

# Cholesterol Levels: Useful Predictors Of Surgical Site Infections In Emergency Laparotomy

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## Abstract

**Background and Objectives:** Emergency surgeries have been found to be associated with high rates of surgical site infections compared to elective surgeries. This study was conducted to determine cholesterol as predictor of SSI in emergency laparotomy as to throw light on how to minimize SSI. This study was intended to find the association between cholesterol levels and SSI, length of hospital stay and death in emergency laparotomy.

**Methodology:** A prospective cohort study was conducted between April 2018 and October 2018 among 94 patients who underwent emergency laparotomy in Department of General Surgery. Each patient will be monitored from time of admission until the time of discharge and followed postoperatively 30 days for surgical site infection. The predictor variable is the cholesterol. The outcome variables are surgical site infection, length of hospital stay and death. The analysis was done to find association between this variable.

**Results:** During follow up of 94 patients, 29(30.8%) developed SSI and 7(8.5%) patients died. Patients with cholesterol level 200mg/dl had 14.3% SSI. The patients with cholesterol had increased length of stay in hospital than those with high values. The statistically significant association between pre-op cholesterol and Death could not be made. Cholesterol emerged significant to SSI after multivariate analysis. Cholesterol had not emerged as significant to length of stay and death.

**Conclusion:** In this study, cholesterol is associated with increased risk of SSI. Association of cholesterol with length of stay and death could not be made. Cholesterol concentration is a better predictor of SSI.

**Keywords:** Surgical site infections, pre-op albumin, pre-op cholesterol, length of hospital stay, death, emergency laparotomy

## Introduction

Incisional infections are more common accounting for 70% of all SSI but better prognosis than organ/space related infection with latter accounting for 90% SSI related mortalities<sup>[1, 2]</sup>. The adverse effects of malnutrition on the morbidity and mortality of patients was first recognized by Hippocrates (460BC-370 BC) many centuries ago. It occurs in about 30% of surgical patients with gastrointestinal diseases and in up to 60% of those in whom hospital stay has been prolonged because of postoperative complications. There is a substantial evidence to show that patients who have signs of malnutrition have a higher risk of complications and an increased risk of death in comparison with patients who have adequate nutritional reserves<sup>[3]</sup>. Nutritional assessment is essential to identify patients who are at risk of developing complications related to significant malnutrition<sup>[4]</sup>. Cholesterol level is an objective measure of nutritional status and a reliable marker of poor prognosis for morbidity and mortality<sup>[5]</sup>. It is found with an increase in C-reactive protein, a prototypically acute phase protein closely related to mortality. Hypercholesterolemia causes structural change in mitochondria, like amorphous densities in mitochondria and functional loss, like loss of membrane permeability. Excess lipids predispose to atherosclerosis, DM and obesity which also delay wound healing and predispose to SSI. The total cholesterol level more than or equal to 239 is high and a value between 200 and 238 is borderline and has a high risk of cardiovascular disease<sup>[6]</sup>. Emergency surgeries have been found to be associated with high rates of surgical site infections compared to elective surgeries. But not many studies have been conducted to determine the risk factors for surgical site infections in emergency surgeries so as to throw light on how to minimize them. This study intends to try and find out if serum albumin and cholesterol are associated with infections following emergency surgeries by studying the association between preoperative albumin and cholesterol levels and SSI, length of hospital stay and death in emergency laparotomy so as to modify them and prevent surgical site infections.

## Aims and Objectives

To study the relation between cholesterol levels and outcome of surgery, measured as surgical site infections, length of hospital stay and death in patients undergoing emergency laparotomy.

## Materials and Methods

**Study design:** Prospective Cohort study.

**Study setting:** General surgery Department.

**Study period:** 7 months from April 2018 and October 2018.

**Study population:**

### Inclusion criteria

Patients undergoing emergency laparotomy in Department of General surgery for non-traumatic disease Age > 13 years.

### Exclusion criteria

Laparotomy in the setting of trauma.

- Foreign body implantation during surgery like prosthetic mesh.
- Not giving consent.

**Predictor variable:** Pre-op serum albumin.

### Outcome variables

- Mainly Surgical site infection.
- Length of hospital stay.
- Death.

### Method of data collection

The preoperative cholesterol will be measured. Other data were obtained using a standardized data collection form. Each patient will be monitored from time of admission until the time of discharge and followed postoperatively 30 days for surgical site infection and correlated with the cholesterol levels. Its correlation with length of stay in hospital and death will also be assessed. Blood was collected preoperatively from all patients for measuring cholesterol. Pus or wound exudates were obtained from incision site and transported for culture to laboratory. The serum cholesterol level less than 150mg/dl is considered as low cholesterol; 150-200 as normal; >200 as high cholesterol.

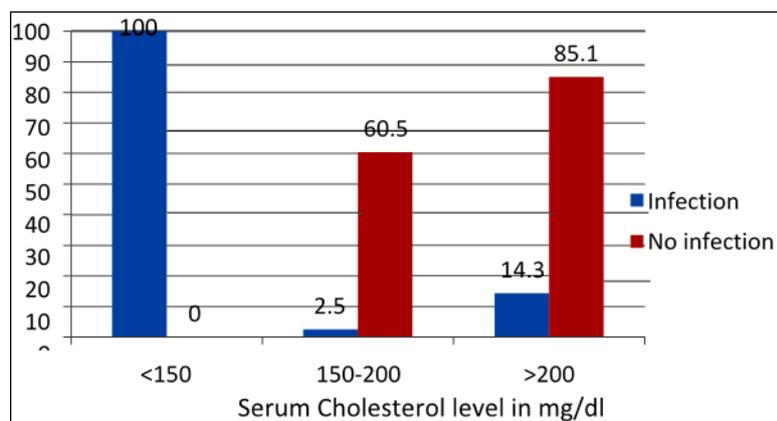
## Results

### SSI and Cholesterol

**Table 1:** Comparison of SSI based on Pre-op Cholesterol

Cholesterol	Infection		NO Infection	
	%	count	%	count
<150	100	7	0	0
150-200	39.5	15	60.5	23
>200	14.3	7	85.7	42

Chi square-23.3; df-2; p value 0.00 (<0.05).



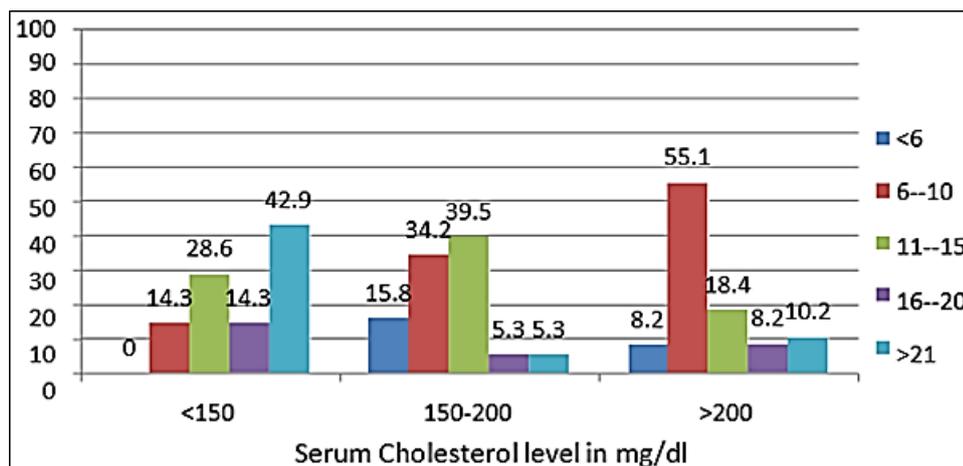
**Fig 1:** Comparison of SSI based on Pre-op Cholesterol

Patients with cholesterol level <150mg/dl had 100% SSI, those between 150-200mg/dl had 2.5% SSI and > 200mg/dl had 14.3% SSI. It was observed that the rate of SSI was more when serum Cholesterol level was less than 150mg/dl which is statistically significant and those with > 150mg/dl were associated with statistically significant lower SSI using the Chi square test.

**Table 2:** Comparison between Length of stay and Pre-Op cholesterol

Cholesterol	<6		6-10		11-15		16-20		>21	
	%	count	%	count	%	count	%	count	%	count
<150	0	0	14.3	1	28.6	2	14.3	1	42.9	3
150-200	15.8	6	34.2	13	39.5	15	5.3	2	5.3	2
>200	8.2	4	55.1	27	18.4	9	8.2	4	10.2	5
		10		41		25		7		10

Chi square-17.7; df-8; P value-0.024.

**Fig 2:** Comparison between Length of stay and Pre-Op cholesterol

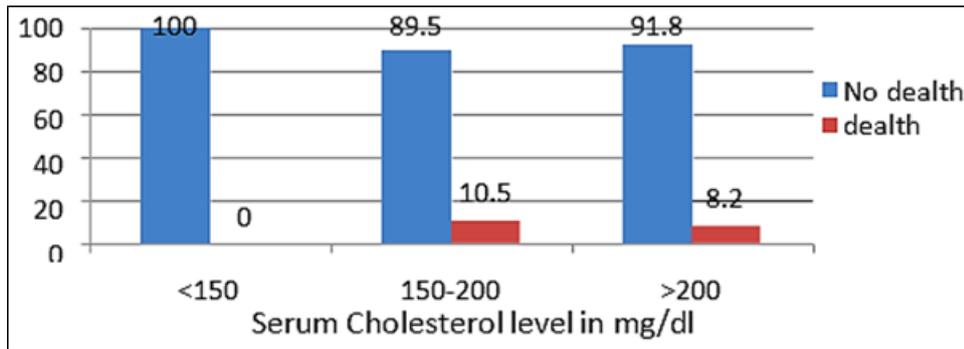
When comparing the sr.cholesterol to LOS, it was found that patients with low cholesterol value (<150mg/dl) had increased length of stay in hospital than those with normal (150-200mg/dl) and high cholesterol (>200mg/dl). Thus, serum albumin is a statistically significant predictor of Length of stay.

### Death and Pre-Op cholesterol

**Table 3:** Comparison between death and pre-op cholesterol

PREOP cholesterol	No death		Death	
	%	count	%	count
<150	100	7	0	0
150-200	89.5	34	10.5	4
>200	91.8	45	8.2	4

Chi square 0.0857; df-2; P value -0.65.



**Fig 3:** Comparison between death and pre-op cholesterol

The statically significant association between preop cholesterol and Death could not be made.

**Fig 4:** ROC curve for prediction of SSI using serum cholesterol

Area under the curve=0.812 the cut off is 174.

With sensitivity = 93.8 and specificity =62%.

## Discussion

Earlier epidemiologic studies found that subjects with altered serum cholesterol levels experienced increased overall mortality. Examples of increased non-cardiovascular mortality at low serum cholesterol levels were observed in patients with cancer, hemorrhagic stroke, some respiratory diseases, digestive disease, suicide, and infectious etiology. Circulating cholesterol- and triglyceride-rich lipoproteins have the capacity to bind and detoxify bacterial lipopolysaccharides (LPSs) or endotoxin. High plasma concentrations of inflammatory cytokines, susceptibility to infections, cytokine-induced catabolism, an increased mortality are consequences of low lipoprotein concentrations, compared with total serum cholesterol. A study by Morimoto (7) et al concluded that both low (159 mg/dl) and high (240 mg/dl) total cholesterol levels are associated with a higher risk of SSI or organ space infection, and only a low level of total cholesterol was associated with a higher risk of pneumonia. No pneumonia occurred in the higher (200 mg/dl) total cholesterol groups. It is well established that serum lipid concentrations decrease after surgical stress and during sepsis. In an emergency setting, particularly with intra-abdominal infection, the cholesterol level is reduced as a consequence of the infection, instead of being a preexisting risk factor. Lower total cholesterol levels that have been observed after severe infection can be mediated by the release of acute-phase reactants. During emergency surgery, peritonitis (localized pus or diffuse peritonitis) is a strong indicator of wound Review of literature [8] and tissue complications. A wound infection is likely to appear when peritonitis occurs with a large intra-abdominal bacterial load and bacteremia despite the perioperative administration of intravenous antibiotics. Some studies have shown that intravenous infusion of reconstituted HDL (rHDL) particles, containing purified apoprotein A-1, phosphatidylcholine and cholesterol, has proved protective for Gram-negative bacteremia in rabbits [9, 10]. rHDL may inhibit the effects of LPS

in human *in vivo* and *ex vivo*, by binding and neutralizing LPS & also by reducing CD14, the main LPS receptor, on monocytes<sup>[11, 12]</sup>. *In vivo* and *in vitro* models of endotoxemia in rodents have shown that lipoproteins-e.g., VLDL cholesterol<sup>68</sup>, LDL cholesterol<sup>[13, 14]</sup>, chylomicrons can modulate the bioactivity of LPS. Prophylactic infusion of VLDL, chylomicrons and rHDL in animals strikingly reduced cytokinemia after LPS administration<sup>[9, 10, 15]</sup>. The level of serum cholesterol, mainly HDL-C, was a predictor of in-hospital death, nosocomial infection, and prolonged stay in hospital. In a study by Canturk<sup>[16]</sup> in 2012, there was an increased association between low HDL-C levels {RR=0.23 (0.13 to 0.41)} and surgical site. Patients with high HDL-C levels (above the 30th percentile) showed a reduced risk of nosocomial infections. On the other hand, HDL-C levels below the 10th percentile elevated the risk of surgical site infections.

### Conclusion

Association of serum albumin and cholesterol with length of stay and death could not be made.

### References

1. Cholesterol and Serum Albumin Levels as Predictors of Cross Infection, Death, and Length of Hospital Stay Miguel Delgado-Rodríguez MD, MPH; Marcelino Medina-Cuadros MD; Antonio Gómez-Ortega MD; Gabriel Martínez-Gallego MD; Marcial Mariscal-Ortiz MD; Miguel Angel Martínez-González MD; María Sillero-Arenas, MD.
2. Townsend, Beauchamp RD, Evers BM, Mattox KL, *et al.*, editors. Sabiston Textbook of surgery 19th edition, The Biological Basis of Modern surgical practice, Saunders, Section LL, Chapter 12, 2012, 243-247.
3. John Macfie. Nutrition and fluid therapy. Bailey and love, short practice of surgery 25th edition, 223 N. Engl. J Med. The Washington manual of Surgery; 5th Edition, 1991;352:52.
4. Sacks GS, Dearman K, Replogle WH, Cora VL, Meeks M, Canada T. Use of subjective global assessment to identify nutrition associated complications and death in geriatric long term care facility residents. J Am Coll. Nutr. 2000;19:570-577.
5. Harrison's online; chapter e53 the clinical laboratory in Modern health care: Table e53.2 National cholesterol education program Adult panel 3rd guideline.
6. Duffy D, Rader DJ. Update on strategies to increase HDL quantity and function. Nat. Rev. Cardiol. 2009;6:455-463.
7. Houterman S, Verschuren WM, Giampaoli S, *et al.* Total but not high-density lipoprotein cholesterol is consistently associated with coronary heart disease mortality in elderly men in Finland, Italy, and the Netherlands. Epidemiology. 2000;11:327-332.
8. Casas AT, Hubsch AP, Rogers BC, *et al.* Reconstituted high-density lipoprotein reduces LPS-stimulated TNF alpha. J Surg. Res. 1995;59:544-552.
9. Casa AT, Hubsch AP, Doran JE. Effects of reconstituted high-density lipoprotein in persistent gram-negative bacteremia. Am Surg. 1996;62:350-355.
10. Pajkrt D, Doran JE, Koster F, *et al.* Anti-inflammatory effects of reconstituted high density lipoprotein during human endotoxemia. J Exp. Med. 1996;184:1601-1608.

11. Galbois A, Thabut D, Tazi KA, *et al.* *Ex vivo* effects of high-density lipoprotein exposure on the lipopolysaccharide induced inflammatory response in patients with severe cirrhosis. *Hepatology*. 2009;49:175-184.
12. Schvartz YS, Polyakov LM, Dushkin MI, *et al.* Modification and clearance of low density lipoproteins during the formation of endotoxin-lipoprotein complexes. *Exp. Biol. Med.* 2008;145:430-432. Navab M, Hough GP, Van Lenten BJ, *et al.* Low density lipoproteins transfer bacterial lipopolysaccharides across endothelial monolayers in a biologically active form. *J Clin. Invest.* 1988;81:601-605.
13. Grunfeld C, Feingold KR, Rapp JH. Human very low density lipoproteins and chylomicrons can protect against endotoxin-induced death in mice. *J Clin. Invest.* 1990;86:696-702.
14. Cantu" RK, Zeynep, NuhZafer Cantu" RK, Berrin C, Etinarslan, NihatZaferUtkan, *et al.* Nosocomial infections and obesity in surgical patients. *Obes Res.* 2003;11:769-775.