Review Article

A Review of Infection Control Measurements in Abdominal Laparoscopic Surgeries

Fardin Amiri *[1], Mina Gharibi [1], Roghaye Rahmanian[1]

1. Department Of Operating Room, School of Allied Medical Sciences, Iran University Of Medical Sciences, Iran.

***Corresponding Author: Fardin Amiri,** Department Of Operating Room, School Of Allied Medical Sciences, Iran University Of Medical Sciences, Iran. http://orcid.org/9001-1174_0003-0000

Abstract:

Background:

Surgical site infections impose burden on patients and health systems costing more than $ 3.5 billion each year. The burden of surgical site infections resulted in efforts to build strategies and control the infections. While laparoscopic surgery is associated with a lower rate of surgical site infections, proper infection control measurements need to have adhered to.

Methods: Narriating the literature.

Results: These measurements divide into three phases preoperative, intraoperative and postoperative. Considering health outcomes and treatment costs, these measurements need to be taken seriously to decrease the risk of infection and reduce the burden. Antibiotic prophylaxis has been indicated for clean-contaminated wounds during the surgeries. A course of full antibiotics is also necessary for dirty and contaminated wounds in order to prevent post-surgical infections. Other perioperative infection control measurements also need to adhere to before surgery including surgical hand hygiene and hair removal. There is a number of intraoperative infection prevention measurements which needs to be implemented including, surgical outfit, hand scrubbing, wound classification, duration and complexity of surgery and the use of antimicrobial suture.

Conclusion: Post-operative wound care is also playing important role in infection control. As recommended the wound should not be touched with bare hands and sterile saline needs to be used for rinsing the wound.

Keywords: Surgical Site Infections, Infection Control, Abdominal Laparoscopy

Submitted: 28 April 2022, Revised: 23 May 2022, Accepted: 4 June 2022

ntroduction

In today's world, the most common complication that affect patients in hospitals, are nosocomial or hospital acquired infections. Hospital acquired infections can increase the cost of illness by more than 3000 dollars and adding more than 18 days to the length of stay (1). Among them, surgical-wound infections are the second common adverse events found in hospitals (2).

Surgical sites infection is reportedly to affect 160000 to 300000 individuals each year, costing more than $ 3.5 billion. The burden of surgical site infections resulted efforts to build strategies and control the infections (3). There are also factors contributing to surgical site infection including blood loss, suture materials and suture technique (4).

Laparoscopic surgery has been available since 1985, when Prof. Muhe performed the first laparoscopic cholecystectomy (5). Soon thereafter, laparoscopic methods have been widely used by surgeons. Laparoscopic approaches were physiologically associated with better responses in compare with open surgeries in terms of less systemic stress, better post-operative pulmonary function, improved immunologic response, less tissue trauma and also decreased surgical site infections (6).

While laparoscopic surgery has shed the light on decreasing side effects, including infections (7), there are still concerns regarding surgical site infection control measurements (8). As previous studies showed higher Body Mass index (BMI), inflammatory bowel syndrome (IBS) and hand-assistance during laparoscopic surgery could increase the chance of surgical site infection (9).

In this article we have reviewed the infection control measurement applied in abdominal laparoscopic surgeries.

Infection Control Measurements

Preoperative phase

Antibiotic prophylaxis has been indicated for clean-contaminated wounds during the surgeries. A course of full antibiotics is also necessary for dirty and contaminated wounds in order to prevent the post-surgical infections (10). The administration needs to before the surgery so the peak antimicrobial level reached in bloodstream to prevent the infection (11). While there are controversies regarding administration of prophylactic antibiotics in abdominal laparoscopic surgery, a meta-analysis by Catarci *et al.* (12) showed that prophylactic antibiotic administration in patients undergoing laparoscopic cholecystectomy, had no significant difference with placebo group in low-risk patients. The study by Zhou *et al.* (13) also concluded antibiotic prophylaxis should not be routinely used in low-risk patients undergoing elective laparoscopic cholecystectomy. While these meta-analyses included relatively small RCTs, a study by Matsui *et al.* (14) showed perioperative administration of prophylactic antibiotics should be recommended these patients in order to prevent postoperative infectious complications and decreasing medical costs.

Other perioperative infection control measurements also needs to be adhered before surgery including surgical hand hygiene and hair removal (15, 16). Hair could be contaminated with pathogens and contribute to developing surgical site infections. While there has been no single recommendation regarding timing of hair

removal, clipping method shortly before surgery is being recommended (17).

Malnutrition is also a risk factor for surgical infections after laparoscopic cholecystectomy (18). Nutritional status has a significant effect on patients immunity as proper nutritional status can improve the outcomes and decrease the incidence of post operative infections (19). Nutrient -enhanced formula could reduce the incidence of surgical site infections (17). Therefore, it is suggested that patients should be assessed regarding nutritional status in order to prevent delayed wound healing.

Perioperative oxygen therapy also has no benefits for preventing surgical site infections (20).

Intraoperative phase

There is a number of intraoperative infection prevention measurements which needs to be implemented including, surgical outfit, hand scrubbing, wound classification, duration and complexity of surgery and the use of antimicrobial suture (16, 21).

Proper surgical fiend asepsis is also necessary. There are microorganisms residing in human skin as normal flora which are potentially pathogens. Chlorhexidine and povidone-iodine are two commonly used solutions for skin preparation before surgery. Regarding the use of these two substances a meta-analysis by Priviter *et al.* (22) showed that use of Chlorhexidine has been associated with lower surgical site infections.

Chlorhexidine and povidone iodine has been shown to have common antibacterial spectrum. However, chlorhexidine acts longer by covalently bonding to skin and mucous membrane proteins. Unlike povidone iodine blood or other bodily fluids does not affect the structure (23).

Blood loss is another complication occurring during surgery which can lead to circulatory failure as well as loss of proteins and antibodies. Previous studies suggested that blood transfusion is associated with increased wound healing disturbance (24), which affects wound infection after surgery. Hypoxia and loss of proteins can also predispose patients to surgical site infections. A study by Poon *et al.* (25) showed that laparoscopic surgery of colorectal resection is associated with lower surgical site infections due to reducing blood transfusion and anastomotic leakage.

Proper surgical technique is important to prevent surgical site infection. Maintaining hemostasis, gentle handling of tissue, removing devitalized tissues, eradicating dead space hematoma or seromas, and preventing hypothermia are numerous important factors to prevent infection during surgery (26).

Postoperative phase

Post-operative wound care is also playing important role in infection control. As recommended the wound should not be touched with bare hands and sterile saline needs to be used for rinsing the wound (10).

Traditional signs of wound infection include: erythema, edema, pain, fever and purulent discharge (27). The suggested surgical site treatment for wound infection is opening the area and draining the pus and debridement in case of necrosis. Proper antibiotics also need to be administered.

Choosing the first-line treatment local epidemiological situation and Gram staining of wound smears should be also

considered. Microbiology studies in surgical site infection in patients include: severe clinical course, need for antibiotic therapy, suspected drug-resistant pathogens, allergy to first-line treatment. In case of Staphylococcal infection cefazolin, cefuroxime or cloxacillin can be used and in case of gram-negative infection, the first-line antibiotic can be second or third generation cephalosporin or fluoroquinolones.

Conclusion

While laparoscopic surgery is associated with lower rate of surgical site infections, proper infection control measurements need to be adhered. These measurements divide into three phases as preoperative, intraoperative and postoperative. Considering health outcomes and treatment costs, these measurements need to be taken seriously to decrease the risk of infection and reduce the burden.

References

1.Chen YY, Chou YC, Chou P. Impact of nosocomial infection on cost of illness and length of stay in intensive care units. Infect Control Hosp Epidemiol. 2005;26(3):281-7.

2.Leape LL, Brennan TA, Laird N, Lawthers AG, Localio AR, Barnes BA, et al. The Nature of Adverse Events in Hospitalized Patients. New England Journal of Medicine. 1991;324(6):377-84.

3.Fuglestad MA, Tracey EL, Leinicke JA. Evidence-based Prevention of Surgical Site Infection. Surgical Clinics of North America. 2021;101(6):951-66.

4.Chida K, Watanabe J, Suwa Y, Suwa H, Momiyama M, Ishibe A, et al. Risk factors for incisional surgical site infection after elective laparoscopic colorectal surgery. Annals of Gastroenterological Surgery. 2019;3(2):202-8.

5.Reynolds W, Jr. The first laparoscopic cholecystectomy. JSLS. 2001;5(1):89-94.

6.Varela JE, Wilson SE, Nguyen NT. Laparoscopic surgery significantly reduces surgical-site infections compared with open surgery. Surgical Endoscopy. 2010;24(2):270-6.

7.Shabanzadeh DM, Sørensen LT. Laparoscopic Surgery Compared With Open Surgery Decreases Surgical Site Infection in Obese Patients: A Systematic Review and Meta-Analysis. Annals of Surgery. 2012;256(6).

8.Targarona EM, Balagué C, Knook MM, Trías M. Laparoscopic surgery and surgical infection. British Journal of Surgery. 2002;87(5):536-44.

9.Drosdeck J, Harzman A, Suzo A, Arnold M, Abdel-Rasoul M, Husain S. Multivariate analysis of risk factors for surgical site infection after laparoscopic colorectal surgery. Surgical Endoscopy. 2013; 27(12):4574-80.

10.Kolasiński W. Surgical site infections–review of current knowledge, methods of prevention. Polish Journal of Surgery. 2019;91:41-7.

11.Anderson DJ, Podgorny K, Berríos-Torres SI, Bratzler DW, Dellinger EP, Greene L, et al. Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. Infection Control & Hospital Epidemiology. 2014;35(S2):S66-S88.

12.Catarci M, Mancini S, Gentileschi P, Camplone C, Sileri P, Grassi GB. Antibiotic prophylaxis in elective laparoscopic cholecystectomy: lack of need or lack of evidence? Surgical Endoscopy And Other Interventional Techniques. 2004;18(4):638-41.

13.ZHOU H, ZHANG J, WANG Q, HU Z. Meta-analysis: antibiotic prophylaxis in elective laparoscopic cholecystectomy. Alimentary Pharmacology & Therapeutics. 2009;29(10):1086-95.
14.Matsui Y, Satoi S, Kaibori M, Toyokawa H, Yanagimoto H, Matsui K, et al. Antibiotic Prophylaxis in Laparoscopic Cholecystectomy: A Randomized Controlled Trial. PLOS ONE. 2014;9(9):e106702.
15.Allegranzi B, Bischoff P, de Jonge S, Kubilay NZ, Zayed B, Gomes SM, et al. New WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective. The Lancet Infectious Diseases. 2016;16(12):e276-e87.
16.Edmiston Jr CE, Spencer M. Patient care interventions to help reduce the risk of surgical site infections. AORN journal. 2014;100(6):590-602.
17.Allegranzi B, Bischoff P, De Jonge S, Zeynep N, Zayed B, Gomes S. Surgical Site Infections 1. New WHO Recommendations on Preoperative Measures for Surgical Site Infection Prevention: an Evidence-Based Global Perspective. Lancet Infect Dis. 2016;16(12):e276-87.
18.Warren DK, Nickel KB, Wallace AE, Mines D, Tian F, Symons WJ, et al. Risk Factors for Surgical Site Infection After Cholecystectomy. Open Forum Infectious Diseases. 2017;4(2).
19.Di Carlo V, Gianotti L, Balzano G, Zerbi A, Braga M. Complications of pancreatic surgery and the role of perioperative nutrition. Digestive surgery. 1999;16(4):320-6.
20.Togioka B, Galvagno S, Sumida S, Murphy J, Ouanes J-P, Wu C. The Role of Perioperative High Inspired Oxygen Therapy in Reducing Surgical Site Infection: A Meta-Analysis. Anesthesia & Analgesia. 2012;114(2):334-42.
21.Ban KA, Minei JP, Laronga C, Harbrecht BG, Jensen EH, Fry DE, et al. American College of Surgeons and Surgical Infection Society: surgical site infection guidelines, 2016 update. Journal of the American College of Surgeons. 2017;224(1):59-74.
22.Privitera GP, Costa AL, Brusaferro S, Chirletti P, Crosasso P, Massimetti G, et al. Skin antisepsis with chlorhexidine versus iodine for the prevention of surgical site infection: a systematic review and meta-analysis. American Journal of Infection Control. 2017;45(2):180-9.
23.Lim K-S, Kam P. Chlorhexidine-pharmacology and clinical applications. Anaesthesia and intensive care. 2008;36(4):502-12.
24.Weber EWG, Slappendel R, Prins MH, van der Schaaf DB, Durieux ME, Strümper D. Perioperative Blood Transfusions and Delayed Wound Healing After Hip Replacement Surgery: Effects on Duration of Hospitalization. Anesthesia & Analgesia. 2005;100(5).
25.Poon JT, Law W-L, Wong IW, Ching PT, Wong LM, Fan JKM, et al. Impact of Laparoscopic Colorectal Resection on Surgical Site Infection. Annals of Surgery. 2009;249(1):77-81.
26.Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Committee HICPA. Guideline for prevention of surgical site infection, 1999. Infection Control & Hospital Epidemiology. 1999;20(4):247-80.
27.Patel S. Investigating wound infection. Wound Essentials. 2010;5(3):40-7.