



REVIEW ON GOSSYPIBOMA: THE RETAINED SURGICAL SPONGE

¹Vivek G, ²Harshitha M, ³Md Naveed Ashraf, ⁴Suneetha TB

¹B.E Student, ²B.E Student, ³B.E Student, ⁴Head of Department Biotechnology

¹Department of Biotechnology,

¹Acharya Institute of Technology, Bangalore, India

Abstract:

Gossypiboma possesses a serious problem for the patient as it is life-threatening and leads to medico-legal problems. Gossypiboma should be diagnosed as early as possible to give better treatment and thus decrease the mortality rate. Diagnosing of retained surgical bodies is done by radiological studies that include CT scanning, MRI scanning, ultrasonography, plain radiography and radio frequency identification chips. Patients undergoing cardiac surgery usually have a high risk of sternal wound infection which is caused by microorganisms. Preoperative antibiotic prophylaxis is administered to the patients before cardiac surgery to reduce or eliminate the sternal wound infection. Preoperative antibiotic prophylaxis reduces the risk of postoperative infections. Use of gentamicin impregnated sponge along with preoperative antibiotic prophylaxis is more effective in case of cardiac surgery. This paper mainly focuses on the microorganisms that cause infection through retained surgical sponge, clinical manifestations of gossypiboma, diagnosis of gossypiboma and its preventive measures.

Keywords: Gossypiboma, sternal wound infection, radiological studies, preoperative antibiotic prophylaxis, gentamicin-collagen sponge.

1. INTRODUCTION

The retained foreign object in the body cavity after the surgery is called gossypiboma. The foreign objects which are retained in the body cavity may be sponges, scissors, needles, towels, forceps and rubber materials. Gossypiboma may occur due to poor attention during the sponge count, emergency surgery, modification of operation, high body index, profuse bleeding and many other factors [1].

Microorganisms have an active role in the infection caused by retained surgical sponge. The bacteria coagulase-negative *staphylococcus* caused around 46% and *Staphylococcus aureus* caused around 26% of total mediastinitis cases [2]. The microorganisms enter into the body during the surgery by adhering to the surgical instruments [3].

The clinical manifestation of gossypiboma may be non-specific and may take weeks, months or even years from the time of the initial surgery. Hence, diagnosis may be late and thus may increase the mortality rate. However, some cases of gossypiboma show symptoms within weeks, such reactions are called acute manifestations and in few chronic cases where retained sponges are found after months or years. In such chronic cases, patients report pain and irritation for a long time [1].

Retained surgical bodies in the body cavity can be diagnosed preoperatively by radiological studies like plain radiography, ultrasonography, computerized tomography, magnetic resonance imaging and gastrointestinal contrast series [4].

Many advancements are occurring in recent times for preventing the gossypiboma. By proper counting, the surgical materials used in the surgery at the beginning and before the site of surgery is closed [5]. By supplying the antibiotics before the surgery can prevent the infection. This process is called preoperative antibiotic prophylaxis. The antibiotics used in this process kills the bacteria by bactericidal action. Also, during the cardiac surgery, the patient is supplied with the antibiotics before the surgery (preoperative antibiotics) and a gentamicin-collagen sponge is placed between the sternum to increase the efficiency of the wound healing without any infection [2].

2. INFECTION BY RETAINED SURGICAL SPONGE

The infection caused by the retained surgical sponge is majorly by the microorganisms. Gram-positive bacteria possess a thick peptidoglycan layer and do not have an outer lipid membrane whereas gram negative possess a thin layer of peptidoglycan and have an outer lipid membrane. *Escherichia coli* and *Pseudomonas aeruginosa* [gram-negative bacteria] and *Staphylococcus aureus* and *Staphylococcus epidermidis* [gram-positive bacteria] that are most commonly encountered bacteria which contaminate the bones and tissues in the body [6].

The common microorganisms that cause the sternal wound infection are *Staphylococcus aureus* and coagulase negative *staphylococci*. The bacterium coagulase negative *staphylococci* easily adhere to the operative substances such as stainless-steel wires used for the closure of the sternum and the sponges used during cardiac surgery. This bacterium after binding to the operative substances forms the biofilm which is of the polysaccharide, once the biofilm is formed it's very difficult to eliminate the bacterium [2].

Acinetobacter, *Klebsiella*, *Enterobacter cloacae*, and *Propionibacterium acnes* are the other bacteria that cause infection after the surgery [7,8].

3. CLINICAL MANIFESTATION OF GOSSYPIBOMA

Retained sponge's post-surgery are the foremost common foreign body retained after surgery within the body. Sponges could be retained in the innocuous in the body for shorter or longer durations prior to showing any symptoms. These sponges can retain in the internal cavity of the trachea, uterus, retroperitoneum and abdominal cavity (primarily observed in this region). The symptoms rely on the fabric of the sponge and site of occurrence of the sponge. However, symptoms are classified as:

3.1. Acute retention of sponges:

Acute reactions show symptoms as an inflammatory response, infection or swollen area containing pus in the course of a few days or weeks postoperative. Further, in some cases of retained surgical foreign bodies, they show aseptic inflammation or no infection, leading to nonspecific symptoms of the retained sponges. Acute infections caused by retained surgical sponge require immediate attention after the first surgical procedure for detection along with emergency surgery to retrieve retained sponge. The operative measures taken to remove retained sponge is more efficient when removed within two weeks after the first surgery which can be detected in x-ray and shows inflammation [9].

3.2. Chronic retention of sponges:

In case of a chronic reaction, symptoms are shown after months or a year. In this case, patients exhibit pain due to retained sponge post-surgery. Retained sponges for a long time often cause malignant tumours which could be detected by a CT scan or an MRI scan, retained sponges appear as a mass like a tumour. In this case, extensive diagnostic imaging could be done to distinguish between the retained sponge and a tumour mass [9].

In some cases, retained sponges give clinical signs of sepsis [10]. They also show inflammation around the retained surgical sponge and causes bowel obstruction [11]. A bowel obstruction refers to a blockage in the small or the large intestine. This also causes life-threatening complications like gastrointestinal bleeding from the upper gastrointestinal tract which requires immediate treatment [12].

4. DETECTION OF GOSSYPIBOMA

Retained surgical bodies that are retained after surgery can be diagnosed preoperatively with the help of radiological studies like plain radiography, ultrasonography, computerized tomography, magnetic resonance imaging, and gastrointestinal contrast series [4]. Recent advancements have been developed like radiofrequency chip identification by bar code scanner [13].

ULTRASONOGRAPHY: Ultrasonography is one of the diagnostic methods to diagnose retained surgical sponge [14]. In ultrasonography, we observe brightly echogenic wavy structures present in cystic mass which shows acoustic shadow behind. acoustic shadow refers to the area where sound waves fail to propagate. acoustic shadowing observed behind changes with the direction of an ultrasound beam.[15]

COMPUTERISED TOMOGRAPHIC SCANNING: Computerized tomographic scanning commonly known as CT Scan helps in diagnosing the retained surgical sponge. CT Scan shows gas molecules trapped in between the fibers of surgical sponge and existence of the calcium within the cavity membrane in long-standing cases [16]. However, all these features are not different from another intraabdominal abscess [15].

MAGNETIC RESONANCE IMAGING[MRI]: It is cited as MRI scanning which is employed to diagnose chronic retained surgical bodies in the body cavity. MRI scan shows the presence of mass by displaying signal intensity which varies with the amount of fluid and protein accumulation [17].

GASTROINTESTINAL CONTRAST SERIES: Gastrointestinal contrast series is an X-Ray evaluation of the upper alimentary canal. In these test series oesophagus, stomach, and duodenum are found in x-ray film by the liquid suspension. In this case, any retained surgical bodies can be diagnosed in the X-Ray film.[18]

RADIOFREQUENCY IDENTIFICATION: Most of the time, gauze sponges are retained accidentally in the body cavity during surgery. Gauze sponge refers to disposable medical sponges used in surgery. Radio Frequency identification tags have a barcode printed on it with the help of this they can detect if it's remained in the body. Implementation of embedding the radio frequency identification tags extend a greater chance of decreasing instances of retention of surgical sponges [19].

5. DETECTION OF GOSSYPIBOMA

A retained medical instrument is considered to be any item left behind a patient's body throughout the surgery is called as Unintended Retention of Foreign Body. This is said to be dangerous and harmful to the operated patient. An event organized by the Sentinel from the Joint Commission in 2013 notified clinicians regarding the risks of retention of foreign objects [20].

However, many advancements are occurring in recent times to prevent the retention of surgical bodies. Some of the measures are:

5.1. Counting the surgical instruments:

Counting the surgical materials used while performing the surgery is the responsibility of the surgical team according to the direction of the head member. There are 3 important risk factors responsible for retaining surgical bodies in the body cavity after the surgery, that includes emergency surgery, unplanned change in surgery, and surgical instrument count [15]. Based on this to avoid such circumstances instances, 4 separate counts of sponge and instruments has been advised:

- While organizing the surgical instruments and unpackaging of sponges.
- Before the surgery begins.
- When the closure begins.
- During skin closure [7].

5.2. Preoperative Antibiotic Prophylaxis:

The process of administering the anti-biotics prior to the surgery is called preoperative antibiotic prophylaxis. This helps to reduce the threat of postoperative infections. Majorly the antibiotics are administered intravenously. The time of administering the antibiotics may vary from different surgeries, but prophylactic antibiotics should be present in higher concentrations during the surgery and act efficiently. The antibiotics used are bactericidal, it means the targeted bacterium is killed. Certain antibiotics may act on the targeted bacterium by both bactericidal and bacteriostatic when they are present at a different dose. Vancomycin, gentamicin and cefazolin are three mainly used antibiotics during the surgery in adults. Limiting the duration is important, if this is not controlled then there is a chance to develop antibiotic-resistant bacteria which is more dangerous to treat. Also, it may cause allergic reactions in some patients [21].

5.3. Gentamicin impregnated collagen sponge in cardiac surgery:

Micromonospora purpurea is a bacterium that releases a chemical substance in the form of gentamicin. Gentamicin is an antibiotic substance which was discovered by the Weinstein, Wagman et al... [22]. Gentamicin belongs to the class of aminoglycoside antibiotics. Aminoglycosides do not cause allergic reactions because they have good chemical stability. Gentamicin antibiotic acts against both the class of bacteria i.e., gram positive and gram-negative bacteria. The amount of gentamicin is proportional to its bactericidal action [3]. These aminoglycosides bind to the 30S subunit ribosome of the targeted bacterium and stop the protein

synthesis which in turn kills the targeted bacterium^[23]. Collagen sponge possesses a biocompatible and biodegradable structure. Due to these structural characteristics, it is used in many medical applications. The gentamicin-collagen sponge is generally used to prevent infections after the surgery. The gentamicin-collagen sponge promotes wound healing due to the characteristics of gentamicin and the collagen. Once the sponge is placed after some time, the gentamicin is released over the site of surgery. The gentamicin-collagen sponge is used along with perioperative antibiotic prophylaxis to enhance the wound healing without causing any infection. The gentamicin-collagen sponge is placed in between the sternum halves during the cardiac surgery and by modifying the sternal closure method the incidence of wound infections after surgery decreased significantly^[2]. Generally, aminoglycosides will show the nephrotoxic and ototoxic effects. But the gentamicin-collagen sponge heals the wound without showing the nephrotoxic or ototoxic effect^[3]

6. CONCLUSION

Gossypiboma possesses a serious problem medically to the patients and legally to the doctors and the hospitals. The infection caused by the retained surgical sponge is mainly by the microorganisms mainly. *Pseudomonas aeruginosa*, *E. coli*, *S. epidermidis* and *S. aureus*. Based upon the symptoms they are classified into acute and chronic retention of sponge, chronic retention of sponges in the later stage turns into malignant tumours. In some cases, retained surgical bodies show clinical sepsis, bowel obstruction, and inflammation around the area of the retained surgical sponge. Gossypiboma should be identified at early stages to provide better treatment and thus decrease the mortality and morbidity rate. Preoperative antibiotic prophylaxis is the best method to prevent the infection caused by the gossypiboma. Usage of the gentamicin impregnated collagen sponge along with the preoperative antibiotic prophylaxis is more effective in preventing the sternal wound infection.

7. REFERENCE

- [1] Umunna, J. (2012, October). Gossypiboma and its implications. Retrieved September 27, 2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4220479/>.
- [2] Schersten, H. (2007). Modified prophylaxis for preventing deep sternal wound infection after cardiac surgery. *Apmis*, 115(9), 1025-1028.
- [3] Koziół, M., Targońska, S., Stażka, J., & Koziół-Montewka, M. (2014). Gentamicin-impregnated collagen sponge for preventing sternal wound infection after cardiac surgery. *Kardiochirurgia i torakochirurgia polska= Polish journal of cardiothoracic surgery*, 11(1), 21.
- [4] Şahin-Akyar, G., Yağci, C., & Aytaç, S. (1997). Pseudotumour due to surgical sponge: gossypiboma. *Australasian Radiology*, 41(3), 288-291.
- [5] Quraishi, A. (2012). Beyond a gossypiboma. Retrieved September 27, 2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3420082/>.
- [6] Kilian, O., Hossain, H., Flesch, I., Sommer, U., Nolting, H., Chakraborty, T., & Schnettler, R. (2009). Elution kinetics, antimicrobial efficacy, and degradation and microvasculature of a new gentamicin-loaded collagen fleece. *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, 90(1), 210-222.
- [7] Singh, K., Anderson, E., & Harper, J. G. (2011, February). Overview and management of sternal wound infection. In *Seminars in plastic surgery* (Vol. 25, No. 1, p. 25). Thieme Medical Publishers.
- [8] Friberg, Ö., Svedjeholm, R., Källman, J., & Söderquist, B. (2007). Incidence, microbiological findings, and clinical presentation of sternal wound infections after cardiac surgery with and without local gentamicin prophylaxis. *European Journal of Clinical Microbiology & Infectious Diseases*, 26(2), 91-97.
- [9] Zejnullahu, V. A., Bicaj, B. X., Zejnullahu, V. A., & Hamza, A. R. (2017). Retained surgical foreign bodies after surgery. *Open access Macedonian journal of medical sciences*, 5(1), 97
- [10] Mouhsine, E., Halkic, N., Garofalo, R., Taylor, S., Theumann, N., Guillou, L., & Leyvraz, P. F. (2005). Soft-tissue textiloma: a potential diagnostic pitfall. *Canadian Journal of Surgery*, 48(6), 495.
- [11] Manikyam, S. R., Gupta, V., Gupta, R., & Gupta, N. M. (2002). Retained surgical sponge presenting as a gastric outlet obstruction and duodeno-ileo-colic fistula: report of a case. *Surgery today*, 32(5), 426-428.
- [12] Erdil, A., Kilciler, G., Ates, Y., Tuzun, A., Gulsen, M., Karaeren, N., & Dagalp, K. (2008). Transgastric migration of retained intraabdominal surgical sponge: gossypiboma in the bulb. *Internal Medicine*, 47(7), 613-615.
- [13] "Initial clinical evaluation of a handheld device for detecting" <https://pubmed.ncbi.nlm.nih.gov/16847236/>. Accessed 27 Sep. 2020.
- [14] Sugano, S., Suzuki, T., Iinuma, M., Mizugami, H., Kagesawa, M., Ozawa, K., ... & Yabuta, M. (1993). Gossypiboma: diagnosis with ultrasonography. *Journal of clinical ultrasound*, 21(4), 289-292.
- [15] Singh, G., Dubhashi, S. P., & Jindal, N. (2013). Retained surgical sponge: An enigma. *Medical Journal of Dr DY Patil University*, 6(1), 98.
- [16] Sheward, S. E., Williams Jr, A. G., Mettler Jr, F. A., & Lacey, S. R. (1986). CT appearance of a surgically retained towel (gossypiboma). *Journal of computer-assisted tomography*, 10(2), 343-345.
- [17] Mochizuki, T., Takehara, Y., Ichijo, K., Nishimura, T., Takahashi, M., & Kaneko, M. (1992). Case report: MR appearance of a retained surgical sponge. *Clinical radiology*, 46(1), 66-67.

- [18] Upper Gastrointestinal Series. (n.d.). Retrieved September 27, 2020, from <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/upper-gastrointestinal-series>.
- [19] Rogers, A., Jones, E., & Oleynikov, D. (2007). Radiofrequency identification (RFID) applied to surgical sponges. *Surgical endoscopy*, 21(7), 1235-1237.
- [20] Preventing Retained Surgical Items is a Team Effort. (n.d.). Retrieved September 27, 2020, from <https://www.infectioncontroltoday.com/view/preventing-retained-surgical-items-team-effort>
- [21] Crader, M., & Varacallo, M. (2020). *Preoperative Antibiotic Prophylaxis*. [Ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov). Retrieved 26 September 2020, from <https://www.ncbi.nlm.nih.gov/books/NBK442032/#:~:text=The%20three%20antibiotics%20used%20in.who%20should%20receive%203%20g>.
- [22] Kumar, C., Himabindu, M., & Jetty, A. (2008). Microbial biosynthesis and applications of gentamicin: a critical appraisal. *Critical reviews in biotechnology*, 28(3), 173-212.
- [23] Konopska, B., & Warwas, M. (2007). Molekularne aspekty nefrotoksyczności antybiotyków aminoglikozydowych Molecular aspects of aminoglycoside nephrotoxicity. *Postepy Hig Med Dosw. (online)*, 61, 511-518.

