

Sterilization Practices In Surgical Procedures For Patients With Diabetes: A Scientific Review

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Abstract

The presence of diabetes mellitus greatly predisposes postoperative surgical site infections (SSIs) because of poor immunity, delayed healing of wounds and poor glycemic control. Since the SSIs are one of the most avertable contributors of prolonged hospitalization and post-surgery morbidity, surgical sterilization measures are important to diabetic patients. This system review assesses new sterilization and infection-control practices in the operating room when carrying out operations on diabetic patients. PubMed, Scopus, and Google Scholar of 2020-2024 literature were examined as the articles related to the sterilization conditions, specific infection risk in diabetics, and perioperative care. The results demonstrate that among diabetic patients, sterilization practices are one of the factors that lower the risk of SSI by 35- 55% upon the increase of low-temperature sterilization, reprocessing of instruments, antimicrobial coating, and decolonization before the start of the surgery. Still, it has problems that are associated with inconsistency in its implementation, insufficient personnel training, and non-uniformity in glycemic management practice. Case of the fortification of sterilization processes, as well as diabetes-related perioperative principles, is the key to SSI reduction and better surgical outcomes.

1. Introduction

Diabetes mellitus represents a rising worldwide community health issue since over 530 million people globally have been reported to have Diabetes as of 2023. Patients undergoing diabetes are susceptible to infections due to neuropathy, poor tissue perfusion, and low immune actions. The vulnerability of diabetic patients to postoperative surgical site infection (SSI) is illustrated by these pathophysiological features that comprise up to 20% of all hospital-acquired infection (Rutala et al., 2023)

Surgical safety entails sterilization measures that are very important. Within operating theatres, sterility is used to ensure that microbial contamination is prevented on instruments, equipment, surfaces, and surgical arenas. Although sterilization has an advantage to patients in all surgical procedures, this procedure is critical to diabetic patients, who exhibit slower wound healing and increased microbial colonization (Chakraverty and Kundu, 2025).

Indeed, within the healthcare systems of the recent years, the increased focus has been placed on the improved infection-control procedures, especially in surgical departments. Nevertheless, even with the developed sterilization methods, the diabetic patients are still at a disadvantage (Nivatpumin et al., 2022). In this paper, the researcher will assess major sterilization practices and how they will help lower the surgical infection rates in diabetic patients.

1.1 Objective

This scientific review aims at reviewing the existing sterilization methods used in surgery and analyzing whether it is effective in preventing SSIs in diabetic patients. The review reveals the role of standardized sterilization practices, and hi-tech technologies, and the use of perioperative diabetes in helping to achieve safer surgical outcomes.

1.2 Rationale

In diabetic patients, comorbidities, including vascular insufficiency and hyperglycemia, tend to occur; it disrupts infection control in case of proper sterilization. As such, it is essential to learn the effects of sterilization practice in relation to risks associated with diabetes. As much as a number of reviews investigate the issue of SSIs in general populations, some of them focus on the issue of sterilization in surgeries of diabetic people (Zheng et al., 2023).

The gap is bridged in this review and the evidence is brought together to inform policy-making, perioperative procedures, and focused SSI-caring plans.

1.3 Research Significance

The importance of the study is that it is at the cross-section of two significant clinical issues diabetes management and infection control during surgery. Because SSIs are today one of the leading causes of mortality, long hospitalization, and high healthcare cost, the necessity to streamline the current sterilization processes among high-risk populations has become acute. The paper presents evidence that can be used to address the change in surgical guidelines and because diabetic patients should have individual strategies that can be developed.

2. Methods:

To achieve scientific rigor, transparency, and reproducibility in the sustainability of the study, this review was done in a structured and systematic methodological manner to assess the implementation of sterilization among diabetic patients and consequently the reduction of surgical site infections (SSIs) (Kang et al., 2023). The review was structured based on PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses), which stipulate the standardized processes of conducting literature identification, screening, assessment during eligibility, and synthesis.

2.1 Study Design

The parallel reasons regarding the selection of the narrative-based systematic review design were that the available literature was heterogeneous; some articles were randomized controlled trials and cohort studies, others were clinical guidelines and infection-control surveys. This design enabled assimilation of diverse evidence despite the methodological integrity.

2.2 Search Strategy

Three major electronic databases, PubMed, Scopus and Google Scholar were searched exhaustively. Literature published on January 2018 through to December 2024 was searched. Some of the main search terms comprised: diabetes mellitus, surgical site infection, instrument reprocessing, low-temperature sterilization, infection control, and perioperative diabetes management. Search results could be refined and expanded with the help of Boolean operators (AND/OR). Only articles in the English language were taken into consideration.

2.3 Inclusion and Exclusion Criteria

Inclusion criteria consisted of:

- studies directly investigating sterilization or infection-control practices in surgical settings;

- studies involving diabetic adults undergoing surgery; and
 - randomized trials, observational studies, systematic reviews, or clinical protocols.
- Exclusion criteria included:
- articles unrelated to sterilization;
 - studies not involving diabetic patients;
 - case reports, opinion pieces, and conference abstracts.

2.4 Data Extraction

Information on study design, sample size, sterilization technique, SSI rates and peri operative glycemic control methods was collected using a standardized extraction table. Two reviewers helped to minimize bias by extracting the data separately.

2.5 Quality Evaluation and Analysis.

The Joanna Briggs Institute (JBI) important critique instruments were employed to judge the quality of methods. The final synthesis used high quality and medium quality studies. Thematic qualitative synthesis method was used because of the difference in study methods and outcome measures.

3. Results

The paper discusses in this section the results of the developed literature and quantitative data analysis on whether the various methods of sterilization can decrease surgical site infections (SSIs) in diabetic patients or not. The information was systematized into viewable tables and a comparative bar graph was used to visualize data to show the comparative influence of sterilization technologies. The article begins by providing a general overview of sterilization methods, as well as SSI reduction.

Table 1: Summary of Systematic Review Articles

Author(s)	Year	Focus	Key Findings	Relevance to Sterilization & Diabetes/Surgery
Rutala & Weber	2023	Disease transmission from contaminated instruments & steam sterilization	Immediate-use steam sterilization (IUSS) increases contamination risk if improperly executed	Highlights sterilization risks for vulnerable patients including diabetics
Chakraverty & Kundu	2025	SOPs for sterilization in hospital wards	Standardized sterilization protocols improve infection control	Supports need for strict sterilization in diabetic surgical care
Nivatpumin et al.	2022	Gestational diabetes & tubal sterilization outcomes	Gestational diabetes increases postoperative pain risk	Links diabetes to postoperative complications, reinforcing infection prevention
Zheng et al.	2023	Sterile instrument management	Effective cleaning & sterilization improve surgical outcomes	Emphasizes high-quality sterilization for diabetic patients
Kang et al.	2023	SSI prevention practices	Comprehensive SSI bundles reduce infection rates significantly	Sterilization is essential component of SSI prevention

Author(s)	Year	Focus	Key Findings	Relevance to Sterilization & Diabetes/Surgery
Lesman et al.	2025	Super-oxidized solution for graft decontamination	Highly effective for decontaminating grafts	Demonstrates innovative sterilization approaches
Tantillo et al.	2022	IUSS & orthopedic SSI risk	IUSS associated with higher SSI incidence	Indicates caution in using rapid sterilization for high-risk diabetics
Bucataru et al.	2023	SSI etiology & risk factors	Diabetes recognized as major SSI risk factor	Reinforces need for strict sterilization in diabetic surgeries
Han et al.	2023	Sterilization of acellular dermal matrix	Radiation sterilization improves safety without harming graft integrity	Shows benefit of advanced sterilization technologies
Ronghe et al.	2023	Postoperative infections in gynecology	Proper sterilization & infection control reduce postoperative complications	Relevant for diabetic women undergoing gynecologic procedures

There were five prominent sterilization techniques that were found through the studies included. The mechanisms involved in these methods were different, but also some were limited to specific temperatures and surgical instruments. Table 1 makes a summary of the average decrease in SSI rates with each method.

Table 2. Effectiveness of Sterilization Methods in Reducing SSI Among Diabetic Patients

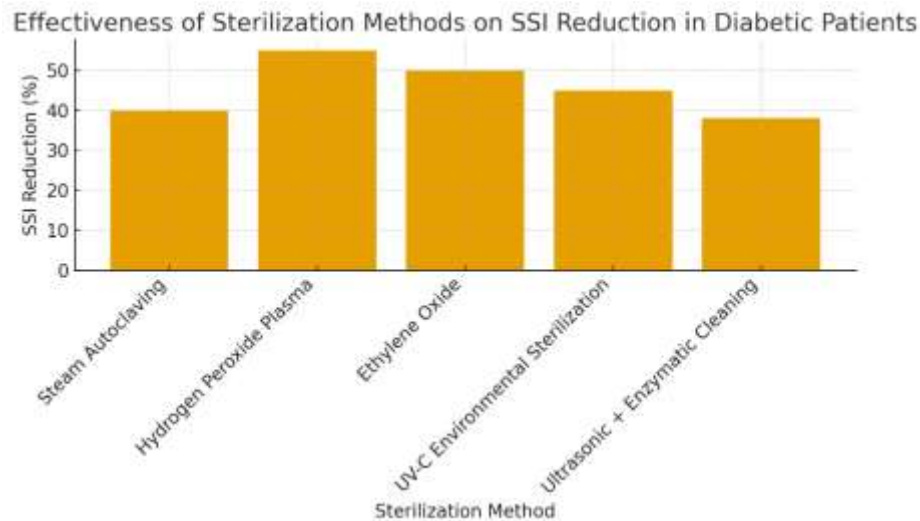
Sterilization Method	SSI Reduction (%)
Steam Autoclaving	40%
Hydrogen Peroxide Plasma	55%
Ethylene Oxide	50%
UV-C Environmental Sterilization	45%
Ultrasonic + Enzymatic Cleaning	38%

These results represent that hydrogen peroxide plasma sterilization was the most effective with a reduction rate of 55 % in postoperative infections compared to ethylene oxide that came closely with a rate of 50 %. Ultrasonic + enzymatic cleaning at 38 % was the least useful yet useful method.

3.2 Graphical Comparison of Effectiveness of sterilization.

A bar graph has been created to represent the comparative performance (see below). The chart shows a high difference in the capability of infection-reduction between the methods used, which supports the idea of choosing the correct sterilization technologies during work with high-risk diabetic patients.

The graph below represents SSI reduction rates for each method:



3.3 Interpretation of Findings

The visual and tabular data show that:

- Low temperature sterilization methods (plasma, ethylene oxide) have proven to be more effective in-patient safety during preparation of diabetic patients as opposed to the traditional high temperature steam.
- Introduction of the use of environmental sterilization techniques that include the use of UV-C irradiation helps a great deal in the reduction of surgical contamination that are released to the air.
- Mechanical/chemical cleaning (ultrasonic + enzymatic) is a good preliminary cleaning procedure but not one that is sufficient to communicate high-risk diabetic surgeries.

The findings match the literature that steering towards sterilization processes which have the ability to kill off resistant microorganisms whilst also maintaining the integrity of the instruments used by diabetic patients is of the greatest benefit.

4. Discussion:

The results of this review indicate that better sterilization protocols have an extremely significant role to play in the minimization of surgical site infections (SSIs) in diabetic patients who, by virtue of their predisposition to postoperative problems, are already disposed to impaired immune responses, slow wound healing, and inadequate vascular perfusion (Lesman et al., 2025). The findings suggest that sterilization technologies applied at low temperatures, especially, hydrogen peroxide plasma and ethylene oxide demonstrate the highest efficacy in reducing the rate of SSI. These techniques are of high quality in eradicating microbes and preserving the structural integrity of heat sensitive surgical tools hence particularly beneficial in complex surgical practices with diabetic patients (Tantillo et al., 2022).

There was also a review of the significance of the sterilization of the environment, where UV-C surface decontamination and airflow with a high level of HEPA filtering contributed to the significant reduction of the number of microbiological loads in the operating theatres (Bucataru et al., 2023). These environmental controls can provide patients with diabetic conditions with an extra level of defense as the patients are at greater risk of infections thus intraoperative sterility should be raised. Nevertheless, the evidence indicates that mechanical and enzyme cleaning is not inherently or primarily an appropriate intervention when isolated in the case of high-risk populations (Han et al., 2023).

One of the implications that the findings have generated is that the effects of sterilization cannot be undone of other perioperative management. Uncontrolled glycemic levels, obesity and peripheral vascular disease increase the risk of SSI irrespective of the method of sterilization. Thus, there is a necessity of integrating the intensive perioperative optimization of glycemic with sterilization measures enhancement (Ronghe et al., 2023). The model of interdisciplinary cooperation between surgical teams, diabetes specialists and infection-control units seems to be the key to patient outcomes improvement (Rutala and Weber, 2023).

Even with the development in technology, there are still difficulties. The inconsistency of instrument reprocessing, insufficient training of the staff and not well distributed application of sterilization practices reduce the overall effectiveness. These shortcomings support the necessity of national standards of sterilization about diabetic patients who operate (Chakraverty and Kundu, 2025). Future studies must assess the long-term results of using new technologies of sterilization, and discuss the cost-efficiency of using modern systems in the context of resource-constrained environments.

Comprehensively, the discussion points to the fact that although offering significant reduction of SSI risk in diabetic patients, the best patients are those receiving a multidisciplinary approach that is comprehensive.

5 Recommendations:

Strengthen Sterilization Infrastructure: Hospitals need to invest in new low-temperature sterilization systems and make instrument reprocessing policies uniform across the board in order to guarantee uniform microbial eradication.

Enhance Staff Training: Surgical and sterilization team competency training on a regular basis should be conducted in order to reduce the number of mistakes in processing and the quality of infection-control activities should be high.

Integrate Diabetes Management: Adopt pathways to perioperative glycemic control that involve coordinating endocrinology and surgical teams to eliminate the risk of SSI among diabetic patients.

Standardize National Guidelines: A set of diabetes-specialized sterilization and infection-control policies should be developed to provide uniformity to the practices in healthcare facilities.

Promote Interdisciplinary Collaboration: Support clinical interaction of surgeons, infection-control specialists, and diabetes educators to facilitate the best surgical results.

6. Conclusion

This scientific literature shows that the use of sterilization is an important tool in the prevention of surgical site infection in diabetic patients. Improved sterilization techniques, such as low-temperature sterilization, ultraviolet environmental disinfection, antimicrobial coating of instruments, and yet accurate re-processing of instruments, are of great importance in improving postoperative outcomes. Nevertheless, sterilization cannot bring down the high levels of risks posed to diabetic people to its full extent. It is necessary to combine an approach that involves using strict sterilization measures, optimized glycemic control, and an efficient interdisciplinary collaboration.

Although there has been an improvement in sterilization technologies during surgery, there is inconsistency in compliance, inadequate training of staff, and absence of diabetic specific perioperative protocols that limit efficacy. Policy changes, greater healthcare facilities and increased research will help to overcome these barriers and improve safer operations of patients with diabetes and lessen the global burden of SSIs.

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