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Hypocholesterolaemia: An Overlooked Risk Factor for Surgical Site Infection

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Abstract: ***Background**: A surgical site infection (SSI) is an infection that develops in the body where surgery was performed. SSI involves tissues beneath the skin, organs, or implanted materials, or they might be superficial infections affecting simply the skin. After surgery, SSIs are the second most frequent kind of adverse events that hospitalized patients experience. Since cholesterol is the precursor of five major types of steroid hormones, its importance in the human body cannot be understated. In addition to having an impact on immunological response and gluconeogenesis, cholesterol's transport forms, and lipoproteins, also act as carriers of medications, poisons, fat - soluble vitamins, and antioxidants. Therefore, the purpose of the study was to determine whether total cholesterol levels and the incidence of SSI were related. **Aims and Objectives**: To establish a relationship between hypocholesterolaemia and the occurrence of surgical site infection. **Materials and Methods**: We prospectively included 60 individuals who were undergoing elective hernia surgery were evaluated for fasting lipid profiles preoperatively and tried to predict the occurrence of SSI during this study. This prospective study was conducted from September 2023 to December 2023 on 60 patients who were admitted and had undergone elective hernia surgeries at Kanyakumari Government Medical College. **Results**: Out of 60 patients, 11 (18.3%) experienced SSI. Multivariant data analysis revealed several factors were associated with a higher risk of SSI, with hypocholesterolaemia being a significant factor, along with diabetes and hypoalbuminemia. Other factors such as smoking, drinking, gender, and hypertension have no significant influence on the development of SSI in the current investigation, but other factors such as age played a minimal role in raising the incidence of SSI. **Conclusion**: Hypocholesterolaemia is one of the overlooked characteristics often disregarded but whose consideration can result in a considerable decrease in this preventable consequence.*

Keywords: Hypocholesterolaemia, SSI, Hernia, Fasting lipid profile

1. Introduction

Surgical site infections (SSIs) are infections of the tissues, spaces, or organs exposed by surgeons during an invasive procedure. SSIs are classified into incisional and organ/space infections, and the former are further classified into superficial (limited to the skin and subcutaneous tissue) and deep categories. By definition, an incisional SSI occurs if a surgical wound drains purulent material or if the surgeon judges it to be infected and opens it. {1}The infection of a wound can be defined as the invasion of organisms into tissues following a breakdown of local and systemic defences, leading to either cellulitis, lymphangitis, abscess formation or bacteremia. The infection of most surgical wounds is referred to as superficial surgical site infection (SSSI). The other categories include deep SSI (infection in the deeper musculofascial layers) and organ - involved infection (such as an abdominal abscess after an anastomotic leak). {2} Healthcare systems bear a greater financial burden due to SSI, which includes longer hospital stays and higher costs after surgeries. The ASA score, surgical wound class, blood transfusion, ostomy construction, types of operations, use of drainage, sex, and surgeons were significant predictors of postoperative SSI. Since cholesterol is the precursor of five major types of steroid hormones, its importance in the human body cannot be understated. In addition to having an impact on immunological response and gluconeogenesis, cholesterol's transport forms, and lipoproteins, also act as carriers of medications, poisons, fat - soluble vitamins, and antioxidants. In reaction to tissue - specific trophic hormones, the adrenal gland and gonads are the primary locations for the synthesis of these hormones from cholesterol. {3} The distinctive feature of these steroidogenic tissues is that they require cholesterol not only for cell signalling, membrane biogenesis, and membrane fluidity maintenance but also as the building block for the biosynthesis of steroid hormones and as an important component of the cell membrane. In addition to the different causes of hypocholesterolaemia, malnutrition is a significant secondary factor that affects most patients who present to a government hospital in India. {4}This study was conducted to find an association between the incidence of SSI about Total cholesterol levels in 60 patients admitted for elective hernia repair at Kanyakumari Government Medical College.

2. Methods

This is a prospective cohort study conducted at Kanyakumari Medical College and was approved by our institution's ethical committee. A study population of 60 patients, was admitted to the Department of General Surgery in Kanyakumari Medical College for elective hernia repair (Inguinal/ Umbilical) from September 2023 to December 2023. Patients excluded from this study were:

Critically ill patients presenting in casualty like obstructed/strangulated hernias requiring emergency OT, Patients with immunocompromised states like HIV positive, on corticosteroids, and Pregnant females. Patients who lost follow - up.

Parameters studied:
Gender distribution of the study group.
Age distribution of the study group.
Distribution of study participants according to their total cholesterol levels.
Association between total cholesterol levels and incidence of SSI.

Detailed information was given to the patients and informed consent was collected from them. The study design was approved by the Institutional Ethics Committee constituted as per ICMR guidelines. {5} Details of patients were recorded including history and clinical examination. Necessary pre - operative investigations were performed. Most likely variables having a possible relationship with post - operative complications due to this study were evaluated at the time of admission and blood samples were obtained under fasting conditions.

Total cholesterol levels were classified into three categories (tertiles) according to (<169, 170 - 240, <240 mg/dl). The lower limit level was considered to be 170 mg/dl. Hypercholesterolemia (above 240 mg/dl).

Antibiotic prophylaxis of Inj. Cefotaxime 1g was given intravenously half an hour before the skin incision and repeated 12 hourly for two days. {6}

Strict aseptic precautions were taken to minimize the chances of SSI including standard preparation of a patient before incision like spirit - povidone iodine - spirit sequence, irrigation with normal saline and povidone - iodine solution before closing the wound, changing of gloves when handling a mesh, discharged on postoperative day 5.

All the surgeries done for hernia repair were open surgeries and no laparoscopic repairs were done. Operative wounds were examined on the second, fifth, and eighth postoperative days for signs of surgical site infection.

Incisional SSI both superficial and deep were defined according to CDC criteria and were recorded and SSI surveillance was extended to 30 days post - surgery.

3. Results

A total of 60 patients underwent open hernia repairs with mesh placement of 49 (81.7%) were male patients and 11 (19.3%) were female patients.

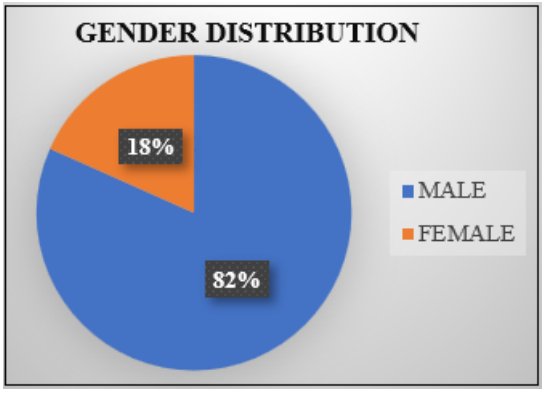


Figure 1: Gender Distribution among Participants

The majority of the patients in the present study population consisted of males 81.7%

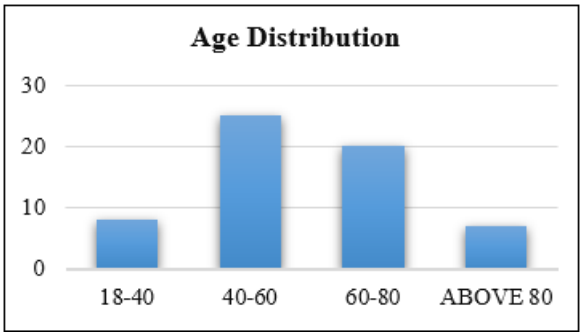


Figure 2: Age among the participants

A majority (41.7%) of the patients were belonging to the age group of 40 - 60 years. The mean age of study participants was 52.7 years.

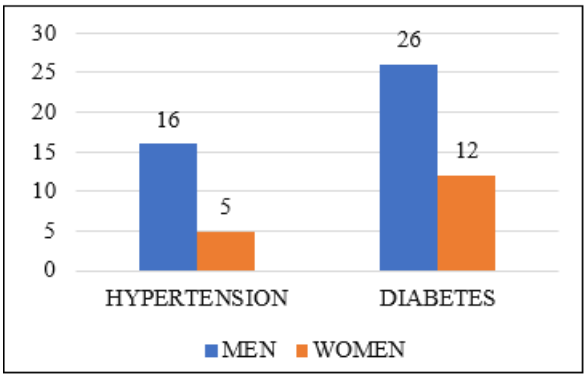


Figure 3: Co - Morbidities among the Participants

Among 60 individuals, 21 individuals (35%) had hypertension, 38 patients (63%) had diabetes mellitus, and 14 patients (23%) had both hypertension and diabetes mellitus. {7}

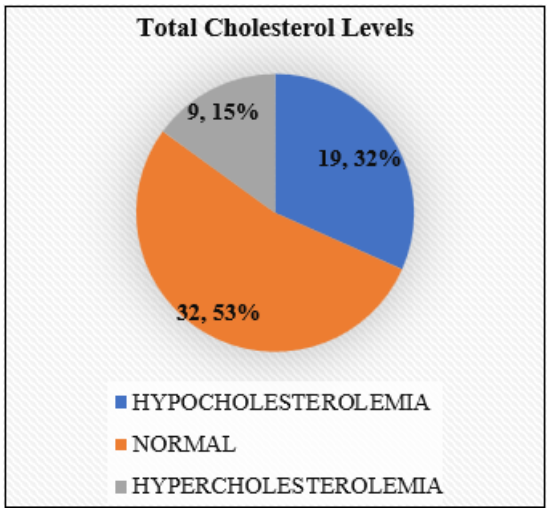
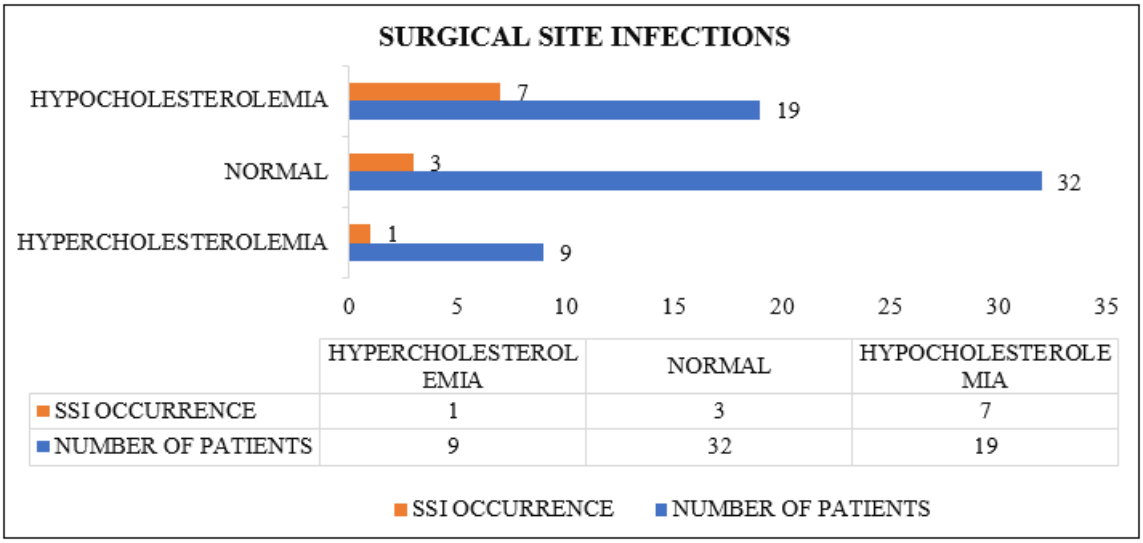


Figure 4.1: Distribution of Study Participants according to Total Cholesterol Levels

Among the 60 patients, 19 patients (32%) were found to have hypocholesterolaemia, out of which 7 developed surgical site infections, 9 patients (15%) were hypercholesterolemic, out of which 1 patient developed SSI, 32 patients (53%) were having normal cholesterol values, out of which 3 developed surgical site infection as described in fig 4.1 and fig 4.2.



	HYPERCHOLESTEROLEMIA	NORMAL	HYPOCHOLESTEROLEMIA
SSI OCCURRENCE	1	3	7
NUMBER OF PATIENTS	9	32	19

Figure 4.2: Surgical Site Infection in Study Population

In the whole study population out of 60 patients, 11 patients (18.33%) developed SSI. Surgical site infections were noted to be occurring significantly more in patients with hypocholesterolaemia (36.8%). In contrast, other groups were found to have less significance in patients with normal cholesterol levels (9.3%) and hypercholesterolemia (11.1%) Which has a p - value of less than <0.001, hence statistically significant.

4. Discussion

One of the main risks of surgery is surgical site infection (SSI), which is linked to longer hospital stays, higher prices, and higher rates of morbidity and mortality. Recently, Randomized trials have revealed several preventive measures that can significantly lower the risk of SSI. These include managing hyperglycemia, maintaining perioperative normothermia, and administering the proper prophylactic antibiotics. Numerous processes, many of which depend on oxygen, are involved in the healing of wounds. The strength of the wound is determined by the development and production of collagen, which is directly related to the tissue's partial pressure of oxygen. Specific enzymes must function normally for collagen synthesis, cross - linking, and the resulting strength of the wound to occur.

The amount of oxygen present directly affects how these enzymes function; for example, hydroxylase enzymes hydroxylate proline, and lysine. A multitude of hormonal alterations are brought on by neuronal activation of the hypothalamic - pituitary - adrenal axis, which has an overall metabolic effect of catabolism of body fat stores. This is known as the stress response to surgery. [8] The stress hormone cortisol, which is produced from cholesterol and secreted from the adrenal cortex, rises quickly for four to six hours, from a baseline of 400 nmol/lit to over 1500 nmol/lit. Following surgery, the pituitary - adrenal axis' feedback mechanism is rendered ineffective, so the levels of both hormones stay high[9, 10, 11].

Various literature quote the incidence of SSI ranging from 1 - 20% in various case series. In our study/series, we found the overall incidence to be 18.33%. In a study done by Morimoto M, et al. Serum total cholesterol concentrations <160mg/dl were associated with an increased incidence of superficial and deep SSI[12]. Another study by, Delgado - Rodriquez et al in a prospective study to access the risk factors associated with

nosocomial infections found that both low levels (below 102 mg/dl) and high levels (above 290 mg/dl) of serum total cholesterol were associated with high - risk of SSI and RTI in comparison with the reference group (139 - 261 mg/dl) whose findings were same as the findings in present study[13]. This study is a trial to create awareness to recognize hypocholesterolaemia as a risk factor for the development of SSI particularly in a government setup where patients who present are usually underweight and should be taken under consideration.

5. Conclusion

Hypocholesterolaemia is one of the overlooked characteristics that is often disregarded but whose consideration can result in a considerable decrease in this preventable consequence.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethical Committee

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