can be related to the inflammatory tissue which does not consent a normal implant consolidation process (18). The infected mesh appears “rejected”, as happens in other cases of “foreign body” reaction.

Conclusion

The CT-scan sign (rippled mesh) we are here reporting can be useful in distinguishing infected prostheses when clinical differential diagnosis between seromas and infected fluid collections is dubious.

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