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Original Research Article

Port Site Infection Due to Atypical Mycobacteria after Laparoscopic Surgery in Tertiary Care Hospital of Eastern India

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Abstract:

Introduction: Despite the use of traditional decontamination procedures and protocols, atypical mycobacteria may survive in conditions that make elimination difficult. As a consequence, outbreaks caused by these bacteria might be the result of errors made during the sterilisation of laparoscopic tools. The purpose is to look into an outbreak of post laparoscopic wound infection caused by a rare mycobacterium.

Materials and Procedures: A four-month institution-based cross-sectional survey was conducted from February 2021 to May 2021. After being diagnosed with Ziehl-Neelsen (ZN) staining and pus culture on Lowenstein Jensen (LJ) medium, 14 patients were treated with the appropriate antibiotics for postlaparoscopic surgical site wound infections. Environmental samples were collected for further analysis, and the isolation rates (%) of atypical mycobacteria from these samples were calculated.

Results: Atypical mycobacteria were the predominant cause of postlaparoscopic surgical site wound infections in all research individuals. Among the sources of atypical mycobacterial contamination detected during infection control inspections of operating rooms (OTs) were laparoscopic surgical instruments and disinfection (gluteraldehyde disinfectant solution).

Conclusion: If the findings of regular bacterial culture on samples collected from port areas were negative, atypical mycobacteria that do not grow on routine bacterial culture should be investigated further. High indices of suspicion are indicated since quick and efficient treatment of individuals with post laparoscopic surgical site infections is critical.

Keywords: Atypical mycobacteria, Laparoscopic surgery, Port site infection.

Introduction

Non-tuberculous mycobacteria (NTM) species, also known as atypical mycobacteria, are often discovered in soil and water samples from a variety of geographic regions [1-3]. Because there is a scarcity of labs capable to diagnose these ailments, it is unknown how widespread they are in India. In India, the total isolation rate for atypical mycobacteria varies from 0.5-8.6% [4].

Because of their ability to form biofilms, atypical mycobacteria are resistant to removal even when treated with traditional decontamination procedures and protocols [1]. Because atypical mycobacteria are less pathogenic than Mycobacterium tuberculosis in humans, they normally cause less illness in healthy hosts [5]. When the host's defences are insufficient, these organisms generally exhibit clinical signs.

Nosocomial infection outbreaks are primarily caused by rapidly reproducing organisms and are almost always associated with contaminated instruments and other hospital equipment [6]. Rapidly growing Mycobacterium indicates that the species may multiply after seven days of inoculation in culture conditions [7, 8].

Because they may colonise tap water, atypical mycobacteria can readily contaminate treatments, including disinfectants. As a consequence, opportunistic infections have considerably increased morbidity in patients undergoing laparoscopic surgeries [5].

The majority of these outbreaks are triggered by errors in the sterilisation processes of laparoscopic instruments. Because single-use tools are less frequent in developing countries like India [9], this issue primarily impacts them. Because prolene material, which is used in sutures, has been mentioned as a potential infection trigger in previous studies from India [10, 11,12], the initial diagnosis is made based on the patient's medical history, physical examination, and a high degree of

suspicion based on the geographic prevalence of atypical mycobacteria.

Because these bacteria do not respond to regular anti-mycobacterial medicine and second-line chemotherapy is the major treatment option, early discovery and diagnosis of such instances is critical to a positive result [5]. Strict adherence to the recommended sterilising method is critical for preventing post laparoscopic port-site infections. It is critical to detect such illnesses to evaluate the sterilisation routine utilised at the hospital, where the present research is being undertaken. Consequently, the present investigation was carried out to investigate a post laparoscopic wound infection outbreak caused by atypical mycobacteria.

The institution-based cross-sectional survey was conducted at tertiary care medical college hospital in SCB Medical College and Hospital, cuttack, India, from February 2022 to July 2022. The research included 14 people who had post laparoscopic port-site infections. All research participants gave their informed consent. The trial lasted 6 months and included all patients who developed post laparoscopic wound infection three to four weeks following surgery.

Sample selection: The patients' port sites experienced non-healing, persistent sinus drainage, as well as wound suppuration, limited erythema, pain, and fever. At the time of their hospital release, none of them had showed any signs of surgical site infections or complained of a feverish illness. They were excluded from this inquiry. Patients who developed wound infections after non-laparoscopic surgery were excluded from this research.

Study Methodology

Pus was collected from the infection site of the wound using normal protocol for specimen collection and processing. In order to lower the possibility of cross-contamination of the sample, the wound borders were avoided. All pus samples underwent ZN staining analysis and were grown on LJ medium [13].

Processing and environmental sample collection: In order to further investigate the cause of the epidemic, samples were collected and examined from surgical tools, utilised disinfection solution, the bottom of the disinfectant tray, the mouth of the tap aerators, and the supplying water tank reservoir.

From laparoscopic devices: Using sterile swabs that had been newly soaked with sterile saline before usage, samples were collected from the outside of reusable laparoscopic surgical equipment. To verify the efficiency of the disinfectants and the presence of biofilms, samples of spent disinfectant solution and material from the bottom of the disinfectant tray were obtained from each of the major OTs using two sterile swabs.

From tap aerators: The inner side of the tap aerator mouth was swabbed with sterile swabs dipped in sterile saline shortly before use to check for the presence of residual biofilms.

From the water tank reservoir: Water samples of 200 mL were gathered from each water tank reservoir and placed in sterile glass stopper bottles before being immediately transported to the lab. The residue left behind after filtering the reservoir water samples and all of the ambient swab samples were subjected to both conventional culture on LJ medium and ZN staining.

Results

In a total of 28 patients (eight males and six females, with a median age of 57 years) who presented with laparoscopic port hole infection three to four weeks after surgery and tested positive for Acid Fast Bacilli (AFB) on ZN staining, atypical mycobacteria (rapid growers) were detected in a conventional culture of pus on LJ media after seven days of incubation. All patients received ciprofloxacin (500 mg), linezolid (600 mg), and clarithromycin (500 mg) twice daily for three months, in addition to open drainage of nodules and dressings. Atypical mycobacteria were originally detected in a microbiology lab from a single pus sample recovered from a surgical site infection of a patient who had undergone laparoscopic surgery in a month of instances [14, 16, 18]. The majority of the instance’s, polluted water has been proven to have directly or indirectly contaminated the port site. Patients will begin to arrive in February 2022 because to the NTMs' affinity for skin and soft tissues. Gramme staining indicated no microorganisms in the sample, and bacteriological culture on normal medium confirmed no contamination. This prompted scepticism, which led to the application of ZN staining, which revealed AFB. The findings of the ZN staining were immediately communicated to the concerned surgeon. Atypical mycobacteria (rapid growth) were detected by culture on LJ medium on the fourth day of incubation. Ciprofloxacin, neosporin, and amikacin were given to the patient for 28 days and both helped to treat their disease. A week later, a second patient with a similar clinical profile and set of test findings came at the outpatient clinic. As a result, the Hospital Infection Control (HIC) personnel received and coordinated a request for an OT investigation. Environmental samples were collected from the tap aerators' mouths, the disinfection trays' bottoms, used disinfectant solution, surgical equipment, and used disinfectant solution. The samples were taken from the water tanks that serve the respective OTs. Atypical mycobacteria were found in one of the

two laparoscopic surgical tool swabs collected. In all, 28 swabs were taken and analysed, fourteen from the disinfectant solutions used and fourteen from the disinfection tray's bottom. A similar proportion of sample types, 42.9%, tested positive for atypical mycobacteria. Twelve of the eighteen tap aerator swabs acquired during the outbreak investigation were positive for atypical mycobacteria. However, none of the water tank samples tested positive for atypical mycobacteria (Table 1).

Table 1: Result of Isolation of atypical mycobacteria from various sources

Environmental source		Total number of samples, n	Positive for atypical mycobacteria, n (%)
Laparoscopic surgical instruments		36	18 (50)
Disinfectants	Used solution	79	34 (42.9)
Tray		89	38 (42.9)
Tap aerators		18	12 (66.7)
Water tank reservoir		24	0

Discussion

Infections caused by atypical mycobacteria have been reported in a number of surgical patients, including injection site abscesses, cellulitis after rhinoplasty, liposuction, and augmentation mammoplasty, outbreaks of sternal wound infections, endocarditis after cardiac surgery, vein graft harvest site infections, keratitis after laser in situ keratomileusis, and the use of contaminated endoscopes [14-18].

NTM port-site infections are rapidly being recognised as a significant cause of morbidity in postoperative laparoscopic patients who present with port-site infections three to four weeks after surgery and often with five clinical stages [19]. In stage 1, a little uncomfortable nodule around the port site is followed by an expansion, inflammation, and pus discharge. Stage 3: Less pain due to prolonged nasal discharge and skin necrosis. Stage 4: Prolonged sinusitis with white or puffy discharge. Stage 5: Nodules and hyperpigmentation with necrosed skin appear at the opposite location. The samples were stained with ZN and cultured on LJ medium, which confirmed the presence of atypical mycobacteria. Therefore, when patients presented with non-healing discharging sinuses at port-sites that were sterile on routine gramme staining and traditional bacteriological culture, doubts were raised. Due to the high degree of suspicion, the microbiology laboratory screened for atypical mycobacteria in pus samples from individuals with clinical symptoms like the previous occurrences. In the present study, 14 cases of port-site infections caused by atypical mycobacteria (rapid growth) were discovered during a two-month period. Vijayraghavan R et al. found 145 port-site infections caused by atypical mycobacteria after a laparoscopy. The source was polluted cleaning rinse water. The patients reacted well to a 28-day treatment of clarithromycin, neosporin, and amikacin, and the concerned doctor was notified right away [18]. The HIC team was immediately notified and began efforts to determine the core cause of the epidemic. In the major OTs, they performed an investigation, collecting samples from tap aerators, surgical equipment, utilised disinfection solutions, and their trays. During the first OT inspection, the gluteraldehyde solution, which is used to disinfect surgical equipment, tested positive for atypical mycobacteria.

Furthermore, tap aerator swabs produced positive findings, prompting an examination of the hospital's OT water supply. Although water tanks were discovered and investigated, no atypical mycobacteria were discovered. A second study in the minor OT found the presence of atypical mycobacteria in the trays used to clean the scopes and the gluteraldehyde solutions. The investigation was launched because of a proactive HIC team and a high degree of suspicion sparked by a single instance from the general surgery department. Because NTMs may colonise tap water, untreated natural water, sewage, and soil, they can readily contaminate hospital solutions and disinfectants [20].

Duarte RS et al. discovered that a variety of factors, including long-term spread in aquatic environments, insufficient mechanical cleaning of surgical instruments, and dissemination inside commercially available non-activated glutaraldehyde solutions, all contributed to postsurgical NTM infections in their study [21]. Numerous solutions have been recommended as part of an improved infection management strategy in light of these illnesses. To allow for the removal of organic material and the prevention of patient-to-patient transmission of illness, standard infection control standards require that all equipment be dismantled before being cleaned and disinfected, perhaps using ultrasonic technology [22]. Furthermore, reusable laparoscopic tools may have an exterior sleeve where biofilms may readily form if immersed in disinfection solutions for a lengthy period of time, enabling opportunistic infections to thrive [18]. As a result, such equipment must be disassembled and gently brushed. According to Spaulding's categorization, scopes that generally

reach sterile tissues should be sterilised before each use; if this is not practicable, they should be disinfected at a high level [23]. Items should be washed with sterile water to prevent contamination of hospital water sources with atypical mycobacteria. To obtain the requisite degree of sporicidal activity, current infection control guidelines indicate utilising higher concentrations (3.4%) of glutaraldehyde disinfectants for scopes and a minimum exposure duration of 8 to 12 hours [20]. Despite explicit instructions, it is normal practise in many Indian settings, including the one where this piece is being written, to immerse equipment for 20 minutes in a 2-2.5% glutaraldehyde solution, which disinfects but does not sterilise [24]. During laparoscopic procedures, spores commonly survive and are deposited in the subcutaneous tissue, where they germinate and cause port-site infections after a three to four-week incubation period.

Mycobacterium massiliense is resistant to glutaraldehyde at higher concentrations (GTA, 7%), suggesting that glutaraldehyde may not be effective against mycobacteria that grow rapidly, according to Lorena NSO et al. With a contact period of 12 minutes, peracetic acid and orthophthaldehyde (OPA; 0.55%) may be used for high-level disinfection with satisfactory results [25]. OPA eliminates all bacteria, fungi, and mycobacteria. Hydrogen peroxide (in gas plasma and vaporised forms) is also potent against NTM [26]. Ethylene oxide (ETO) is a good replacement for heat-sensitive devices. The authors advocate sticking to the appropriate exposure period and greater glutaraldehyde concentrations to achieve the intended effects [26]. As a consequence, HIC is critical in defining and enforcing institutional rules for the sterilisation and disinfection procedures that must be followed.

Furthermore, disinfectants containing glutaraldehyde should be disposed of carefully. These substances may be used for 100 cycles, or 14 days (2.5% glutaraldehyde) or 28 days (3.4% glutaraldehyde) [20]. Because the hospital did not keep a cycle count record The HIC team determined that the chemicals were insufficiently powerful to achieve the desired degree of sterilisation during the present investigation.

Additionally, germs growing in biofilms that contaminate the instruments may be produced by incorrect disinfectant tray cleaning. The authors aim to emphasise the need of internal auditing and record-keeping, as well as tracking how the solution is utilised so that it may be abandoned as soon as feasible.

Because ETO gas sterilisation has been shown to greatly decrease atypical mycobacterial infections after laparoscopy, the authors also recommend abandoning glutaraldehyde solution cleaning methods for laparoscopic equipment [18]. Another recommended glutaraldehyde solution substitution is to place the laparoscopic tools in a formalin chamber for 24 hours; however, this approach must also follow a demanding protocol for cleaning the instruments before placing them in the chamber [20].

The method of washing the instruments in hot water to remove glutaraldehyde may have contributed to the reintroduction of mycobacterial spores on the equipment since the tap aerators were dirty [26]. One way to handle this issue and prevent recontamination would be to rinse with sterile water. Additionally, to avoid colonisation, places such as tap aerators should be cleaned on a regular basis. Atypical mycobacteria were also detected in the water supply, according to the facts in this study. Regular cleaning of these areas is recommended in addition to monthly chlorination and a yearly tank cleaning. Finally, it is highly advised to use disposable laparoscopic equipment, as is common in Western countries [9].

Treatment of atypical mycobacterial wound infections usually requires a multidisciplinary approach. There is no strong agreement on the methodology or duration of therapy. Nonetheless, a combination of antimicrobials has shown the most effectiveness, according to various sources in the literature [7, 20]. Resistance development during treatment is a known concern when treating mycobacterial infections with a single active drug [24]. The literature suggests providing antibiotics for at least three months or for at least three to six weeks after the wound has completely healed to avoid recurrence [27]. However, this was not done in the context of the present inquiry. It is critical to be vigilant since many infections are treatable but may have fatal implications if left untreated, necessitating surgical wound debridement [10]. This is true even if, in certain cases, reaction might be immediate after just one dose of treatment [28]. There is currently insufficient evidence to justify the use of antibiotic prophylaxis for the prevention of porthole infections. Following suggestions for upper gastrointestinal and biliary system laparoscopies is not always essential [29].

Conclusion

Thus, skilled work paired with a high index of suspicion for atypical mycobacteria may result in efficient infection management strategies that improve and maximise patient care. Because these infections cannot be treated with ordinary anti-tuberculous drugs, they must be identified carefully. The authors anticipate that this research will enhance clinicians' awareness of the significance of examining atypical mycobacteria before initiating therapy, as well as the requirement

for extra processing by culture in appropriate conditions for all acid-fast bacteria positive smears. Atypical mycobacteria infections in post-laparoscopic wounds must be prevented by appropriately sterilising surgical instruments and following strict infection control methods.

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