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NONTUBERCULOUS MYCOBACTERIA INFECTION FOLLOWING LAPAROSCOPIC HERNIA REPAIR

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Abstract: A 44 years male with umbilical hernia who underwent a planned laparoscopic surgery was readmitted after 6 weeks for swelling and abscess involving anterior abdominal wall. Gram smear and bacterial culture did not yield any organism. Diagnosis of atypical mycobacteria rapid grower was made which was confirmed later to be *M. fortuitum*. This case highlights the importance of strict aseptic precautions even during the minor procedures.

Keywords: Atypical mycobacteria, *M. Fortuitum,* Surgical Site Infections

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INTRODUCTION

Health Care-Associated Infections (HAIs) remain as an important public health concern. Amongst the prominent HAIs, Surgical Site Infections (SSIs) contributing to substantial rate of mortality, significant morbidity, considerable prolongation in length of hospitalization and added treatment expenses. Surgical site infections (SSIs) are the most common post-operative complications even in hospitals with most modern facilities and standard protocols of preoperative preparation and antibiotic prophylaxis. About 3-5% of patients who undergo elective surgery, develop SSIs. These are the third commonest nosocomial infections and account for approximately 10-40% of all health care associated (HAI) infections, which contributed 20% postsurgical readmissions as well. [1]

Surgical site infections (SSIs) are defined as infections of skin or underlying soft tissues at the surgical site, occurring within 30 days following National Healthcare Safety Network (NHSN) operative procedure in which an incision was closed primarily.[2]

CDC classifies SSIs in three categories: [3]

Superficial incisional SSI: Infection occurs within 30 days after any NHSN operative procedure, and involves only skin and subcutaneous tissue of the incision

Deep incisional SSI: Infection occurs within 30 or 90 days after the NHSN operative procedure and involves deep soft tissues (fascial and muscle layers) of the incision

Organ/Space SSI: Infection occurs within 30 or 90 days after the NHSN operation and infection involves any part of the anatomy (organs or spaces), other than the skin incision, fascia or muscle layers that is opened or manipulated during an operation

Laparoscopic surgery (LS), also termed minimal access surgery, has brought a paradigm shift in the approach to modern surgical care. Early postoperative recovery, less pain, improved aesthesis and early return to work have led to its popularity both amongst surgeons and patients. However, Laparoscopic Surgery has a whole lot of unique complications. Besides, major complications such as bowel or vascular injury, port-site infections (PSIs), port-site herniation, pyoderma gangrenosum, and metastasis at the port site following laparoscopic onco surgery are indolent but growing problem nowadays.[4]

Rate of PSI varied from 3.3% to 8% depending on area of reporting and type of surgery. [5] PSI is a type of surgical-site infection (SSI) confined to skin and soft tissue or rarely muscles around the ports through which surgeons gain access into the abdomen and present within a month of the operative procedure.

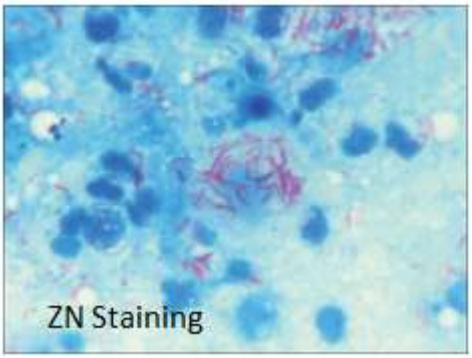
SSIs occur due to exposure of surgical wound to microbes which may be from an endogenous or exogenous source. The source of endogenous flora usually is from the patient's skin, mucous membranes or any of the viscera. The exogenous flora may be from any contaminated sources present in the sterile surgical field including surgeon and team, instruments, room air, etc [6] Infections following LS are broadly classified into two varieties based on the timing of presentation. [7] The "early type" occurs immediately within a week of surgery, by Gram-positive or Gram-negative bacteria which are contracted from endogenous source, the skin or bowel, and can be treated with commonly used topical or oral antibiotics. Second variety, the "delayed type," which has 3–4 weeks incubation period, is caused by rapidly growing NTM.

The clinical significance of Rapidly Growing Mycobacteria (RGM) has only recently been appreciated with increasing number of outbreaks, and cases of health care associated infections being attributed to them.[8] In almost all cases of nosocomial infections caused by this group of microorganisms, failure of adherence to sterilisation processes of surgical instruments, medical devices or solutions was noticed. [9]

Here, we present a case report on infection with *M. fortuitum*, rapidly growing Nontuberculous Mycobacterium following laparoscopic umbilical herniorraphy leading to abdominal wall abscess with the formation of a persistent discharging sinus.

CASE DETAILS:

A 44 years male with umbilical hernia was admitted in General Surgery ward. He underwent laparoscopic repair of Umbilical hernia with mesh. Post op period was uneventful and discharged. He was readmitted after 6 weeks for swelling and abscess involving anterior abdominal wall. He underwent emergency Incision & Drainage and 10 ml of pus drained from abscess cavity on further exploration severe inflammatory reaction noticed around prolene suture, then prolene suture removed. Pus was sent for AFB smear, culture & sensitivity.



Microbiological Investigations

Gram, Ziehl Neelsen and lactophenol cotton blue stains were done for bacteria, mycobacteria and fungi respectively. Gram's stain of the smear shows gram positive bacilli, and the AFB smear revealed numerous acid fast bacilli.

Then the pus is inoculated in blood, Macconkey, Sabourauds dextrose agar and Lowenstein Jensen medium for aerobic bacteria, fungi and mycobacteria respectively. BACT/ Alert bottle were also inoculated. Culture was also put on Robertson cooked meat media to exclude anaerobes. Growth was indicated to be positive in the BacT/ ALERT 3D system within two days of inoculation. L J media also showed growth of no pigmented colonies by the Fifth day. Smears were made from the growth, found to be positive for AFB. The isolate was initially labelled as rapidly growing mycobacteria by its rate of growth. The histopathology also showed granulation tissue suggestive of tuberculosis.

Growth on Blood agar

Growth on Mac Conkey agar

The growth on LJ media was further processed for additional tests to confirm the nontuberculous mycobacteria. Mycobacterial isolates were tested with TB Ag MPT64 Rapid test (SD Bioline). Report was negative indicating the isolate belongs to NTM.

TB Ag MPT64 Rapid test:

Test

Positive control

The pus sample was tested with Mycobacterium Tuberculosis (MTB) Real-time PCR Kit (Helini). It is specific for MTB complex (*M.tuberculosis, M.africanum, M.bovis, M.canettii, M.microti*). The report was negative indicating the sample does not contain MTB complex. The growths on LJ media were further processed for additional tests to confirm the identity of the organism. [10]

Test	*M.fortuitum*	*M.chelonae*	*M.abscessus*
Growth at 25°C	+	+ variable	+
Growth at 37°C	+	+	+
Nitrate reduction	+	_	_
Catalase	+	+	+
Aryl sulfatase test 3 days	+	+	+
Tolerance to 5% NaCl	+	_	+
Iron uptake	+	_	_
Beta galactosidase	_	+	+/_
Tween hydrolysis	+	_	+/_
Mannitol	_	_	_
Sodium citrate	_	+	_
Inositol	_	_	_

The isolate was confirmed to be *M. fortuitum* by its growth within 5 days on BacT/Alert, LJ media, LJ with Paranitrobenzoic acid (PNB), MacConkey agar, inability to form any pigment on LJ medium , tolerance to 5% NaCl , positive nitrate reduction test.

Antimicrobial susceptibility testing was carried out on Mueller-Hinton agar by the disc diffusion Kirby-Bauer method to the following antibiotic discs (HiMedia®, India): erythromycin (15 µg), amikacin (30 µg), imipenem, linezolid, cefoxitin, tigicycline, tetracycline (30 µg), ciprofloxacin (5 µg), co-trimoxazole (25 µg), and polymyxin B (300 µg) .

DISCUSSION:

Nontuberculous mycobacteria (NTM) are widely present in our environment, and they are found in natural recourses of water, dust, and also found in tap water. NTM is lacking the evidence of human to human transmission, but it infects to human from environmental sources. NTM can infect individuals irrespective of their immune status. They can lead to respiratory infections, lymphadenitis, skin and soft tissue infections, and rarely disseminated systemic illnesses. The increase in nontubercular mycobacterial (NTM) infections is a matter of serious public health concern.

Amongst the NTM, rapidly growing mycobacteria (RGM) are emerging in previously unrecognized settings, with new clinical manifestations. RGM are widely distributed in nature and have been isolated from water and soil, tap water being the major reservoir. Improvement in isolation and identification techniques has led to an increased awareness of the importance of RGM as human

pathogens. The RGM are generally defined as nontuberculous species of mycobacteria that show visible growth on solid laboratory media within 7 days. The species of RGM capable of producing disease in humans consist of species primarily belonging to the *M*. *fortuitum* group, the *M*. *chelonae abscessus* group and the *M*. *smegmatis* group. The species of RGM which are common human pathogens have different virulence levels in diverse clinical settings and also have different drug susceptibility patterns.

Infections caused by RGM include traumatic and surgical wound infections, skin and soft tissue infections, post injection abscesses, central nervous system (CNS) disease, pulmonary infections, bone and joint disease, and catheter-associated infections. Predisposing host conditions are the immunocompromised state (steroids, HIV, and malignancy) and chronic lung disease (cystic fibrosis). The *M*. *fortuitum* group accounts for the majority of the cases of localized cutaneous infections caused by RGM. Approximately 75% cases of disseminated cutaneous infections by RGM are due to *M*. *chelonae* and about 20% due to *M*. *abscessus*. The causative agent in most cases of pulmonary disease caused by RGM is *M*. *abscessus*. Rarely other RGM including *M*. *chelonae*, *M*. *smegmatis*, and *M*. *fortuitum* groups can be involved in pulmonary disease. Osteomyelitis after open fracture and secondary to puncture wounds is caused by the *M*. *fortuitum* group, *M*. *goodii*, and *M*. *wolinskyi*. The *M*. *smegmatis* group which was earlier considered as nonpathogenic is now known to cause both community acquired and healthcare-associated disease. RGM infections in HIV-negative patients are mostly due to *M*. *fortuitum* and *M*. *abscessus*. Skin and soft tissue infections by direct inoculation, surgical wound infections, and catheter-related sepsis in HIV-negative patients are mostly caused by *M*. *fortuitum*.

Infections due to RGM at the laparoscopic port site are a common menace encountered in patients undergoing laparoscopic surgery. These infections have been a source of significant morbidity for patients recovering from laparoscopic surgeries. Unlike open surgery, the instruments used for laparoscopic surgery have a layer of insulation that restricts the use of the autoclave in the sterilization process as the high temperatures involved destroy the insulation on them. The standard sterilization procedure has been a 20 minute exposure to 2.0 to 2.5% glutaraldehyde. At the current exposure time, these solutions act only as disinfectants and not sterilants thus allowing bacterial endospores to survive. Also, when proper mechanical cleaning of the instruments is not done, blood and charred tissue deposits are left in the joints of the instruments during laparoscopic surgery. These Contaminated instruments deposit the endospores on to the subcutaneous tissue during the surgery which then germinate following which clinical symptoms appear after an incubation period of 3 to 4 weeks. Wound infections due to RGM take some time to make their clinical appearance, when the operation scar breaks down and a non-healing superficial ulcer develops with discharging sinus. A high index of suspicion is needed for considering RGM as etiological agents, as the clinical

symptoms are often non-specific and unless suspected, these agents as causes of nonhealing wounds may often be missed. [12] Increasing NTM isolation may have important public health implications. In most regions of the world, NTM are not reportable public health diseases, so epidemiological data are not easily available. [13] However, data in published studies note increasing trends in the rate of NTM isolation from different geographic regions in the world.

Successful treatment requires both surgical treatment and combination of antibiotics. Antibiotics should be given based on their susceptibility report and also combination of antibiotics is preferable over single regimen. *M.fortuitum* responds to antibiotics like amikacin, quinolones, doxycycline and sulphamethaxole.[14] It has been recommended that to prevent recurrence, antibiotic treatment should be given for a minimum of at least three months, or at least 3 to 6 wk after the wound heals. [15]

In light of the current evidence and guidelines on hospital infection control, it is recommended that several steps be utilized to ensure proper sterilization of laparoscopic instruments and other invasive surgical devices.[16] The instruments should be thoroughly mechanically cleansed after each use, with complete dismantling of parts to ensure removal of all organic soil. Mechanical cleaning is preferred as it minimises handling and decreases the risk of exposure to infectious materials. In ultrasonicator the sound waves pass at frequency of 100,000 Hz in liquid and generate submicroscopic bubbles which later implode and create minute vacum that lifts the particles from the instruments. It is necessary to limit glutaraldehyde disinfectants and replace it with ethylene oxide gas sterilization, as this has been shown to be highly effective in reducing atypical mycobacterial infections following laparoscopy . [17]

When liquid chemical sterilants are used, higher concentrations (3.4%) must be used and the exposure time should be increased to 8–12 hours to activate sporicidal activity. These chemical can be used for maximum of a 100 cycles or a period of 14 days (2.5% glutaraldehyde) or 28 days (3.4% glutaraldehyde). The water used to rinse the instruments should be autoclaved to prevent recontamination with spores post sterilization. Conventional autoclave can be used for sterilization of the metallic cannula of the ports. The use of advanced sterilization systems such as STERRAD, which uses gas plasma technology to kill spores at low temperatures. Another option is to keep instruments for 24 hours in a formalin gas chamber. The instruments must be thoroughly cleansed and dried for this process to be effective, as the presence of dirt and moisture prevents the penetration of formalin gas, thus giving the same disastrous results. The use of disposable laparoscopic instruments is strongly advocated.

Efforts to limit nosocomial infections due to NTM have also focused on controlling NTM in water systems. Chlorine at high concentrations (1mg/L) is mycobactericidal. Although adequate levels may be present at the originating water treatment facility, chlorine levels at more distant points

in the distribution system may be inadequate to inhibit NTM proliferation. Many NTM may be killed or inhibited at sufficiently high hot water temperatures. Temporarily increasing water temperature to >70 ° C combined with flushing all faucets and showers was used to control colonization in hospital. Other less successful efforts to decontaminate hospital water have included the installation of filters or periodic flushing of water systems. [18]

CONCLUSION:

Rapidly growing mycobacteria are increasingly being implicated as a cause of surgical site infections. The RGM should be considered in the list of etiological agents for all cases of surgical site infections as its non-detection delays the diagnosis and treatment. The surgeons should follow sterilization protocols as per the guidelines.

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