

**Evaluation of Serum Cholesterol Levels as Risk Factor in Developing Surgical Site Infection Following Elective Surgery****Mohd Anas Saeed<sup>1</sup>, Kamal Ji Pandit<sup>2</sup>, Kumar Manish<sup>3</sup>, Aakash Tomar<sup>4</sup>, Shehzad Husain Khan<sup>5</sup>, Anuj Aggarwal<sup>6</sup>**<sup>1</sup>Senior Resident, Department of General Surgery, HIMSR, New Delhi, India<sup>2</sup>Senior Resident, Department of Orthopaedics, HIMSR, New Delhi, India<sup>3</sup>Senior Consultant, Department of General Surgery, Batra Hospital & Medical Research Centre, New Delhi, India<sup>4</sup>Assistant Professor, Department of Orthopaedics, HIMSR, New Delhi, India<sup>5</sup>Medical Officer, Department of General Surgery, Sub District Hospital, Dharchula, Pithoragarh, Uttarakhand, India<sup>6</sup>Senior Resident, Department of Orthopaedics, HIMSR, New Delhi, India

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Conflict of interest: Nil

**Abstract****Background:** Surgical site infection (SSI) is a common postoperative complication that increases patient morbidity, mortality, hospital stay, and healthcare costs. Nutritional and metabolic factors such as serum cholesterol and serum albumin may influence host immunity and wound healing. However, the association between serum cholesterol levels and SSI remains inadequately explored.**Aim:** To evaluate the relationship between preoperative serum cholesterol levels and the risk of developing surgical site infection in elective surgical patients.**Methods:** This hospital-based prospective observational study was conducted in the Department of Surgery at Batra Hospital & Medical Research Centre, New Delhi, from February 2023 to July 2024. Eighty patients aged 20–55 years undergoing elective uncomplicated surgeries were included. Preoperative fasting serum cholesterol and albumin levels were recorded. Patients received standard antibiotic prophylaxis and were followed on postoperative day 2, day 7, and day 30 for development of SSI as per CDC criteria. Data were analyzed using SPSS version 25;  $p < 0.05$  was considered statistically significant.**Results:** The overall incidence of SSI was 18.8%. SSI occurred significantly more frequently in patients with hypocholesterolemia (34.5%) compared with those having high cholesterol levels (9.8%) ( $p = 0.01$ ). Hypoalbuminemia was also significantly associated with SSI (35.3% vs 14.3%,  $p = 0.04$ ). No significant association was found between SSI and age, gender, hypertension, or smoking.**Conclusion:** Hypocholesterolemia and hypoalbuminemia are significant predictors of surgical site infection in elective surgical patients. Routine preoperative assessment of these parameters may help identify high-risk individuals and enable targeted preventive strategies.**DOI:** 10.25258/ijcpr.18.3.145This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Surgical site infection (SSI) is the infection following surgery at the surgical incision or operative space. Surgical site infections are defined as infections occurring up to 30 days after surgery (or up to 90 days after surgery in patients receiving implants) and affecting either the incision or deep tissue at the operation site.[1] There are three types of SSI defined by the Centers for Disease Control and Prevention (CDC): superficial incisional, deep incisional, and organ/space infections.[2] SSIs are responsible for increased economic burden on the healthcare system including prolonged hospital stay, increased cost, and higher morbidity.

Surgical site infections remain one of the most common causes of serious surgical complications [3] and account for 14–17% of all hospital-acquired infections and 38% of nosocomial infections in surgical patients.[5] Each SSI is associated with approximately 7–10 additional postoperative hospital days and patients with SSI have a 2–11 times higher risk of death compared with those without SSI.[6,7] Various risk factors are associated with the development of SSI including age, nutritional status, diabetes, smoking, obesity, and altered immune status.[8] Many preoperative and intraoperative factors such as shaving, skin

preparation, operating room environment, and drains also contribute.[9,10]

The role of cholesterol in the human body is significant as it serves as a precursor for steroid hormones and plays an important role in immune function.[13] Cholesterol-rich lipoproteins such as HDL and LDL have been shown to neutralize bacterial endotoxins and modulate inflammatory responses.[14-17] Low serum cholesterol has been associated with gland dysfunction and increased mortality in critically ill patients.[12] Serum albumin and total cholesterol are markers of nutritional status; however, their role as predictors of SSI has been less extensively studied. Hypocholesterolemia has been reported as a predictor of mortality in geriatric patients.[18] Malnutrition remains highly prevalent in surgical patients in developing countries, with reported rates between 10% and 54%.[26]

Hence, the present study was undertaken to determine the role of serum cholesterol levels as a risk factor for developing SSI following elective surgery.

**Review of Literature:** Studies of SSI epidemiology are complicated by their heterogeneous nature, with incidence varying widely between procedures, hospitals, and patient populations.[27] Data from the CDC NNIS system indicate that SSIs are the third most frequently reported nosocomial infections, accounting for 14–16% among hospitalized patients and up to 38% among surgical patients.[5,28] European data suggest SSI incidence may reach 20% depending on procedure type and surveillance quality.[21] The increasing use of minimally invasive surgery has

contributed to reduced SSI rates. For example, laparoscopic cholecystectomy has an SSI rate of approximately 1.1% compared with 4% in open surgery.[22]

SSIs impose substantial clinical and economic burden. Kirkland et al. reported that SSI increases mortality risk (RR 2.2) and prolongs hospital stay by a median of 6.5 days.[23] Whitehouse et al. also demonstrated significant increases in healthcare costs following orthopedic SSI.[24]

Multiple patient-related and procedure-related risk factors influence SSI development. These include age, diabetes, smoking, duration of surgery, wound contamination, and surgical technique.[20] The NNIS risk index is commonly used to estimate SSI risk based on wound class, ASA score, and operative duration.[28]

Interest has grown regarding the immunological role of cholesterol. Experimental studies show that HDL can attenuate lipopolysaccharide-induced cytokine production.[15] Canturk et al. demonstrated increased nosocomial infection rates in patients with low HDL levels.[25] Morimoto et al. reported that total cholesterol <160 mg/dL predicted higher postoperative infection rates.[27]

However, some recent studies have failed to demonstrate a statistically significant association between total cholesterol and SSI, though hypoalbuminemia consistently remained significant.[28-30] These conflicting findings highlight the need for further prospective evaluation, particularly in nutritionally vulnerable populations.

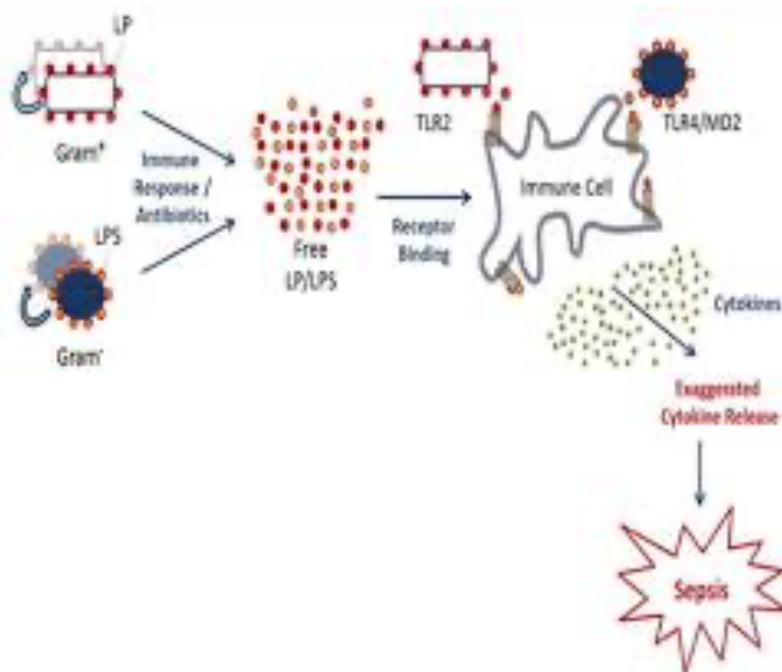


Figure 1:

## Aims and Objectives

**Aim:** To evaluate the role of serum cholesterol levels as a risk factor for surgical site infection in elective surgical patients.

**Objectives:** To estimate preoperative serum cholesterol levels in elective surgical patients, to follow patients postoperatively for development of SSI, to determine the association between serum cholesterol and SSI, to evaluate the relationship between serum albumin and SSI.

## Materials and Methods

**Study Design and Setting:** This hospital-based prospective observational study was conducted in the Department of Surgery at Batra Hospital & Medical Research Centre, New Delhi, from February 2023 to July 2024 (18 months).

**Study Population:** Eighty patients aged 20–55 years undergoing elective uncomplicated surgeries were included after ethical approval and informed consent.

**Sample Size:** Based on previous literature and assuming 15% SSI risk, the required sample size was calculated as 76. After adjusting for 5% dropout, 80 patients were enrolled.

**Inclusion Criteria:** Age 20–55 years, Both sexes, Elective uncomplicated surgery, Provided informed consent, Available preoperative serum cholesterol.

## Exclusion Criteria

Emergency or contaminated surgeries, Diabetes mellitus, malignancy, liver disease, Immunocompromised state Age <20 or >55 years, non-consenting patients.

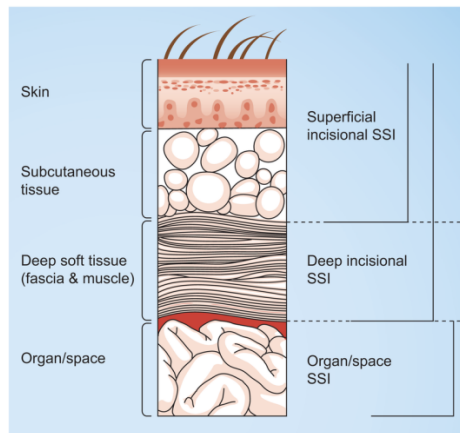
**Preoperative Assessment:** Detailed history and clinical examination were performed. Fasting blood samples were obtained for: Total serum cholesterol, Serum albumin.

**Classification:** Low cholesterol: <159 mg/dL, High cholesterol: >240 mg/dL, Hypoalbuminemia: <3.5 g/dL.

## Perioperative Protocol

**All patients received:** Inj. Ceftriaxone 1 g IV 30 minutes before incision, Strict aseptic precautions, Standard skin preparation with povidone-iodine/chlorhexidine, Saline and povidone irrigation before wound closure.

**Follow-up:** Patients were examined for SSI on: Post-operative day 2, Day 7, Day 30. SSI was diagnosed according to CDC criteria.



**Figure 2:**

**Statistical Analysis:** Data were entered in MS Excel and analyzed using SPSS version 25. Quantitative variables → mean ± SD, Qualitative variables → percentage Tests used → Chi-square, Fisher exact, unpaired t-test, Significance →  $p < 0.05$

**Ethical Considerations:** Institutional ethics approval was obtained. Written informed consent, confidentiality, and voluntary participation were ensured.

## Results

A total of 80 patients were included.

**Demographic Profile:** The mean age was  $37.68 \pm 10.67$  years. Most patients belonged to the 21–30 year age group (33.8%). Males constituted 65% of the study population.

**Incidence of SSI:** Overall SSI incidence was 18.8% (15/80).

## Comorbid Profile

**Hypertension:** 32.5%, **Smokers:** 21.3%, **Hypoalbuminemia:** 21.3%, **Low cholesterol:** 36.3%.

Cholesterol and SSI occurred in: Low cholesterol: 34.5%, High cholesterol: 9.8%, This association was statistically significant ( $p = 0.01$ ).

**Albumin and SSI:** SSI occurred in Hypoalbuminemia: 35.3%, Normal albumin: 14.3%. Statistically significant ( $p = 0.04$ ).

**Other Factors:** No significant association was found between SSI and: Age ( $p = 0.48$ ), Gender ( $p = 0.17$ ), Hypertension ( $p = 0.49$ ), Smoking ( $p = 0.89$ ).

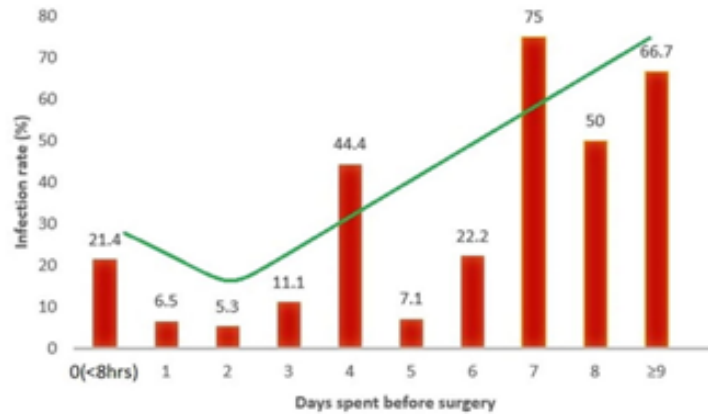


Figure 3: Days spent before surgery

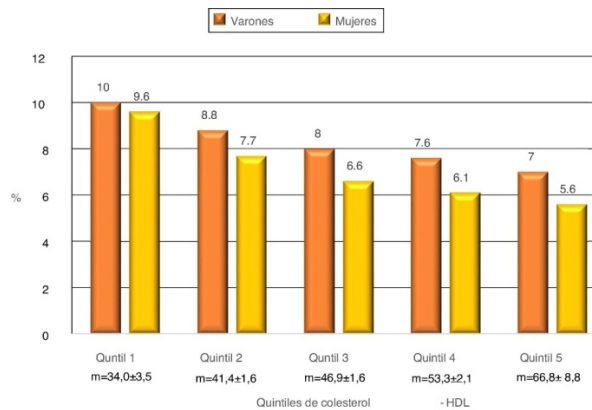


Figure 4:

Overall, hypocholesterolemia and hypoalbuminemia emerged as significant predictors of SSI.

**Discussion and Summary**

Surgical site infection remains a major postoperative complication associated with increased morbidity, mortality, and healthcare expenditure. [6,23] In the present study, the overall SSI incidence was 18.8%, which is comparable to studies by Agrawal et al. and Manjunath et al., reporting rates around 15–16%. [11,48] The present study demonstrated a significant association between hypocholesterolemia and SSI.

Patients with low cholesterol had substantially higher infection rates. This finding supports the biological role of lipoproteins in endotoxin neutralization and immune modulation. [13-17] Similar observations were reported by Morimoto et al. [27] and Canturk et al. [25] Hypoalbuminemia was also significantly associated with SSI in this study, consistent with previous literature identifying serum albumin as a strong predictor of postoperative infection. [29] Traditional risk factors such as age, gender, smoking, and hypertension

were not statistically significant in this cohort, possibly due to the relatively young elective surgical population.

Overall, the findings suggest that metabolic and nutritional parameters—particularly cholesterol and albumin—may play an important role in SSI risk stratification, especially in malnourished populations common in developing countries.

**Conclusion**

The present prospective observational study demonstrates that hypocholesterolemia and hypoalbuminemia are significant predictors of surgical site infection in elective surgical patients. Patients with low serum cholesterol showed a markedly higher incidence of SSI compared with those having higher levels. Routine preoperative assessment of serum cholesterol and albumin may help identify high-risk patients and allow implementation of targeted preventive strategies. Incorporation of nutritional optimization and structured SSI surveillance programs may further reduce postoperative infections, particularly in resource-limited settings.

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