medical sciences forum

MDPI

Proceedings Paper

The Utilization of Antibiotic, Incidence and Risk Aspects for Surgical Site Infections Amongst Surgical Patients †

Devendra Kumar Mishra *, Shilpi Mishra, Archita Tiwari, Vishwanath Dubey, Sandeep Yadav and Savita Upadhyay

Ambekeshwar Institute of Pharmaceutical Sciences, Lucknow 226201, Uttar Pradesh, India; mishra.shilpi2014@gmail.com (S.M.); architatiwari68@gmail.com (A.T.); vishwanathd38@gmail.com (V.D.); sy991961@gmail.com (S.Y.); upadhyaysavita.agi1018@gmail.com (S.U.)

* Correspondence: devendra4747@e-mail.com; Tel.: +91-9453474719

† Presented at the 2nd International Electronic Conference on Antibiotics—Drugs for Superbugs: Antibiotic Discovery, Modes of Action and Mechanisms of Resistance, 15–30 June 2022; Available online: https://eca2022.sciforum.net/.

Abstract: Surgical site infections (SSI) are one of the main healthcare-related infections in developing nations. Regardless of upgrades in surgical strategy and the utilization of best disease avoidance techniques, SSI stayed the significant reason for medical clinic obtained infections. Subsequently, the target of this paper was to describe risk factors for SSI and the utilization of antibiotics to decrease the risk involved for the SSI. SSI is a possibly morbid and expensive intricacy of medical procedure. In this way, an underlying pursuit recognized various titles distributed in 2012–2022. Extracted data including design of study and procedure, revealed combined occurrence and time taken as post-surgery until the beginning of SSI, and probabilities proportions and associated inconstancy for all variables considered in univariate and additionally multivariable investigations. In a wide survey of available works, risk factors for SSI were portrayed as depicting decreased wellness, patient fragility, medical procedure length, and intricacy. The occurrence of SSI was high in the review set. There were critical quantities of contributing variables to the event of surgical site infections. Recognition of risk factors habitually connected with SSI considers the identification of such patients with the best requirement for ideal protective actions to be recognized and pre-treatment before medical procedure.

Keywords: surgical site infection; incidence; risk factors; surgical patients

Citation: Mishra, D.K.; Mishra, S.; Tiwari, A.; Dubey, V.; Yadav, S.; Upadhyay, S. The Utilization of Antibiotic, Incidence and Risk Aspects for Surgical Site Infections Amongst Surgical Patients. *Med. Sci. Forum* **2022**, *1*, x. https://doi.org/10.3390/xxxxx

Academic Editor(s):

Published: date

1. Introduction

Medical care related diseases are considered the most well-known and deadliest occasions undermining the well-being of patients. They drag out the length of clinic stays and increment medical care costs worldwide [1]. A surgical site infection (SSI) is an injury infection that happens following an obtrusive method [2]. SSI is one of the most well-known and genuine medical hospitals that obtained contaminations all around the world [3]. According to the "Centre for Disease Control and Prevention" (CDC), SSI is characterized as "post-operative contaminations that create in 30 days after any careful surgical procedure or the span of one year of any implants [4]. If we see the data worldwide, around 300 million medical procedures are played out consistently. This rising number of medical procedures prompts an increment in the frequency of postoperative injury diseases on surgical sites [5]. A new report distributed by the World Health Organization (WHO) that SSI is one of the usually happening hospital-acquired infections (HAI) in low- and centre pay nations. These effects were dependent upon 33% of patients who have gone through surgery.

Despite the fact that SSI recurrence is lower in developed nations, it remains the second most normal sort of HAI in the USA [6]. Notwithstanding enhancements in operating room rehearses, instrument cleansing strategies, better surgical procedures, and the best endeavours of contamination anticipation systems, SSI stays a significant reason for HAI and rates are expanding universally even in clinics with most present-day offices and standard conventions of preoperative preparation and anti-microbial prophylaxis. In addition, in emerging nations where assets are restricted, even fundamental life-saving tasks, like appendectomies and cesarean sections, are related to high contamination rates and mortality [7]. The disease in a surgical wound means the disrupted host-microorganism balance that prompts colonization of the microbes on the surgical site. Therefore, the injury mending supportive is incredibly impacted, and fundamental reaction likewise will show [8]. Utilizing anti-antibiotics before incision of surgery is viewed as compelling in forestalling SSIs, which are among the most well-known preventable post-medical procedure difficulties including HAIs [9]. A parenteral prophylaxis specialist range with comparing expected microscopic organisms on specific destinations of medical procedure has been recommended as of late to diminish SSI rates proficiently [10]. This study was led to identify the SSI rate and to distinguish risk factors for SSI among surgical patients. A superior comprehension of indicators could further develop disease control by antibiotics in post-surgical patient infections.

2. Methodology

The current systematic review was made according to the Preferred Reporting Items for Systematic Reviews (PRISMA) revealing rules and statements. We looked at PubMed/Medline, Cochrane Library, Embase, and ScienceDirect. The pursuit techniques included the keyword “incidence of surgical site infection”, “prevalence of surgical site infection”, “surgical site infection”, and “utilization of antibiotics in post-operative infection”. First and foremost, articles distributed in the English language comprised and other language articles are removed. The article was distributed during the most recent decade; All the authors have gathered the articles according to the consideration standards. After the assortment and aggregation of articles, the authors explored and included articles for information extraction. The journals taken the study were published in a peer-reviewed journal and all the papers have their International Standard Serial Number (ISSN).

3. Results and Discussion

The SSI is one of the fastest-growing concerns in the medical sector. Prevention and control of the SSI is an important aspect of the reduction in medical care costs and as of now, it’s moreover important as the COVID-19 pandemic paralyzing the medical sectors. Also, there has been seen in the last decade that the use of antibiotics has increased in patients with SSI. The antibiotics help in the control of the spreading tendency in the case of SSI in surgical patients. The current systemic reviews are intended to distinguish the epidemiological features and risk factors for the growth of SSI and the uses of antibiotics to overcome them.

Thus, to understand the utilization of antibiotics, incidence and risk aspects for SSI in surgical patients we performed the systemic review by PRISMA. The underneath figure (flow chart of PRISMA) sums up the information extraction process for this systematic review. The number of articles included and barred in the various stages because of the information extraction measures is depicted. These articles are distributed in peer-reviewed journals over the past 10 years. At first, there were around 312 articles were distinguished in this survey. Consequently, after rejection from each stage on the basis of inclusion/exclusion criteria, an aggregate of 26 full-text articles was evaluated for evidence synthesis.

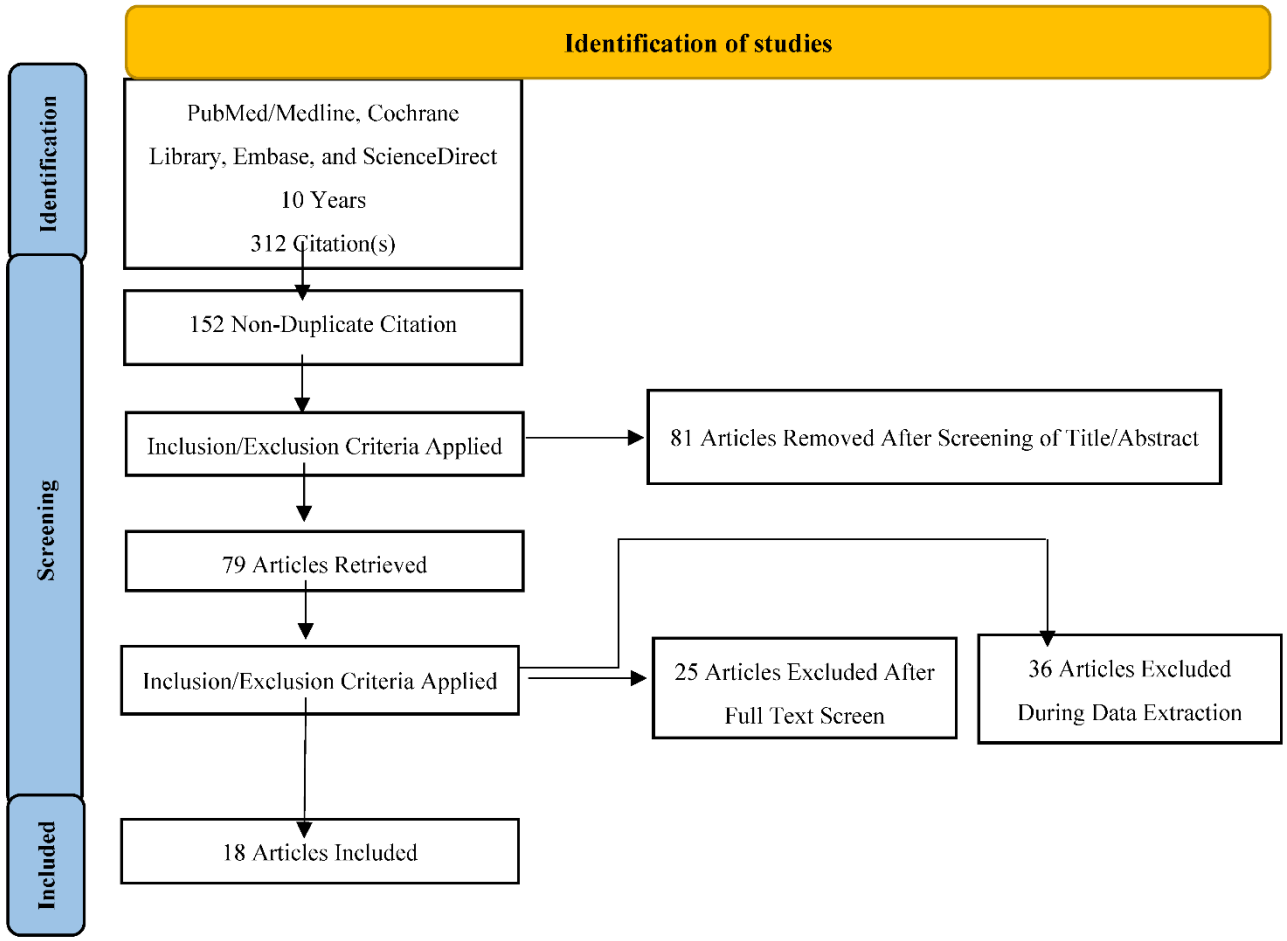

Figure 1. PRISMA Flow Chart.

Table 1. Summary of major outcomes in the SSI.

Author, Year	Study Description	Key Findings
Wakeman et al., 2022 [11]	Administered tazobactam/piperacillin for at least 72 h post-operatively	Decreased significantly from 35% to 15% after the administeration of the drug
Alghamdi et al., 2021 [12]	Patients with spinal surgery, Retrospective case-control study & N = 221	Found low SSI rate in spinal surgery
Li Z et al., 2021 [13]	Emergency abdominal surgery. Prospective multicentric study. N = 953	E.coli was the most common pathogen-29.6% positivity rate. Incidence rate is 7.5%
Brennfleck FW et al., 2020 [14]	Retrospective	Organ space—2.4%. Deep incisional—9%, Superficial SSI—13.5%
Alshammari et al., 2020 [15]	In a tertiary care hospital, a 10 years study of retrospective	The rate of prevalence ranges from 20 per 1000 in 2009-to 3.5 per 1000 in 2018
Rouse T et al., 2019 [16]	Prospective study & N = 120 OBG-GYN patients	5.9% incidence rate
Mekhala et al, 2019 [17]	Patients with intra-abdominal surgery Prospective cohort study N = 100	Incidence rate (29.4–49.2%)
Azeze et al., 2019 [18]	Post cesarian section Cross-sectional study N = 383	7.8% was the prevalence of SSI following caesarian section
Patel S et al., 2019 [19]	Retrospective study N = 16513	Use of dexamethasone; $p < 0.01$, OR (95% CI) = 3.03 (1.71–5.36) Wound: $p < 0.01$, OR (95% CI) = 27.77 (16.36–47.15)

Mirzashahi et al, 2019 [20]	Cross-sectional study N = 78 Aged 18 years and above	A remarkable link founds between SSI and caries, gingivitis/periodontitis.
Torres S et al., 2018 [21]	Craniotomy patients Retrospective study N = 178	The incidence of SSI, therefore, is 11.56%, compared with a 1-month incidence of 8.67% and a 3-month incidence of 10.98%.
Negi V, 2018 [22]	Cross-sectional study N = 768	Prevalence—17.8% The order of common organisms: *S. aureus*—50.4%, *E.coli*—23.02%, *P. aeruginosa*—7.9%
Lubega A et al, 2017 [23]	Prospective study N = 114, Emergency post-operative patients	Klebsiella pneumonia was the most predominant organism (50%) followed by *S. aureus* (27.8%). *E. coli* and *P. aeruginosa* both accounted for 11.1%
Carvalho et al, 2017 [24]	Non-concurrent cohort study N = 16882	3.4% was the incidence of surgical site infection
Pathak A et al., 2017 [25]	Gynaecology and obstetrics Cross-section study N = 1173	7.84% was the occurrence rate of SSI
Kumar A et al., 2017 [26]	All general surgical unit patients Retrospective N = 3321 elective and 451 emergencies	Prevalence—12.5% in elective surgeries and 17.7% emergency surgeries
Morikane K et al., 2016 [27]	Gastric surgery patients A retrospective study from the nationwide database	Rate of SSI 8.8%
Dessie W et al., 2016 [28]	To find the causative organisms a cross-sectional study was done on 107 SSI patients	The commonest infective microorganism was *E.coli* (23.1%). Multi-drug resistance was highly prevalent

In spite of the best exertion from our examination group for this systematic review, certain constraints should be considered while deciphering this systematic review. Initially, the current review included just English-language articles. Subsequently, discoveries of non-English articles are not considered for audit, this systematic review may not be pertinent for worldwide targets.

The sample size of most of the articles in this survey is little. At last, around 33% of included investigations are case-control studies. Thus, the chance of perplexing predisposition should be considered while deciphering this systematic review.

4. Conclusions

The event rate of SSI among post-operative patients is extremely high, particularly in developing nations. This prompts a double burden on the medical services conveyance settings. The foundation of operating rooms, deficient ventilation norms, inadequate staffing, unrestrained traffic in the operating rooms, absence of information about contamination control actions, or more all, obliviousness about disease control exercise account for the high SSI rates. The usage of antibiotics in the case of SSI helps in the faster recovery of the patients but improper usage and maltreatment of antibiotics result in SSIs with multi-resistant microbes. Henceforth, it is fundamental to incorporate a severe contamination control strategy, and fair utilization of antibiotics practices to be executed.

Author Contributions: D.K.M., S.M., A.T., V.D., S.Y. and S.U.: Conceptualization, Methodology, Data collection, Writing—Original draft preparation. D.K.M., S.M., A.T., V.D., S.Y. and S.U.; Writing—Reviewing and Editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement:

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Allegranzi, B.; Bagheri Nejad, S.; Combescure, C.; Graafmans, W.; Attar, H.; Donaldson, L.; Pittet, D. Burden of endemic health-care-associated infection in developing countries: Systematic review and meta-analysis. *Lancet* **2011**, *377*, 228–241.
2. Horan, T.C.; Gaynes, R.P.; Martone, W.J.; Jarvis, W.R.; Emori, T.G. CDC definitions of nosocomial surgical site infections, 1992: A modification of CDC definitions of surgical wound infections. *Infect. Control Hosp. Epidemiol.* **1992**, *13*, 606–608.
3. Lewis, S.S.; Moehring, R.W.; Chen, L.F.; Sexton, D.J.; Anderson, D.J. Assessing the relative burden of hospital-acquired infections in a network of community hospitals. *Infect. Control Hosp. Epidemiol.* **2013**, *34*, 1229–1230.
4. Berríos-Torres, S.I.; Umscheid, C.A.; Bratzler, D.W.; Leas, B.; Stone, E.C.; Kelz, R.R.; Reinke, C.E.; Morgan, S.; Solomkin, J.S.; Mazuski, J.E.; et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection. *JAMA Surg.* **2017**, *152*, 784–791.
5. Weiser, T.G.; Haynes, A.B.; Molina, G.; Lipsitz, S.R.; Esquivel, M.M.; Uribe-Leitz, T.; Fu, R.; Azad, T.; Chao, T.E.; Berry, W.R.; et al. Size and distribution of the global volume of surgery in 2012. *Bull. World Health Organ.* **2016**, 94, 201–209f.
6. Kamat, U.S.; Fereirra, A.M.A.; Kulkarni, M.S.; Motghare, D.D. A prospective study of surgical site infections in a teaching hospital in Goa. *Indian J. Surg.* **2008**, *70*, 120–124.
7. Dinda, V.; Gunturu, R.; Kariuki, S.; Hakeem, A.; Raja, A.; Andrew, K. Pattern of pathogens and their sensitivity isolated from surgical site infections at the Aga Khan University Hospital, Nairobi, Kenya. *Ethiop. J. Health Sci.* **2013**, *23*, 141–149.
8. Robson, M.C. Wound infection. A failure of wound healing caused by an imbalance of bacteria. *Surg. Clin. N. Am.* **1997**, *77*, 637–650.
9. Mangram, A.J.; Horan, T.C.; Pearson, M.L.; Silver, L.C.; Jarvis, W.R. Guideline for Prevention of Surgical Site Infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. *Am. J. Infect. Control* **1999**, *27*, 97–132; quiz 3–4; discussion 96.
10. Umscheid, C.A.; Mitchell, M.D.; Doshi, J.A.; Agarwal, R.; Williams, K.; Brennan, P.J. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. *Infect. Control Hosp. Epidemiol.* **2011**, *32*, 101–114.
11. Wakeman, D.; Livingston, M.H.; Levatino, E.; Juviler, P.; Gleason, C.; Tesini, B.; Wilson, N.A.; Pegoli, W., Jr.; Arca, M.J. Reduction of surgical site infections in pediatric patients with complicated appendicitis: Utilization of antibiotic stewardship principles and quality improvement methodology. *J. Pediatric Surg.* **2022**, *57*, 63–73.
12. AlGamdi, S.S.; Alawi, M.; Bokhari, R.; Bajunaid, K.; Mukhtar, A.; Baeesa, S.S. Risk factors for surgical site infection following spinal surgery in Saudi Arabia: A retrospective case-control study. *Medicine* **2021**, *100*, e25567.
13. Li, Z.; Li, H.; Lv, P.; Peng, X.; Wu, C.; Ren, J.; Wang, P. Prospective multicenter study on the incidence of surgical site infection after emergency abdominal surgery in China. *Sci. Rep.* **2021**, *11*, 7794.
14. Brennfleck, F.W.; Bachmeier, T.; Simet, W.; Zeman, F.; Junger, H.H.G.; Schlitt, H.J.; Dahlke, M.H.; Brunner, S.M. Surgical Site Infections and their economic significance in hepatopancreatobiliary surgery: A retrospective incidence, cost, and reimbursement analysis in a German centre of the highest level of care. *Int. Wound J.* **2021**, *18*, 17–23.
15. Alshammari, L.T.; Alkatheer, S.A.; AlShoaibi, M.B.; Alomran, A.A.; Almulhim, S.N.; Aljindan, R.Y.; Aljehani, Y.M.; Alkharsah, K.R. Surgical site infections in a tertiary hospital over 10 years. The effect of hospital accreditation strategy implementation. *Saudi Med. J.* **2020**, *41*, 971–976.
16. Rouse, T.; Nascu, P.; Dawson, C.; Morris, E. Incidence of surgical site infections after caesarean sections in a community hospital. *Can. J. Infect. Control* **2019**, *34*, 30–34.
17. Mekhla, F.R.B. Determinants of superficial surgical site infections in abdominal surgeries at a Rural Teaching Hospital in Central India: A prospective study. *J. Fam. Med. Prim. Care* **2019**, *8*, 2258–2263.
18. Azeze, G.G.; Bizuneh, A.D. Surgical site infection and its associated factors following cesarean section in Ethiopia: A cross-sectional study. *BMC Res. Notes* **2019**, *12*, 288.
19. Patel, S.; Thompson, D.; Innocent, S.; Narbad, V.; Selway, R.; Barkas, K. Risk factors for surgical site infections in neurosurgery. *Ann. R. Coll. Surg. Engl.* **2019**, *101*, 220–225.
20. Mirzashahi, B.; Tonkaboni, A.; Chehrassan, M.; Doosti, R.; Kharazifard M.J. The role of poor oral health in surgical site infection following elective spinal surgery. *Musculoskelet. Surg.* **2019**, *103*, 167–171.
21. Torres, S.; Perdiz, L.B.; Medeiros, E.A. Incidence of surgical site infection after craniotomy: Comparison between three months and twelve months of epidemiological surveillance. *Braz. J. Infect. Dis. Off. Publ. Braz. Soc. Infect. Dis.* **2018**, *22*, 433–437.
22. Negi, V.; Pal, S.; Juyal, D.; Sharma, M.K.; Sharma, N. Bacteriological Profile of Surgical Site Infections and Their Antibiogram: A Study From Resource Constrained Rural Setting of Uttarakhand State, India. *J. Clin. Diagn. Res.* **2015**, *9*, DC17–DC20.
23. Lubega, A.; Joel, B.; Justina, L.N. Incidence and Etiology of Surgical Site Infections among Emergency Postoperative Patients in Mbarara Regional Referral Hospital, South Western Uganda. *Surg. Res. Pract.* **2017**, *2017*, 6365172.
24. Carvalho, R.L.R.d.; Campos, C.C.; Franco, L.M.d.C.; Rocha, A.D.M.; Ercole, F.F. Incidence and risk factors for surgical site infection in general surgeries. *Rev. Lat. Am. Enfermagem.* **2017**, *25*, e2848.

25. Pathak, A.; Mahadik, K.; Swami, M.B.; Roy, P.K.; Sharma, M.; Mahadik, V.K.; Lundborg, C.S. Incidence and risk factors for surgical site infections in obstetric and gynecological surgeries from a teaching hospital in rural India. *Antimicrob. Resist. Infect. Control* **2017**, *6*, 66.
26. Kumar, A.; Thakur, A. Prevalence of surgical site infection in general surgery in a tertiary care centre in India. *Int. Surg. J.* **2017**, *4*, 3101–3106.
27. Morikane, K.; Honda, H.; Suzuki, S. Factors Associated With Surgical Site Infection Following Gastric Surgery in Japan. *Infect. Control Hosp. Epidemiol.* **2016**, *37*, 1167–1172.
28. Dessie, W.; Mulugeta, G.; Fentaw, S.; Mihret, A.; Hassen, M.; Abebe, E. Pattern of Bacterial Pathogens and Their Susceptibility Isolated from Surgical Site Infections at Selected Referral Hospitals, Addis Ababa, Ethiopia. *Int. J. Microbiol.* **2016**, *2016*, 2418902.