

## Case report

# Evaluation of the clinical-immuno-radiological and legal consequences in the presence of post-surgical gossypiboma

M.D. Maldonado<sup>a,\*</sup>, J. Romero-Aibar<sup>b</sup><sup>a</sup> Department of Medical Biochemistry, Molecular Biology, and Immunology, University of Seville Medical School, Spain<sup>b</sup> Virgen del Rocío University Hospital in Seville, Andalusian Health Service, Spain

## ARTICLE INFO

Handling Editor: Wilma Duijst

## 1. Introduction

One of the risks of invasive open or non-endoscopic surgery is the possibility of leaving surgical material inside the patient's body through the surgical field. In most cases, 70% of this is usually textile material, such as gauze, compresses, or dressings. They are therefore also called textilomas, compressomas, gasomas, oblitomas, or oblitomas<sup>1</sup>. Anglo-Saxon physicians coined a term for this peculiar postoperative syndrome, which they called gossypiboma (from the Latin Gossypium, cotton, and oma, tumour)<sup>2</sup>.

Gossypiboma represents a medical emergency that will depend on the affected anatomical region, the time of evolution, the patient's age, and comorbidities, and even the type of forgotten material that has generated condition<sup>3</sup>. In most cases, the radiology and imaging department gives the definitive diagnosis and pinpoints the location of the foreign body<sup>4</sup>.

This is because in 1929 Cahn<sup>5</sup> introduced, for the first time and as a preventive measure, that all gauze and compresses used in the operating theatre for field cleaning, haemostasis, restraint, etc. Should be banded with radiopaque material so that if they were accidentally left inside the patient, they could be diagnosed and located with a simple X-ray<sup>6</sup> (Fig. 1). However, it took 11 years for this practise to be generally implemented in all hospitals<sup>5,7</sup>. The radiologically visible thread is made of polypropylene mixed with 65% barium sulphate. It is a compress with two overlapping layers of nonwoven fabric, and the radiologically visible thread is placed between the two surfaces<sup>8,9</sup>.

Such materials are usually recognised by our immune system as foreign bodies, which will be activated with the aim of destroying or

encapsulating them. A reaction like the one that would occur when we are infected by pathogens, with the difference that microbes are usually destroyed by acute inflammatory reactions that resolve the situation. The forgotten textiloma, not being biological material, cannot be destroyed by the immune system, so it will remain activated for a long time, causing abnormal chronic inflammatory reactions that do not resolve the situation, but isolate it by strong fibrosis as part of its response. This textile material can remain inside the organism, asymptotically or with nonspecific symptomatology, for years, making diagnosis very difficult. On the other hand, gossypiboma can sometimes manifest itself a few days or months after surgery, with painful discomfort in the area, fever with no apparent source, palpable mass, or fistulization of the surgical incision<sup>10</sup>. Additionally, gossypiboma occurs more frequently after intraabdominal operations and, although both sexes can be affected by gossypibomas, women are at increased risk due to obstetric and gynecological interventions related to pregnancies, and other associated pathologies<sup>11</sup>. All these premises and symptoms in a patient who arrives at the emergency department with a history of surgery should lead us to suspect the possibility of surgical negligence and to make the differential diagnosis of any postoperative case with unresolved or unusual problems<sup>12</sup>.

Risk factors that facilitate the occurrence of gossypiboma include<sup>1,2,13,14</sup>:

1. Patient-dependent risk factors: morbid obesity and heavy bleeding.
2. Surgery-dependent risk factors: very long, unplanned, and last-minute emergency operations; last-minute changes in surgical techniques to be performed; absence of counting of the textile material used in the surgery; complexity of the surgery itself; incorporation/

\* Corresponding author. Department Medical Biochemistry, Molecular Biology, and Immunology, University of Seville Medical School, Avda. Sánchez Pizjuán 4, 41009, Seville, Spain.

E-mail address: [aibar@us.es](mailto:aibar@us.es) (M.D. Maldonado).

<https://doi.org/10.1016/j.jflm.2023.102574>

Received 4 May 2023; Received in revised form 22 June 2023; Accepted 31 July 2023

Available online 4 August 2023

1752-928X/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### Abbreviations

CT	Computed Tomography Scan
Simple X-ray	Plain radiography
MRI scan	Magnetic resonance
TNF-alpha	Tumour necrosis factor-alpha
TNF-beta	Tumour necrosis factor-beta
MCF	Macrophage chemotactic factor
IL-1beta	Interleukin-1beta
IL-3	Interleukin-3
IL-6	Interleukin-6
IL-8	Interleukin-8
IL-12	Interleukin-12
GM-CSF	Granulocyte and monocyte colony-stimulating factor
WHO	World Health Organization

departure during the operation of assistant surgeons in teaching hospitals, and heavy bleeding during the operation.

3. Surgeon-dependent risk factors: tiredness and fatigue from long periods of work; changes in exposure to surgical fields; lack of surgeon leadership and discipline; use of mobile phones during surgery.
4. Risk factors dependent on nursing and auxiliary personnel: shift changes during surgery; poor communication between operating theatre staff; fatigue and tiredness.

The aim of this study was to analyse and describe the signals sent by the patient's immune system, postoperatively, to indicate that something had gone wrong with the surgery, to make recommendations and preventive measures to improve pre- and postoperative safety.

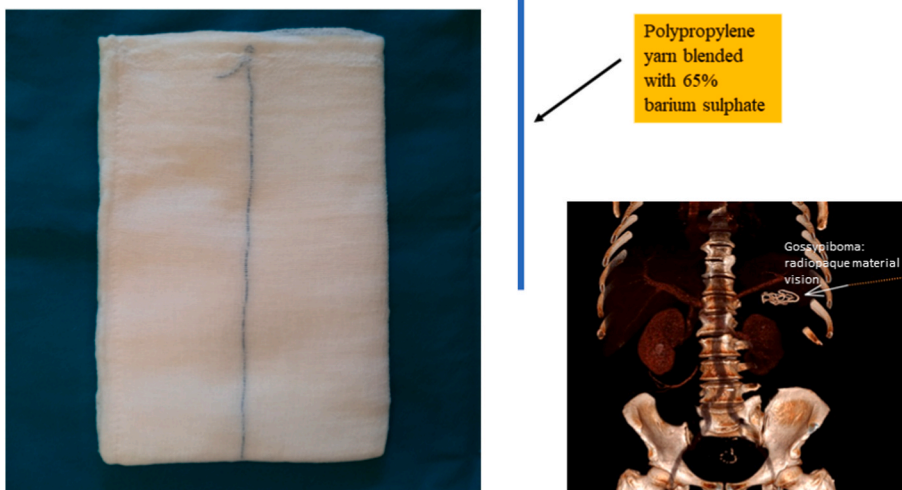
## 2. Presentation of case

A 59-year-old male patient underwent partial nephrectomy for a left renal tumour measuring 4 cm in diameter. Diagnosed by pathological anatomy as renal cell carcinoma with WHO grade 2 clear cell pattern and without peritoneal adipose tissue infiltration or signs of vascular invasion. The neoplasm was delimited by a pseudo capsule and normal renal parenchyma, with haemorrhage areas with abundant macrophage reaction and without necrosis. The operation was performed by laparotomy on the left flank (Fig. 2). The patient's personal history included metformin-treated type II diabetes and had undergone surgery for stage IIIB pT3 N1b adenocarcinoma of the colon two months earlier,

synchronous with renal tumour, so adjuvant treatment was not started for the adenocarcinoma of the colon. After the kidney operation, the urologists informed the family that the operation went well and the patient started a gradual recovery at home. During recovery, the patient complained of persistent asthenia that limited his daily activity and affected his mood, which became depressive. Thirty-eight days after the operation, the patient was examined by the urologists: at palpation, he complained of pain in the left lateral flank, the wound evolved awkwardly, revealing a raised, hard, painful and warm lump with a crescent-shaped morphology and the patient was informed that it would be reabsorbed over the days, advising him to wear a compressive bandage. Two days later, the patient came to the emergency department of the hospital because the surgical wound was fistulated, with the excretion of abundant bloody and purulent material. Laboratory tests showed: anemia with a haemoglobin (g/dl) of 11.7 and hematocrit (%) of 39.5; leukocytosis ( $\times 10^3/\text{ul}$ ) with 14.83 at the expense of neutrophils 8.5; eosinophils 1.54 and slightly increased monocytes 1.79. The patient was sent home with antibiotic coverage and no imaging tests were performed. Ten days after the visit to the emergency department, the patient was admitted to the hospital for surgery for a gossypiboma, due to a surgical compress forgotten in the left renal fossa, diagnosed by CT scan of the protocol for his oncological pathology. The textiloma was removed by means of a new surgical intervention and the patient is currently recovering at home, with a strong tension in the area.

## 3. Discussion

Fortunately, the presence of a gossypiboma after surgery is rare and has a low incidence. Although not exactly known, published studies give values of 1 case/100–3000 of all surgeries performed and 1/1000–1500 among abdominal surgeries, where it occurs most frequently<sup>8,9,15,16</sup>. These data should be viewed with suspicion, as they show an excessively low incidence, in part because many cases of gossypiboma go unreported, due to the medical legal implications that accompany them<sup>1,17</sup> (Table 1). Furthermore, many patients with retained postoperative textile material remain asymptomatic for years, and a simple X-ray, for other medical indications, allows them to discover the presence of a gossypiboma by chance. Some patients who have suffered from gossypibomas do not report medical error because they must continue to be treated by the negligent doctor and fear that by complaining, they will no longer be treated. Therefore, it is very difficult to know the real incidence of gossypibomas in the different hospitals<sup>18</sup>. In most cases, the diagnosis of gossypiboma is made by the imaging service. In the present case, gossypiboma was revealed by a CT scan review. Figs. 3 and 4 shows an abdominal CT scan with intravenous contrast on multislice



**Fig. 1.** Band of radiopaque material (blue line) that all gauze and compresses used in surgery must carry. This allows that in case of iatrogenic forgetfulness of the textiloma by the surgeon in the body of the operated patient, it can be quickly recognised by various imaging techniques, facilitating diagnosis and treatment with extraction and cleaning. The image in the lower left corner of Fig. 1 corresponds to a multiplanar projection volume rendering (MPVR). It is a volumetric reconstruction where the radiopaque threads of the forgotten compress are clearly visible. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

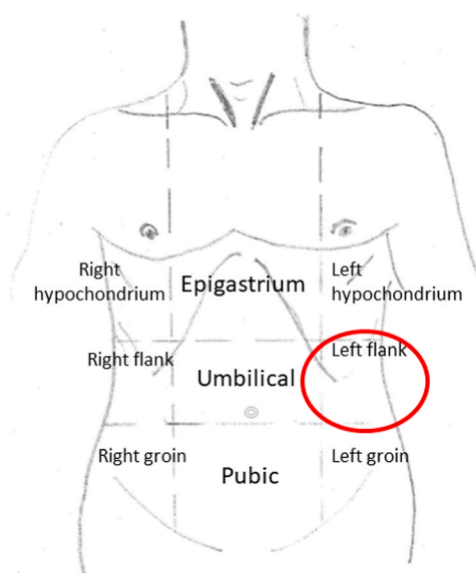


Fig. 2. Laparotomic incision in the left lateral flank for removal of a well encapsulated clear cell renal tumour of the left renal upper pole.

Table 1

Medico-legal consequences of a post-surgical gossypiboma.

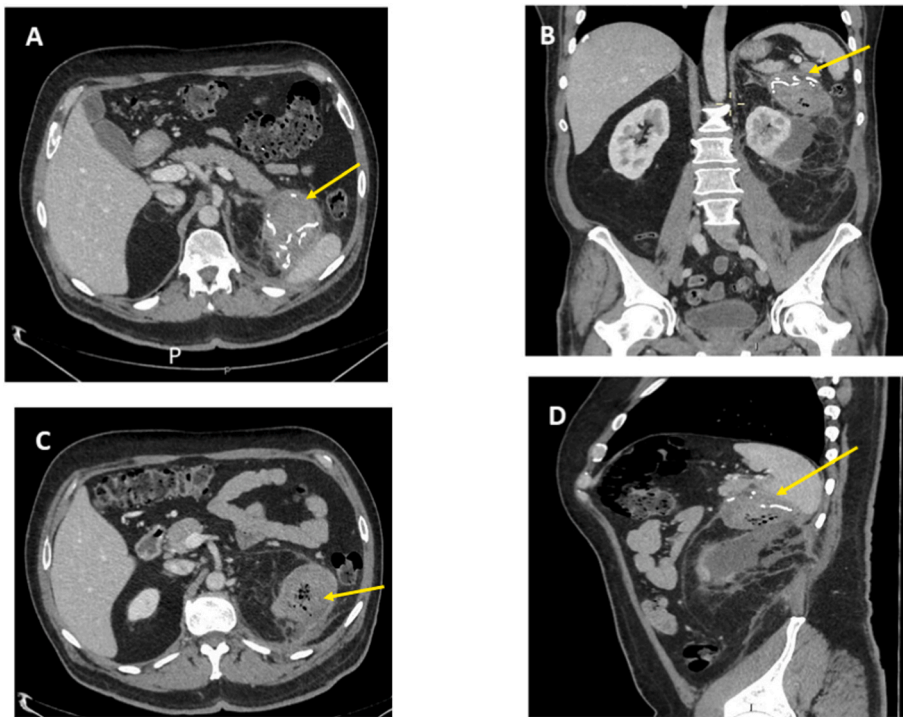
Social implications:
Lengthy and costly legal proceedings
Discredit for the hospital institution
Patients' mistrust in health services
Economic decline in health systems
Implications for the patient:
Financially and emotionally costly legal proceedings
Mistrust of the surgical team that has yet to care for you
A clumsy evolution of its original pathology with risks of:
Aggravation of the original pathology
Disability and dependency
Loss of organ function e.g., infertility
Loss of viscera or limbs
Exhausted immune system for adequate defence
Unrecoverable infection and death
Implications for hospital institutions:
Increasing the cost of patient care
Criminal prosecution and compensation
Discredit to the hospital institution
Forensic doctors, must assess the damage.

equipment showing a left nodular mass located in the posterosuperior portion of the left renal fossa with a well defined wall, clear contours, hydroaerial levels of microbubbles within it and long linear high-density images belonging to the radiopaque thread of the forgotten compress. These features of the contrast-enhanced CT images of the patient correspond to an acute-subacute phase of the complication, 54 days with the compress retained in the patient's body. Thus, the gossypiboma mass shows a hyperdense capsule and a spongy pattern with air bubbles when contrast medium is administered. This sign may not be seen in chronic cases due to air absorption<sup>14</sup>. Gauze or compresses retained in the body for a short period of time, days, or weeks, usually present an acute inflammation of an exudative nature, with infection and abscess formation; whereas those retained for longer periods or even years usually present a chronic fibrotic inflammation due to capsulation of the retained foreign body within the scar tissue<sup>19,20</sup>.

Purulent and infected collections can fistulize in less resistant tissues such as the skin, gastrointestinal lumen, bladder, or vagina, eroding

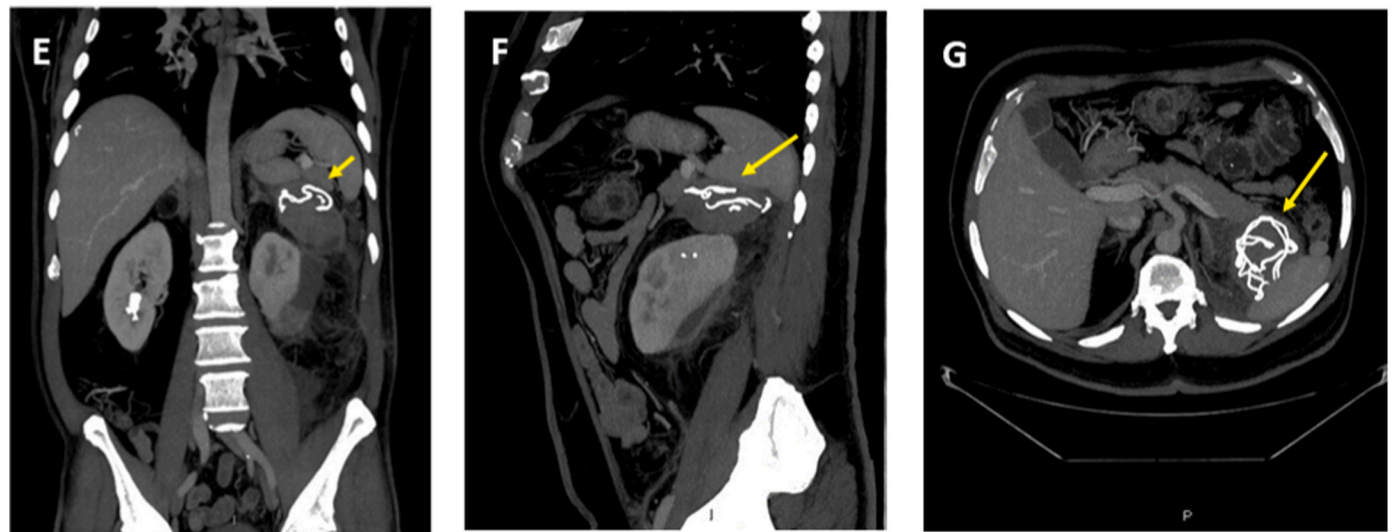
these tissues<sup>10</sup>. As it is a condition not anticipated and unthought, it is often misdiagnosed, and unnecessary radical surgical procedures are performed<sup>21</sup>. In the clinical case in question, the patient had a rapid postoperative evolution that forced him to visit the emergency services twice, with a tumour mass in the surgical wound, fever, pain, and tightness of the area, finally fistulising through the skin, draining a purulent collection through the surgical wound. Although it is assumed to be an unintentional medical error, gossypiboma can be a negligence on the part of the surgeon, with minor or serious consequences for the patient's health. Thus, the gossypiboma that appeared in the patient in our clinical case prevented the patient from being treated by oncologists with chemotherapy, as chemotherapy is only effective when administered within two months after the tumour has been removed. Non administration of chemotherapy, due to the lengthening of the post-operative convalescence period due to gossypiboma, increases the risk of the patient developing recurrence or metastasis of the original tumour and would entail civil, criminal, and deontological responsibilities.

The immune system is designed to attack everything that is foreign to it, and thus defend us from external invaders, educated in self-tolerance and rejection of what is not our own, be it microbes, toxic substances, cancerous or defective cells, ... etc. Sometimes, when it cannot destroy the foreign invader, it forms a granuloma that isolates it from the rest of the organism, thus containing the aggressor agent. This is a delayed cellular response of type IV of the Gell and Coombs 1963 classification. A hypersensitivity response led by Th1 lymphocytes and their cytokines, which will involve the arrival of other cells at the focus such as macrophages, epithelioid cells, CD8<sup>+</sup> Tc lymphocytes, fibroblasts, etc. A chronic inflammation with the characteristic granulomatous pattern usually appears 24–48 hours after exposure to antigen<sup>22</sup>. Under normal conditions, immune responses eradicate infectious microorganisms without damaging host tissues. However, when the invader is a foreign body, as in the present case (a surgical drape of non-absorbable material with a cotton matrix), the immune system cannot destroy it and so mounts a granulomatous hypersensitivity response, characterised by the persistence of the foreign body that will trigger the activation and arrival at the focus of macrophages of innate immunity. Macrophages initially try to engulf the textiloma, stimulated by INF-gamma and other cytokines released by the Th1 lymphocyte CD4<sup>+</sup>, to destroy it but without success<sup>23</sup> (Fig. 5). The exhausted Th1 CD4<sup>+</sup> lymphocytes, unable to get macrophages to eliminate the foreign body, decrease or inhibit the



**Fig. 3.** Contrast-enhanced CT scan of the abdomen in multislice equipment. Nodular image located in the posterosuperior portion of the left renal fossa, well delimited and measuring 79 × 72 × 49 mm (antero-posterior x transverse x craniocaudal) of heterogeneous density, predominantly hyperdense, with air microbubbles in its interior and linear images of high density and elongated length, compatible with a postsurgical gossypiboma.

**A:** Axial image with nodular lesion and hyperdense linear images corresponding to the forgotten compress. **B:** Idem in coronal section. **C:** Axial image showing the nodular lesion with air microbubbles inside. **D:** Idem in sagittal section.



**Fig. 4.** **E:** Coronal image with maximum intensity projection (MIP) showing a rounded mass containing linear strips of radiopaque material adjacent to the posterosuperior region of the left renal fossa. **F:** Sagittal image with MIP and **G:** Axial image with MIP all showing the same lesion.

production of cytokines and macrophages do not receive their stimulating effect and the foreign body persists for long periods of time, even years, causing granulomatous lesions with peripheral fibrosis and central necrosis due to anoxia, as blood vessels tend to infarct in the periphery of the lesions<sup>19,24</sup>. After five years of evolution, the granuloma may eventually disintegrate, calcify, and, in some cases, even ossify<sup>25</sup>. In the clinical case described in this article, the patient's immune system started to show signs that something was wrong already in the post-operative period. For example, the patient had fever, probably due to the action of pro-inflammatory cytokines released by activated macrophages acting as endogenous pyrogens (TNF-alpha, IL-1beta, IL-6, IL-8, IL-12); swelling and heat in the surgical wound as a consequence of acute inflammation that built up around the forgotten compress; the surgical wound, despite systematic dressings by the nursing staff, was

not closing and the dressings stained with purulent discharge. The patient's immune system, which should be busy fighting the renal cancer for which it was operated on, is diverted and expends energy on fighting a forgotten surgical compress, with accompanying complications such as: a) an exhausted immune system which reduces the antitumor activity; b) adhesions to other tissues due to fibroblast and collagen activation; c) organ and tissue obstructions that can lead to organ and tissue malfunction; d) systemic allergic reactions due to an eosinophilic infiltrate by the generated microfibrillar collagen e) sepsis or infection. All this implies a surgical reintervention for the removal and cleaning of the forgotten foreign body<sup>13,26</sup>. When a patient with a surgical history comes to the emergency department with this set of symptoms, gossypibomas should be considered in the differential diagnosis along with disorders such as abscesses, organised haematomas, cysts in any location

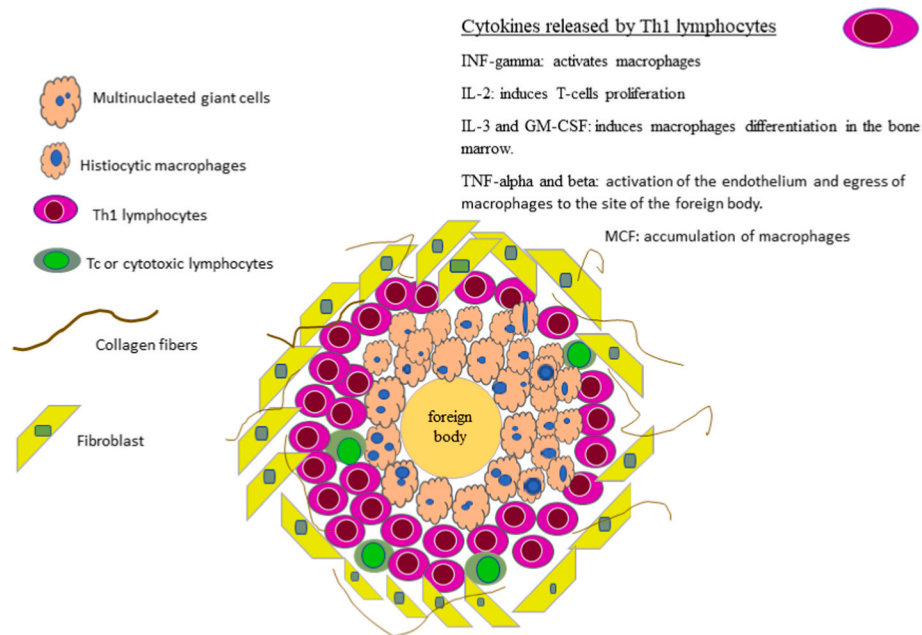


Fig. 5. Granulomatous hypersensitivity reaction generated around the gossypiboma with central necrosis and anoxia.

and dependent on organs, tumour lesions, pseudocystic masses, fecalomas, and tuberculous masses, among others.

Prevention of such complications is essential to avoid further comorbidities and, in some cases, even death<sup>27</sup>. This prevention involves a thorough count of surgical drapes and instruments before closing the surgical field, involving the entire team, including nursing and auxiliary personnel; always use surgical drapes with radiopaque thread; and the use of radiographic or radiofrequency controls (radiofrequency blankets placed on the operating table or the use of wands) is also considered to have a favourable cost/benefit ratio<sup>12,16,28–31</sup>.

#### 4. Conclusions

Gossypiboma is an adverse event in which textile material remains in the patient's body after surgery. This event complicates the post-operative evolution, causing hyperactivation of the immune system leaving it exhausted for adequate defence, resulting in increased morbidity and mortality for the patient due to infection and sepsis. Knowing risk factors and adopting preventive habits, such as a careful counting of the material used in each surgery, are fundamental to avoiding them.

#### 5. Ethics statement

This study was conducted in accordance with the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" and written informed consent was obtained from the patient for publication, of this case report and any accompanying images included in this article, according to the specifications established by the Ethics Committee of the University of Seville for the publication of clinical cases.

#### Data availability statements

Data supporting the findings of this study are available at SAS (Andalusian Health Service Spain). Restrictions apply to the availability of these data, which were used under license for this study. The data have been made available, to the authors, with the permission of affected patient.

#### Authors' contributions

MDM conducted the literature review, interpreted the immunological and clinical data of the patients and she was the major contributor to the manuscript. JRA participated in the care and analytical follow-up of the patient as a senior laboratory technician and helped in revising the manuscript.

#### Declaration of competing interest

Author 1 MD. Maldonado has no financial disclosures.  
Author 2 J. Romero-Aibar has no financial disclosures.

#### Acknowledgements

This work was supported by Seville University (Immunology area), Department of Medical Biochemistry, Molecular Biology, and Immunology.

#### References

- Mota-Ramirez GA, Mayor MC, Gonzalez-Burgos O, et al. Forgotten surgical material: gossypiboma, textiloma, gasoma. *An Rad Mex*. 2007;4:285–296. <https://www.analesderadiologiamexico.com/temp/2007/4,%202007/Anrx074-04.pdf>.
- Borr  ez AO, Borr  ez AB, Orozco M, Matzalik G. Abdominal foreign bodies: case report and literature review. *Rev Colomb Cir*. 2009;24:114–122. <http://www.scielo.org.co/scielo.php?script=sci>.
- Contreras MJD, Salda  a DY, Jim  nez RMA, et al. Foreign bodies, from neglect to emergency. Timely radiographic diagnosis and literature review. *An Rad Mex*. 2002; 1:557–564. [https://www.analesderadiologiamexico.com/previos/ARM%202002%20Vol.%201/ARM\\_02\\_1\\_4\\_Octubre-Diciembre/arm\\_02\\_1\\_2\\_4\\_557-564.pdf](https://www.analesderadiologiamexico.com/previos/ARM%202002%20Vol.%201/ARM_02_1_4_Octubre-Diciembre/arm_02_1_2_4_557-564.pdf).
- Tinker MA, Burdman D, Deysine M, et al. Granulomatous peritonitis due to cellulose fibers from disposable surgical fabrics: laboratory investigation and clinical implications. *Ann Surg*. 1974;180:831–835. <https://doi.org/10.1097/0000658-197412000-00006>.
- Rymer CA, McCarthy JD. A silent sponge speaks. *Am J Surg*. 1974;128:103–104. [https://doi.org/10.1016/0002-9610\(74\)90245-1](https://doi.org/10.1016/0002-9610(74)90245-1).
- Shyung LR, Chang WH, Lin SC, et al. Report of gossypiboma from the standpoint in medicine and law. *World J Gastroenterol*. 2005;11:1248–1249. <https://doi.org/10.3748/wjg.v11.i8.1248>.
- Lincourt AE, Harrell A, Cristiano J, et al. Retained foreign bodies after surgery. *J Surg Res*. 2007;138:170–174. <https://doi.org/10.1016/j.jss.2006.08.001>.
- Crossen HS, Crossen DF. *FOREIGN BODIES LEFT IN the ABDOMEN. The Surgical Problems. Cases, Treatment, Prevention. The Legal Problems. Cases, Decisions, Responsibilities*. St. Louis: Mosby Company; 1940. Published by.

9. Verna C, Gibbs MD. *Did We Forget Something?* PSNet; 2003. <https://psnet.ahrq.gov/web-mm/did-we-forget-something>.
10. Dore MP, Errigo A, Pes GM. Gossypiboma: an unexpected guest in the stomach. *Clin Gastroenterol Hepatol*. 2022;20:A29–A30. <https://doi.org/10.1016/j.cgh.2022.04.001>.
11. Umunna J. Gossypiboma and its implications. *J West Afr Coll Surg*. 2012;2:95–105. <https://pubmed.ncbi.nlm.nih.gov/25453006/>.
12. Biswas RS, Ganguly S, Saha ML, et al. Gossypiboma and surgeon- current medicolegal aspect - a review. *Indian J Surg*. 2012;74:318–322. <https://doi.org/10.1007/s12262-012-0446-3>.
13. Gawande AA, Studdert DM, Orav EJ, et al. Risk factors for retained instruments and sponges after surgery. *N Engl J Med*. 2003;348:229–235. <https://doi.org/10.1056/NEJMs021721>.
14. Charter-Cure G, Fonnegra-Caballero A, Baldion-Elorza AM, et al. Gossypiboma in neurosurgery. Case report and literature review. *Neurosurgery (Baltim)*. 2009;20:44–49. <https://doi.org/10.4321/s1130-14732009000100006>.
15. Magalini S, Sermoneta D, Lodoli C, et al. The new retained foreign body. Case report and review of the literature on retained foreign bodies in laparoscopic bariatric surgery. *Eur Rev Med Pharmacol Sci*. 2012;16:129–133. <https://pubmed.ncbi.nlm.nih.gov/23090829/>.
16. Steelman VM, Shaw C, Shine L, et al. Retained surgical sponges: a descriptive study of 319 occurrences and contributing factors from 2012 to 2017. *Patient Saf Surg*. 2018;12:20–28. <https://doi.org/10.1186/s13037-018-0166-0>.
17. Alemu BN, Tiruneh AG. Gossypiboma: a case series and literature review. *Ethiop J Health Sci*. 2020;30:147–149. <https://doi.org/10.4314/ejhs.v30i1.19>.
18. Kaiser CW, Friedman S, Spurling KP, et al. The retained surgical sponge. *Ann Surg*. 1996;224:79–84. <https://doi.org/10.1097/0000658-199607000-00012>.
19. Regueiro P, Mateo EM, López A, et al. Foreign body simulating kidney tumour. *Actas Urol Esp*. 2004;28:390–392. [https://doi.org/10.1016/s0210-4806\(04\)73095-8](https://doi.org/10.1016/s0210-4806(04)73095-8).
20. Wan T, Le L, Riskin M. Improving safety in the operating room: a systematic literature review of retained surgical sponges. *Curr Opin Anesthesiol*. 2009;22:207–214. <https://doi.org/10.1097/ACO.0b013e328324f82d>.
21. Rajagopal A, Martin J. Gossypiboma—"a surgeon's legacy": report of a case and review of the literature. *Dis Colon Rectum*. 2002;45:119–120. <https://doi.org/10.1007/s10350-004-6124-1>.
22. Abbas AK, Lichtman AH, Pillais S. *Cellular and Molecular Immunology*. 10<sup>th</sup> Edition. Spain: Elsevier; 2022, 978-84-1382-206-8.
23. Doan T, Lievano F, Swanson-Mungerson M, et al. *Immunology*. 3<sup>rd</sup> Ed. USA: Wolters Kluwer; 2021, 978-19-75151-33-1.
24. Rich R, Fleisher A, Shearer T, et al. *Clinical Immunology Principles and Practices*. 5 ed. USA: Elsevier; 2019, 9788491134763, USA.
25. Balcazar-Rincon LE, Gordillo-Gomez EA, Ramirez-Alcantara YL. Intestinal occlusion secondary to surgical obliteration. *Surg Surgeons*. 2016;84:503–508. <https://doi.org/10.1016/j.circir.2015.06.035>.
26. Brown J, Feather D. Surgical equipment and materials left in patients. *Br J Perioperat Nurs*. 2005;15:259–262. <https://doi.org/10.1177/175045890501500603>, 264-5.
27. Gomes ET, Galvão MCB, Shimoda GT, et al. Surgical counts in open abdominal and pelvic surgeries in a university hospital: a best practice implementation project. *JBI Evid Implement*. 2021;19:84–93. <https://doi.org/10.1097/XEB.0000000000000253>.
28. Steelman VM, Alasagheir MH. Assessment of radiofrequency device sensitivity for the detection of retained surgical sponges in patients with morbid obesity. *Arch Surg*. 2012;147:955–960. <https://doi.org/10.1001/archsurg.2012.1556>.
29. Steelman VM, Shaw C, Shine L, et al. Unintentionally retained foreign objects: a descriptive study of 308 sentinel events and contributing factors. *Joint Comm J Qual Patient Saf*. 2019;45:249–258. <https://doi.org/10.1016/j.jcjq.2018.09.001>.
30. DeWane MP, Haytham M, Kaafarani Md A. Retained surgical items: how do we get to zero? *Joint Comm J Qual Patient Saf*. 2023;49:1–2. <https://doi.org/10.1016/j.jcjq.2022.11.005>.
31. Carmack A, Valleru J, Randall K, et al. A multicenter collaborative effort to reduce preventable patient harm due to retained surgical items. *Joint Comm J Qual Patient Saf*. 2023;49:3–13. <https://doi.org/10.1016/j.jcjq.2022.09.005>.