Case Series

Chronic Granulomatous Inflammation of the Abdominal Wall after Laparoscopy: A look at High Level Disinfection

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Background: Port site infections after laparoscopic surgery are a known complication and take away a lot of benefits attributed to the minimal access approach. Detecting the flora responsible is essential and atypical mycobacteria must also be considered.
Case Series: This case series is a compilation of the accounts of ten different patients with chronic granulomatous inflammation of the anterior abdominal wall presenting with port site discharging sinuses and lumps after laparoscopic surgery.
Conclusion: Atypical mycobacterial infections must be considered in patients with persistent wound infections after laparoscopic surgery and warrants a revision of the high level disinfection (HLD) process.
Key words: Port Site Infection, High Level Disinfection, Chronic Granulomatous Inflammation.

Introduction

Laparoscopic surgery has many benefits which include decreased post operative pain, decreased rate of wound infection, shorter hospital stay, early resumption of daily activity and of course cosmesis. () Wound infection although reduced with the laparoscopic approach is not entirely nonexistent. () When all has gone well as regards the abdominal procedure the port site wound infection takes away the advantages of the laparoscopic approach. The pain scores rise, hospital stay increase, productivity suffers and the cosmetic wound which was sub centimeter to begin with turns to an ugly scar.

Despite using various strategies to prevent wound soiling from intra abdominal contents e.g retrieval bags, lavage of wounds before closure and using antibiotic coverage, port site infections still remain a cause of postoperative morbidity.()

This case series puts forward an account of ten patients who presented with persistent port site infections refractory to conventional treatment after laparoscopic surgery. The three different ways these patients presented were a discharging sinus, multiple sinuses with lateral tracts and definitive lumps.

Presentation as:

1) Discharging Sinus

Five patients all middle aged females who had undergone a laparoscopic Cholecystectomy for chronic calculous cholecystitis presented four to six weeks postoperatively with purulent discharge from the epigastric port site wound. The wounds showed a discharging sinus. No significant cellulitis or collection appreciated clinically. A soft tissue ultrasound scan showed no collection, foreign body (clips, stones) or intra peritoneal communication. The patients were managed conservatively with culture of the discharge dispatched and the patient prescribed a course of oral co-amoxiclav. The cultures showed no growth but the patient's discharge continued although it was reduced in quantity.

After changing the spectrum of the antibiotic cover and seeing no response to conservative management surgical exploration of the wounds was carried out. The surgical exploration showed no pus cavities or foreign materials but the soft tissues i.e. the subcutaneous fat was seen to have lost its luster, debrinous to look at and was fibrous to touch.

The wounds were surgically excised and the specimen sent for tissue culture and also histopathology. The tissue cultures were negative while the histology revealed fibrocollagenous tissue containing multiple granulomas comprising epitheliod cells, multinucleated granulomas and lymphocytes. Considering the rampant endemicity of tuberculosis in our environment AFB staining and cultures were obtained which were negative.The wounds were left to heal by secondary intention.

2) Discharging sinuses with lateral subcutaneous tracts

These 2 patients were no different from the first group with the same presentations and same

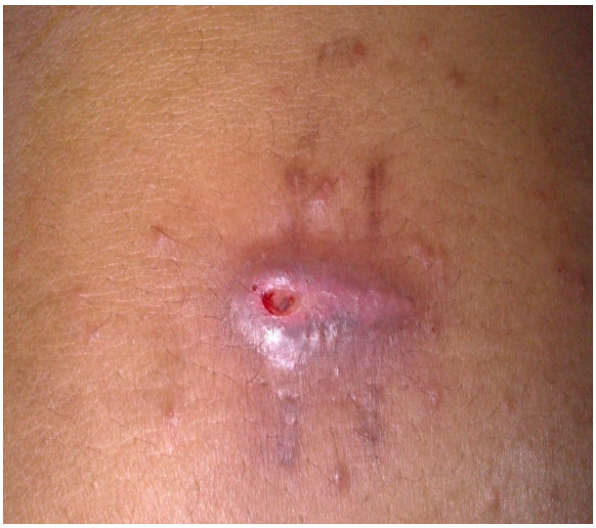

Figure-1: Discharging sinus epigastric port.

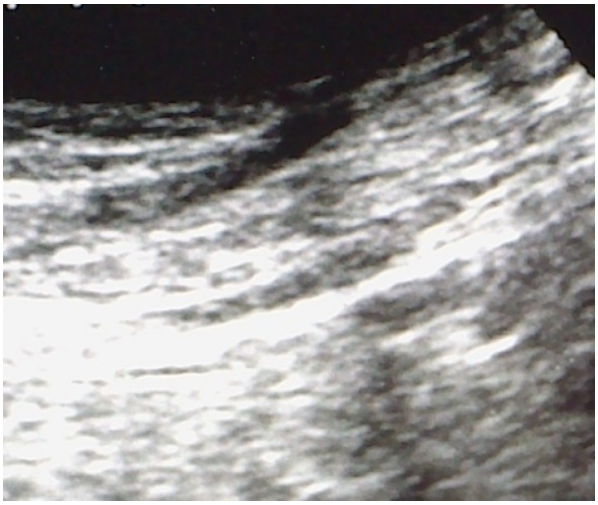

Figure-2: USG showing tract running down the anterior abdominal wall.

2) Discharging sinuses with lateral subcutaneous tracts:

These 2 patients were no different from the first group with the same presentations and same workup. The surgical exploration however revealed that the epigastric port wounds had lateral extensions (tracts) in the subcutaneous tissues which had to be completely excised. Again the tissue cultures were negative and the histopathology revealed chronic granulomatous inflammation. The wounds healing by secondary intention were covered by a protracted 2 weeks course of broad spectrum antibiotics.

3) Lumps / Nodules:

The third patient group comprising 3 patients again postoperative cases of laparoscopic cholecystectomy presented 2 months after surgery with a lump in the anterior abdominal wall. The lumps were firm, tender, partly mobile and non reducible. Clinically it was a soft tissue swelling arising above the muscular plane. The soft tissue ultrasound showed a debrinous collection above the muscles with no intra peritoneal communication. It was resistant to aspiration so a surgical course was adopted which showed infected soft tissues and a purulent collection.

The lumps were excised, wounds left open, pus & tissue sent for culture and histology. The pus and tissue cultures were negative while the histopathology again narrated chronic granulomatous inflammation.

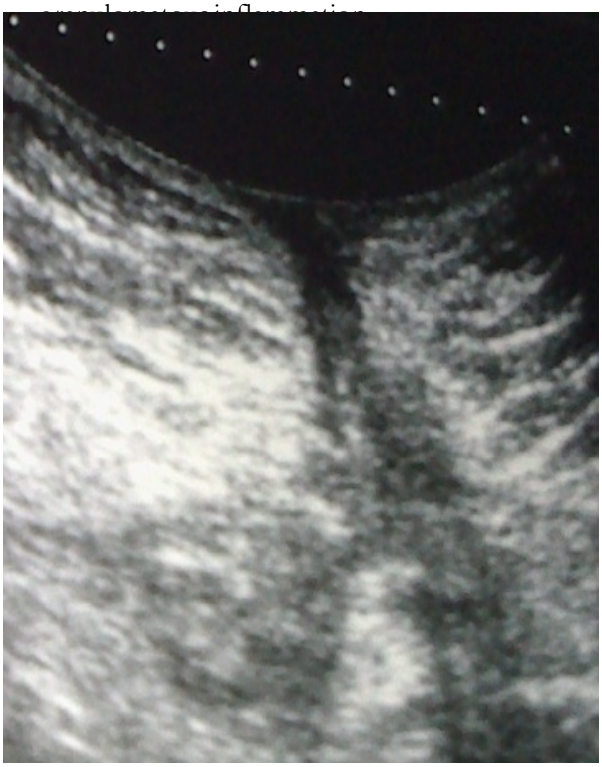

Figure-3: USG shows multiple tracts extending into the subcutaneous planes..

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Table-1: Distribution of patients according to clinical presentation .

Clinical Presentations	Discharging Sinus	Sinus with Multiples tracts	Lumps/ Nodules
Number of Patients	05	02	03

Discussion

Wound infection, commonly port site infection is nothing new to the laparoscopic surgeon. The factors responsible being contact with viscera, spillage of gastrointestinal contents, immunosupression and a breach in sterilization.[5] Notorious for spoiling the "fun" wound infections at times can be very resistant to treatment, develop complications like cellulitis, abcess and sinuses.[6]

Much has been written and documented about this complication and treatments devised. The use of synthetic impervious specimen retrieval bags to avoid contact with the skin of the delivered organs, search for foreign bodies like stones, metallic clips, meticulous techniques to avoid spillage and the use of prophylactic antibiotics all have their part to play. However the most overlooked and the most common causative factor is a breach in sterilization and that is what this refractory to treatment case series points at.

All the patients in our case series were without any comorbidities like diabetes or evidence of immunosupression. They had no close contact with tuberculosis nor were ever known cases of the disease themselves. The gallbladder histology in all the cases was chronic cholecystitis and no evidence of malignancy or TB was ever noted.

The presentation of discharging sinuses with chronic granulomatous inflammation in an environment where mycobacterium tuberculosis is rampant leads one to suspect a tubercular etiology in the infective pathology of the anterior abdominal wall. With the routine cultures negative for the common comensals one must be weary of atypical organisms as well.

Chronic granulomatous inflammation as a histopathological diagnosis could not be solely attributed to tuberculosis and the negative AFB staining and cultures proved it to be the case as well. The other possibility to be explored was infection with atypical mycobacteria and the search of their origin sought.[7,8]

The varied clinical presentations with a possible common etiological factor made us address very basic questions;

- What organisms are involved in the infective process?
- What is the source of this infection?
- Is High Level Disinfection (HLD) a satisfactory technique for laparoscopic instruments?
- Can we use HLD to reuse disposable instruments?
- Are the skin granulomas truly infective?

To start with the cultures sent from discharge were always negative for gram positive and negative microorganisms. This might be attributed to repeated use of antibiotics prescribed over the course and late presentation to the surgical team. In addition to that mycobacterial cultures were requested only after a protracted antibiotic usage and even than only when the histopathology showed chronic granulomatous inflammation.[9] AFB cultures and staining was also sent. The AFB staining showed no evidence of mycobacterium tuberculosis and the mycobacterial cultures were also negative.

As regards the source of the microorganisms spillage was ruled out in all cases. Almost all the port sites infected were epigastric ports away from the umbilicus which was infected in only one case hence excluding the resident umbilical organisms.

The instruments used for the procedure varied from reusable trocars prepared using HLD to new disposable ones but the common entity was the laparoscopic hand instruments which were all disinfected using the same technique.

This leads to another question whether HLD is sufficient to prevent such infective complications? The traditional soak of 20 minutes in 2% glutaral-dehyde solution of various commercial origins was employed.[10] The instruments were washed with tap

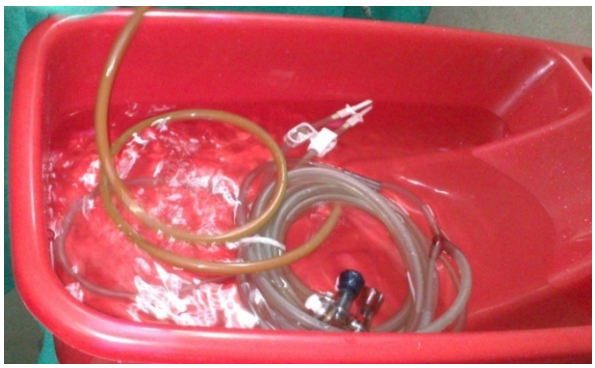
Glutaraldehyde Solution one on top of each other for 20 minutes.

The soakage time was always ensured and never compromised. The soaked instruments than dipped in saline solution for removal of its chemical coating before usage.

The HLD process when scrutinized unearthed major breaches. Regardless of the technique used to wash or soak there was no practical method to monitor the efficacy of the HLD process. The pH of the solution which was supposed to be alkaline was not monitored. The concentration of the solution had to be ensured and there was no practical way of assessing the pH.

The tanks in which the instruments were soaked in had no satisfactory way of being disinfected and on top of it there was no protocol devised to routinely culture the various utensils, or remove the inner films of these containers other than using common detergents.

Fig-4: Soak of laparoscopic instruments one on top of each other in 2% Glutaraldehyde solution.



ig-5: Washing of disinfected instruments after the soak in Glutaraldehyde solution.

Disinfection describes a process that eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects. () Unlike sterilization, disinfection is not sporicidal. A few disinfectants will kill spores with prolonged exposure times (312 hours); these are called chemical sterilants. At similar concentrations but with shorter exposure periods (e.g., 20 minutes for 2% glutaraldehyde), these same disinfectants will kill all microorganisms except large numbers of bacterial spores; they are called high-level disinfectants.

The FDA definition of high-level disinfection is a sterilant used for a shorter contact time to achieve a 6-log10 kill of an appropriate Mycobacterium species. Cleaning followed by high-level disinfection should eliminate enough pathogens to prevent transmission of infection.

Laparoscopes entering sterile tissue ideally should be sterilized between patients. However, in the United States, this equipment sometimes undergoes only high-level disinfection between patients. (,) Although sterilization is preferred, no reports have been published of outbreaks resulting from high-level disinfection of these scopes when they are properly cleaned and high-level disinfected.

Rinsing instruments and flushing channels with sterile saline, filtered water, or tap water will prevent adverse effects associated with the disinfectant retained. Items can be rinsed and flushed using sterile water after high-level disinfection to prevent contamination with organisms in tap water, such as nontuberculous mycobacteria, (,,) Legionella, (,,) or gram-negative bacilli such as Pseudomonas. () Alternatively, a tapwater or filtered water (0.2µ filter) rinse should be followed by an alcohol rinse and forced air drying. () Forced-air drying markedly reduces bacterial contamination. After rinsing, items should be dried and stored (e.g., packaged) in a manner that protects them from recontamination. ()

Although high-level disinfection appears to be the minimum standard for processing laparoscopes between patients, () this practice continues to be debated, () Proponents of high-level disinfection refer to membership surveys () or institutional experiences () involving more than 117,000 and 10,000 laparoscopic procedures, respectively, that cite a low risk for infection (<0.3%) with high-level disinfection. Proponents of sterilization focus on the possibility of transmitting infection by spore-forming organisms.

Researchers have proposed several reasons why sterility was not necessary for all laparoscopic equipment: only a limited number of organisms (usually <10) are introduced into the peritoneal cavity during laparoscopy; minimal damage is done to inner

abdominal structures with little devitalized tissue; the peritoneal cavity tolerates small numbers of spore-forming bacteria; equipment is simple to clean and disinfect; surgical sterility is relative; the natural bioburden on rigid lumen devices is low () and no evidence exists that high-level disinfection instead of sterilization increases the risk for infection. ()

Although the debate for high-level disinfection versus sterilization of laparoscopes will go unsettled until well-designed, randomized clinical trials are published, this guideline should be followed. () That is, laparoscopes that enter normally sterile tissue should be sterilized before each use; if this is not feasible, they should receive at least high-level disinfection.

The activity of germicides against microorganisms depends on a number of factors, some of which are intrinsic qualities of the organism, others are chemical and external physical environment and these include;

- Number and Location of Microorganisms
- Innate Resistance of Microorganisms
- Concentration and Potency of Disinfectants

Glutaraldehyde is used most commonly as a high-level disinfectant for medical equipment and reuse of laparoscopic disposable plastic trocars. ()Glutaraldehyde is a saturated dialdehyde that has gained wide acceptance as a high-level disinfectant and chemical sterilant. () Aqueous solutions of glutaraldehyde are acidic and generally in this state are not sporicidal. Only when the solution is "activated" (made alkaline) by use of alkalinating agents to pH 7.58.5 does the solution become sporicidal. The use of glutaraldehyde-based solutions in health-care facilities is widespread because of their advantages, including excellent biocidal properties; activity in the presence of organic matter (20% bovine serum); and noncorrosive action to equipment. The in vitro inactivation of microorganisms by glutaraldehyde has been extensively investigated and reviewed. () Several investigators showed that >2% aqueous solutions of glutaraldehyde, buffered to pH 7.58.5 with sodium bicarbonate effectively killed vegetative bacteria in <2 minutes; M. tuberculosis, fungi, and viruses in <10 minutes; and spores of Bacillus and Clostridium species in 3 hours. () Spores of C. difficile are more rapidly killed by 2% glutaraldehyde than are spores of other species of Clostridium and Bacillus. ()

Microorganisms with substantial resistance to glutaraldehyde have been reported, including some mycobacteria (M. chelonae, Mycobacterium avium-intracellulare, M. xenopi), () Methylobacterium mesophilicum , Trichosporon, fungal ascospores (e.g., Microascus cinereus, Cheatomium globosum), and Cryptosporidium, M. chelonae persisted in a 0.2% glutaraldehyde solution used to store porcine prosthetic heart valves. Two percent alkaline glutaraldehyde has slow action (20 to >30 minutes) against M. tuberculosis. ()

Chemical test strips or liquid chemical monitors () are available for determining whether an effective concentration of glutaraldehyde is present despite repeated use and dilution. The frequency of testing should be based on how frequently the solutions are used (e.g., used daily, test daily; used weekly, test before use; used 30 times per day, test each 10th use), but the strips should not be used to extend the use life beyond the expiration date.

Several physical and chemical factors also influence disinfectant procedures: temperature, pH, relative humidity, and water hardness. The activity of most disinfectants increases as the temperature increases, but some exceptions exist. Furthermore, too great an increase in temperature causes the disinfectant to degrade and weakens its germicidal activity and thus might produce a potential health hazard. An increase in pH improves the antimicrobial activity of some disinfectants (e.g., glutaraldehyde, quaternary ammonium compounds) but decreases the antimicrobial activity of others (e.g., phenols, hypochlorites, and iodine). The pH influences the antimicrobial activity by altering the disinfectant molecule or the cell surface. () In addition organic and inorganic matter, duration of exposure and the presence of biofilms must also be considered when employing the high level disinfection procedure.

Conclusion

This case series is just the initial presentation of a multitude of patients who present with port site infections. These patients are still in follow up and continue to have wound related problems. Scrutiny of our HLD process points to major shortcomings in the proper application and especially monitoring of the HLD process. The practice we employ is not unique or especially lacking. It is the same as the rest country wide. Putting forth data, continuing efforts to evaluate our practices and formulating a standard protocol is what is required.

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