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Port site infection due to atypical mycobacteria after laparoscopic surgery in tertiary care hospital of north India

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Abstract

Introduction: Despite employing the conventional decontamination methods and protocols, atypical mycobacteria can thrive in situations that make them difficult to eliminate. As a result, outbreaks brought on by these germs may be the result of mistakes made during the sterilization process for laparoscopic instruments. The goal is to investigate an epidemic of postlaparoscopic wound infection caused by an unusual mycobacterium.

Materials and Methods: An institution-based cross-sectional study was carried out from Feb 2021 to May 2021 over a four-month period. A total of 14 patients were diagnosed with postlaparoscopic surgery site wound infections, which were then treated with the proper antibiotics after being diagnosed using Ziehl-Neelsen (ZN) staining and pus culture on Lowenstein Jensen (LJ) medium. Environmental samples were obtained for additional examination, and the isolation rates (%) of atypical mycobacteria from these samples were examined.

Results: In all study subjects, atypical mycobacteria were the main culprits behind postlaparoscopic surgery site wound infections. Laparoscopic surgical tools, utilized disinfectant (gluteraldehyde disinfectant solution were among the causes of atypical mycobacterial contamination discovered during infection control inspections of the operating rooms (OTs).

Conclusion : Atypical mycobacteria that do not grow on routine bacterial culture should be looked into further if the results of routine bacterial culture on samples taken from port locations were negative. Since prompt and effective therapy of patients with postlaparoscopic surgical site infections is crucial, high indexes of suspicion are advised.

Keywords : Atypical mycobacteria, Laparoscopic surgery, Port site infection

1.0 Introduction

Non-tuberculous mycobacteria (NTM) species, also known as atypical mycobacteria, are frequently found in soil and water samples from various geographical areas [1-3]. The past information available and a dearth of laboratories equipped is required to identify these illnesses, it is uncertain how common they are in India. According to reports, the overall isolation rate for atypical mycobacteria in India ranges from 0.5-8.6% [4].

Atypical mycobacteria are resistant to elimination even when treated with conventional decontamination techniques and protocols because of their capacity to build biofilms [1]. Atypical mycobacteria typically cause less disease in a healthy host because they are less pathogenic than Mycobacterium tuberculosis in humans [5]. These organisms typically show clinical symptoms when the host's defenses are weak.

Nosocomial infection outbreaks are typically brought on by quickly reproducing organisms and are virtually always mentioned in relation to contaminated tools and other medical supplies [6]. Rapidly growing Mycobacterium demonstrates that the species can proliferate after being inoculated in culture media after seven days [7, 8].

Atypical mycobacteria can easily contaminate treatments, including disinfectants, because they can colonize tap water. As a result, these infections have contributed significantly to morbidity in patients recovering from laparoscopic procedures [5]. Most of these outbreaks are caused by mistakes in the laparoscopic tools' sterilizing procedures. Since single-use tools are less common than in the West, this problem mostly affects developing nations like India [9]. Prolene material, which is utilized in sutures, has also been mentioned in earlier studies from India as

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a potential infection trigger [10, 11,12], so 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.

Since these bacteria do not react to standard anti-mycobacterial medication and second-line chemotherapy is the primary care option, early detection and diagnosis of such cases are essential to a favorable outcome [5]. For the prevention of postlaparoscopic port-site infections, strict adherence to the suggested sterilizing strategy is essential. To assess the sterilizing routine being used in the hospital, which is where the current study is being conducted, it is vital to identify such infections. As a result, the current study was conducted to look into a postlaparoscopic wound infection epidemic brought on by atypical mycobacteria.

2.0 Materials and methods

A new tertiary care medical college hospital in the rural region of Himachal Pradesh, India, underwent the institution-based cross-sectional survey across a four-month period between Feb 2021 to May 2021. The study comprised a total of 14 individuals with postlaparoscopic port-site infections. All study participants provided their informed permission. The Institutional Ethical Committee gave its approval to this investigation (GMC/IEC/F/012/01/2021). The study included a two-month period (Feb 2021 to May 2021) and included all patients with postlaparoscopic wound infection that manifested three to four weeks after surgery.

2.1 Sample selection :-

The patients had non-healing, prolonged sinus discharge at their port sites, as well as wound suppuration, limited erythema, discomfort, and fever. None of them had displayed any symptoms of surgical wound infections or complained of a feverish sickness at the time of their hospital discharge. They were left out of this investigation. Patients who had wound infections that appeared after non-laparoscopic surgery were disqualified from this study.

2.2 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].

2.3 Processing and environmental sample collection: Samples were also taken and tested from surgical instruments, used disinfection solution, the bottom of the disinfectant tray, the mouth of the tap aerators, and the supplying water tank reservoir in order to further study the source of the epidemic.

2.4 From laparoscopic devices: Samples were taken from the exterior of reusable laparoscopic surgical instruments using sterile swabs that had been freshly wet with sterile saline before use. In order to test the efficacy of the disinfectants and the existence of biofilms, samples of used disinfectant solution and material from the bottom of the disinfectant tray were collected using two sterile swabs from each of the primary OTs.

2.5 From tap aerators: To check for the existence of leftover biofilms, the inner side of the tap aerator mouth was swabbed with sterile swabs that had been soaked with sterile saline just before use.

2.6 From the water tank reservoir: 200 mL of water samples were taken from each water tank reservoir and put in sterile glass stopper bottles before being sent right away to the lab. The residue left over after filtering the water samples from reservoir tanks and all of the environmental swab samples were both treated to traditional culture on LJ medium and ZN staining.

Table 1 Demographic profile of patients with numbers of infected ports found positive to MTB presence

Sr. No.	Age / gender	Type of laparoscopic surgery	Number of ports	
			Total	Infected
1	48/Male	Appendectomy	3	2
2	22/Male	Cholecystectomy	3	1
3	41/Male	Cholecystectomy	4	1
4	70/Male	Cholecystectomy	3	2
5	28/Male	Appendectomy	4	1

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6	35/Male	Cholecystectomy	3	1
7	60/Male	Cholecystectomy	4	2
8	25/Male	Cholecystectomy	4	2
9	47/Female	Appendectomy	3	1
10	62/Female	Cholecystectomy	4	1
11	50/Female	Cholecystectomy	4	1
12	45/Female	Cholecystectomy	3	1
13	27/Female	Cholecystectomy	4	2
14	41/Female	Appendectomy	3	2
15	65/Male	Appendectomy	3	1
16	53/Male	Appendectomy	3	2
17	57/Male	Appendectomy	4	1
18	62/Male	Appendectomy	3	1
19	32/Male	Cholecystectomy	4	1
20	64/Male	Appendectomy	3	1
21	29/Male	Cholecystectomy	4	2
22	28/Male	Cholecystectomy	3	2
23	42/Female	Appendectomy	3	1
24	57/Female	Cholecystectomy	3	1
25	48/Female	Cholecystectomy	4	1
26	53/Male	Cholecystectomy	3	1
27	38/Male	Appendectomy	4	2
28	41/Male	Cholecystectomy	3	2

3.0 Results

Atypical mycobacteria (rapid growers) were detected in a conventional culture of pus on LJ media after seven days of incubation 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 [Table-1]. For three months, all of the patients received ciprofloxacin (500 mg), linezolid (600 mg), and clarithromycin (500 mg) twice daily in addition to open drainage of nodules and dressings. In a month of cases, atypical mycobacteria were initially suspected in the microbiology lab from a single pus sample taken from the surgical site infection of a patient who had undergone laparoscopic surgery [14, 16, 18]. The majority of the time, it has been determined that contaminated water has directly or indirectly contaminated the port site. Patients will start to show up in Feb. 2021 as a result of the NTMs' preference for skin and soft tissues. Gram staining of the material revealed no bacteria, and bacteriological culture on standard media likewise revealed no contamination. This sparked skepticism, leading to the use of ZN staining, which indicated AFB. The concerned surgeon was informed right away of the ZN staining results. On the fourth day of incubation, atypical mycobacteria (fast growth) were discovered through culture on LJ medium. The patient had ciprofloxacin, neosporin and amikacin for 28 days, and they both worked as intended to treat their condition. A week later, a second post-laparoscopic surgery patient arrived at the outpatient clinic with a same clinical profile and set of test results. The Hospital Infection Control (HIC) staff thus received and organized a request for an OT investigation. Environmental samples were taken from the mouth of the tap aerators, the bottom of the disinfectant trays, used disinfectant solution, surgical tools, and used disinfectant solution. Samples from the water tanks that supply the appropriate OTs were identified.

Table -2- Result of Isolation of atypical mycobacteria from various sources

	Environmental source		Total number of samples, n	Positive for atypical mycobacteria, n (%)
1	**Laparoscopic surgical instruments**		36	18 (50)
2	**Disinfectants**	**Used solution**	79	34 (42.9)

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		Tray	89	38 (42.9)
3	**Tap aerators**		18	12 (66.7)
4	**Water tank reservoir**		24	00

One of the two laparoscopic surgical tool swabs that were obtained tested positive for atypical mycobacteria. 28 swabs in total, fourteen from the utilized disinfectant solutions and fourteen from the disinfectant tray's bottom, were collected and subjected to analysis. Similar numbers of i.e. 42.9% of sample types tested positive for atypical mycobacteria. Twelve tap aerator swabs out of the eighteen that were obtained during the outbreak investigation were positive for atypical mycobacteria. None of the water tank samples, however, tested positive for atypical mycobacteria (Table-2).

4.0 Discussion

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

In postoperative laparoscopic patients who come with port-site infections three to four weeks after surgery and often with five clinical stages, NTM port-site infections are increasingly being recognized as a substantial source of morbidity [19].A little painful nodule close to the port site in stage 1 is followed by an enlargement, inflammation, and pus discharge in stage 2. Stage 3: Less discomfort with persistent nasal discharge and necrosis of the surrounding skinStage four: Prolonged sinusitis with a white or swollen dischargeStage 5: Nodules and hyperpigmentation with necrosed skin occur at the opposite site.The samples were processed for ZN staining and cultured on LJ media, which revealed the growth of atypical mycobacteria. As a result, suspicions were raised when postlaparoscopic patients presented with non-healing discharging sinuses at port-sites that were sterile on routine gram staining and conventional bacteriological culture. Due to a high level of suspicion, the microbiology laboratory tested for atypical mycobacteria using pus samples from patients who had a similar clinical picture to the earlier cases. In the current investigation, port-site infections caused by atypical mycobacteria (fast growth) were found in 14 instances over a two-month period. Following a laparoscopy, 145 port-site infections caused by atypical mycobacteria were reported by Vijayraghavan R et al. The source was contaminated rinse water used for cleaning. The patients responded to a 28-day course of clarithromycin,neosporin and amikacin, and the worried doctor was immediately informed [18].The HIC team was alerted right away and took action in an effort to identify the outbreak's root cause. They conducted an inquiry in the main OTs, gathering samples from tap aerators, surgical tools, used disinfection solutions, and their trays. The gluteraldehyde solution, which is used to disinfect surgical tools, tested positive for atypical mycobacteria during the initial OT examination.

Additionally, tap aerator swabs yielded positive results, which prompted a review of the hospital's OT water supply. Although water tanks were located and examined, unusual mycobacteria were not found there. The trays used for cleaning the scopes and the gluteraldehyde solutions were the subject of a second analysis in the minor OT, which also revealed the presence of atypical mycobacteria. The inquiry was started as a result of a proactive HIC team and a high level of suspicion brought on by a single case that came from the general surgery department.The NTMs can easily infect solutions and disinfectants used in hospitals because they can colonize tap water, untreated natural water, sewage, and soil [20].

In their study, Duarte RS et al. found 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, contributed to postsurgical NTM infections [21].In light of these infections, numerous strategies have been proposed as parts of an enhanced infection control plan. Standard infection control guidelines recommend that all devices be disassembled before being cleaned and disinfected, maybe with the aid of ultrasonic technology [22], to allow for the removal of organic material and the prevention of patient-to-patient transmission of infection. Furthermore, reusable laparoscopic instruments may contain an outer sleeve where

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biofilms may easily develop if they are submerged in disinfectant fluids for an extended period of time, allowing opportunistic infections to survive [18]. So, it is necessary to disassemble and carefully brush such devices. Spaulding's classification states that scopes that typically access sterile tissues should be sterilized before each use; if this is not possible, they should receive high-level disinfection [23]. To avoid hospital water sources becoming contaminated with atypical mycobacteria, items should be rinsed with sterile water.Current infection control recommendations advise using greater concentrations (3.4%) of glutaraldehyde disinfectants for scopes and a minimum exposure time of 8 to 12 hours to achieve the necessary degree of sporicidal activity [20]. Despite clear instructions, however, it is common practice in many Indian locales, including the one where this article is being written, to submerge equipment in a 2-2.5% glutaraldehyde solution for 20 minutes, which disinfects but does not sterilize [24]. During laparoscopic surgeries, spores frequently survive and are deposited in the subcutaneous tissue where they germinate and, following an incubation period of three to four weeks, cause port-site infections.

According to Lorena NSO et al., Mycobacterium massiliense is resistant to glutaraldehyde at higher concentrations (GTA, 7%), indicating that glutaraldehyde may not be useful against mycobacteria that proliferate quickly. Peracetic acid and orthophthaldehyde (OPA; 0.55%) with a contact time of 12 minutes each can be employed for high-level disinfection with good results [25]. OPA completely eradicates all bacteria, fungus, and mycobacteria. Additionally effective against NTM is hydrogen peroxide (in gas plasma and vaporized forms) [26]. Ethylene oxide (ETO) is a useful substitute for instruments that are sensitive to heat. To get the desired results, the authors advise adhering to the recommended exposure time and higher glutaraldehyde concentrations [26]. As a result, HIC is crucial in developing institutional policies for the sterilization and disinfection protocols that must be followed and ensuring that they are strictly implemented.

Additionally, glutaraldehyde-based disinfectants should be properly disposed of. A total of 100 cycles, or 14 days (2.5% glutaraldehyde) or 28 days (3.4% glutaraldehyde), can be achieved with these compounds [20]. Because there was no cycle count record kept at the hospital throughout the current study, the HIC team discovered that the chemicals were insufficiently potent to accomplish the target level of sterilization. Furthermore, bacteria living in biofilms that contaminate the instruments may be caused by improper cleaning of disinfectant trays. The authors want to emphasize how crucial internal audit and record-keeping are, as well as how important it is to track how the solution is used so that it may be discarded as soon as possible.

Atypical mycobacterial infections following laparoscopy have been demonstrated to be significantly reduced by ETO gas sterilization, therefore authors also advise doing away with glutaraldehyde solution disinfection protocols for laparoscopic equipment [18]. Another suggested substitute for glutaraldehyde solution is to place the laparoscopic instruments in a formalin chamber for 24 hours; however, this procedure also has to follow a stringent process for cleaning the instruments before putting them in the chamber [20].

Because the tap aerators were polluted, the procedure of washing the instruments in hot water to remove glutaraldehyde may have contributed to the reintroduction of mycobacterial spores on the instruments [26]. Use of sterile water for rinsing would be one method to address this problem and stop recontamination. Additionally, in order to prevent colonization, locations such as tap aerators should be routinely cleansed. According to the information in the present report, atypical mycobacteria were also discovered to be present in the water supply. Along with monthly chlorination and an annual tank cleaning, regular cleaning of these regions is also advised. Finally, it is strongly encouraged to utilize disposable laparoscopic equipment, as is done in Western nations [9].

A multidisciplinary approach is typically necessary for the treatment of atypical mycobacterial wound infections. Regarding the protocol and length of treatment, there is no firm consensus. A combination of antimicrobials, according to numerous sources in the literature, has demonstrated the best benefit, nevertheless [7, 20]. When mycobacterial infections are treated with a single active medication, the development of resistance during therapy is a recognized issue [24]. In order to prevent recurrence, the literature recommends giving antibiotics for at least three months or for a minimum of three to six weeks after the incision has fully healed [27]. However, in the context of the current investigation, this was not done. It is crucial to be alert because many infections are manageable, may have disastrous consequences if left untreated, and may necessitate surgical wound debridement [10]. This is true even though, in certain situations, response can be quick after just one dosage of medication [28]. The use of antibiotic prophylaxis for the prevention of porthole infections is presently not supported by sufficient data. For upper gastrointestinal and biliary system laparoscopies, following recommendations is not always necessary [29].

5.0 Conclusion

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Thus, it is clear that expert work combined with a high index of suspicion for atypical mycobacteria can result in effective infection control methods that enhance and maximize patient care. These infections need to be diagnosed specifically because they can't just be treated with standard anti-tuberculous medications. With the aid of this report, the authors hope to raise doctors' awareness of the importance of considering atypical mycobacteria before beginning treatment and the need for additional processing by culture in suitable media for all acid-fast bacteria positive smears. Postlaparoscopic wound infections with atypical mycobacteria must be avoided by properly sterilizing surgical tools and adhering to stringent infection control procedures.

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