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TOTAL CHOLESTEROL AND C-REACTIVE PROTEIN LEVELS AS A PROGNOSTIC MARKERS OF UROSEPSIS

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ABSTRACT

Objective: To investigate whether total cholesterol and C-reactive protein levels could be use as a prognostic factor for outcome in patients with urosepsis. **Material & Methods:** An analytic observational study using 30 patients assigned for total cholesterol and CRP level at the day of admission, three days later, and on the last day of sepsis or on the dead day. All subjects were managed according to standard urosepsis therapy. At the 14th day of treatment, patients were evaluated with a clinical severity score. Then we classified the outcome as improve/good condition, worse, and died. The variables were statistically tested using Spearman's rho test with software SPSS 20. $P < 0.05$ was consider significant. **Result:** From 30 subjects with urosepsis, we found 15 patients in septic condition, 14 patients had severe sepsis and one patient had septic shock. The mean of total cholesterol level in patient with died and worse was lower than that in patient with good outcome. Day 1 (63.25 mg/dl and 101.38 mg/dl vs 119.5 mg/dl), day 3 (56.0 mg/dl and 93.6 mg/dl vs 128.6 mg/dl) and last day/died day (51.0 mg/dl and 82.25 mg/dl vs 154.8 mg/dl). The mean of CRP level in patient with died and worse was higher than that in patient with good outcome. Day 1 (177.18 mg/l and 146.74 mg/l vs 88.1 mg/l), day 3 (127.1 mg/l and 148.8 mg/l vs 56.2 mg/l) and last day/died day (141.88 mg/l and 88.71 mg/l vs 31.58 mg/l). These were statistically significant between total cholesterol and CRP levels in determining the outcome of urosepsis patient. Day 1 (p 0.000 vs 0.011), day 3 (p 0.000 vs 0.002), and last day/died day (p 0.000 vs 0.000). The coefficient correlation total cholesterol was better than CRP in day 1 (ρ -0.633 vs 0.459), day 3 (ρ -0.755 vs 0.543), and last day/died day (ρ -0.874 vs 0.686). **Conclusion:** Low total cholesterol and high C-reactive protein levels can be used as poor prognostic in urosepsis patients. Total cholesterol level was better than CRP as a prognostic marker.

Key words: Urosepsis outcome, prognostic marker, cholesterol level, C-reactive protein level.

ABSTRAK

Tujuan: Untuk mengetahui apakah kadar kolesterol total dan C-reactive protein (CRP) dapat digunakan sebagai faktor prognosis pada hasil pasien urosepsis. **Bahan & cara:** Penelitian analitik observasional Dengan menggunakan 30 sampel pasien dengan urosepsis, yang dilakukan pemeriksaan kolesterol total, CRP, dan keparahan klinisnya pada hari pertama, ketiga, dan hari terakhir atau hari kematian. Seluruh sampel mendapatkan terapi standar untuk urosepsis. Observasi dilakukan maksimal pada hari ke 14 untuk dilakukan penilaian hasil yaitu membaik, memburuk, dan meninggal. Seluruh variabel secara statistik dites menggunakan uji korelasi Spearman's rho dengan software SPSS 20. Nilai signifikan $p < 0.05$. **Hasil:** Dari 30 pasien dengan urosepsis pada awal masuk didapatkan 15 pasien dalam kategori sepsis, 14 pasien sepsis berat, dan 1 pasien syok sepsis. Pada pasien dengan hasil meninggal dan memburuk didapatkan rerata kolesterol total yang lebih rendah dibandingkan pasien dengan hasil membaik, terlihat pada hari pertama (63.25 mg/dl dan 101.38 mg/dl vs 119.5 mg/dl), hari ketiga (56.0 mg/dl dan 93.6 mg/dl vs 128.6 mg/dl) dan hari terakhir pasien meninggal atau sembuh (51.0 mg/dl dan 82.25 mg/dl vs 154.8 mg/dl). Sedangkan rerata kadar CRP pada pasien dengan hasil meninggal dan memburuk lebih tinggi dibandingkan pasien dengan hasil membaik terlihat pada hari pertama (177.18 mg/l dan 146.74 mg/l vs 88.1 mg/l), hari ketiga (127.1 mg/l dan 148.8 mg/l vs 56.2 mg/l) dan hari terakhir pasien meninggal atau sembuh (141.88 mg/l dan 88.71 mg/l vs 31.58 mg/l). Didapatkan nilai bermakna secara statistik pada kolesterol total dan CRP dalam menentukan hasil dari pasien urosepsis baik pada hari pertama (p 0.000 vs 0.011), hari ketiga (p 0.000 vs 0.002), dan hari terakhir (p 0.000 vs 0.000). Kekuatan korelasi kolesterol total lebih baik dibanding CRP baik pada hari pertama (ρ -0.633 vs 0.459), ketiga (ρ -0.755 vs 0.543), dan hari terakhir (ρ -0.874 vs 0.686). **Simpulan:** Kadar kolesterol total yang rendah dan kadar CRP yang tinggi dapat digunakan sebagai prediktor prognosis urosepsis yang memburuk. Kadar kolesterol total lebih baik dibanding CRP sebagai marker prognosis.

Kata kunci: Hasil urosepsis, marker prognostik, level kolesterol, level C-reactive protein.

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INTRODUCTION

Urosepsis is a sepsis condition which originates from focus of infection in urinary tract.¹ Urinary tract infection (UTI) has wide clinical manifestation from asymptomatic bacteriuria, dysuria, frequency, stranguria, sepsis, severe sepsis into septic shock, involving response of immune system and many organ systems.¹

Incidence of sepsis in the United States was about 750.000 cases per year, while 250.000 of them were died. Prevalence of urosepsis included 25% of all sepsis cases.² Sepsis severity directly correlates with patient prognosis. Incidence of mortality increasing more than 70% in sepsis patient with multiple organ dysfunction syndrome (MODS).³

Sepsis biomarker is biological marker from biologic substance in sepsis condition which can give additional information for risk stratification, monitoring response of therapy and outcome predictor.⁴ Nowadays, there are 178 biomarkers which can be used to evaluate sepsis, 118 of them can be used for predicting the prognosis. One biomarker that frequently used to predict the prognosis is C-reactive protein (CRP). It has high sensitivity, but its specificity is still in questioned.² Another examination which is easy to be done for certain purpose and eventually has prognostic value for sepsis is total cholesterol.²

The decrease of blood cholesterol level in inflammation condition first described by Chauffard et al in 1911.⁵ The decrease of cholesterol significantly found in patient with severe trauma, MODS and sepsis.³ Hypocholesterolemia mechanism in severe sepsis and MODS may be due to an increase usage of cholesterol as adhesion substance and bacteria endotoxin neutralizer,⁶⁻⁸ the decrease of cholesterol synthesis in liver,⁶ low intake and the increase of cholesterol catabolism.^{6,9} Tissue damage during sepsis will produce pro-inflammatory cytokines, which induce cholesterol receptor activity, suppress cholesterol production and increase cholesterol degradation.¹⁰

CRP is an acute phase protein which synthesized by liver as a systemic response of tissue damage and infection. The increase of CRP can happen in several hours after infection or inflammation.³

OBJECTIVE

The purpose of this research in our clinic was to evaluate the prognostic value of total

cholesterol level and CRP towards the outcome/prognosis of urosepsis patient by evaluating the clinical severity from beginning until the end of the research. Total cholesterol level is easy to be measure, affordable and has a predictor value for sepsis.

MATERIAL & METHODS

This was an observational analytic study, starting from September 2014 until January 2015 with prospective design. As many as 30 patients with urosepsis underwent total cholesterol and CRP examination and were evaluated for their clinical severity such as severe inflammatory response syndrome (SIRS)/no sepsis; sepsis (infection + ≥ 2 signs of SIRS); severe sepsis (infection + ≥ 2 signs of SIRS + ≥ 1 MODS) and septic shock (infection + ≥ 2 signs of SIRS + refractory hypotension). The classification of the sepsis syndrome follows different levels of criteria.

Criteria I (Infection): Proof of bacteraemia or clinical suspicion of sepsis. Criteria II (SIRS): 1) Body temperature $\geq 38^{\circ}\text{C}$ or $\leq 36^{\circ}\text{C}$; 2) Tachycardia ≥ 90 beats/min; 3) Tachypnoea ≥ 20 breaths/min ($\text{PaCO}_2 \leq 32$ mmHg); 4) Leucocytes $\geq 12000/\mu\text{L}$ or $\leq 4000/\mu\text{L}$ or band forms $> 10\%$. Criteria III (MODS): 1) Heart, circulation: Arterial systolic blood pressure ≤ 90 mmHg or mean arterial blood pressure ≤ 70 mmHg, ≥ 1 hour despite adequate fluid or vasopressor agents resuscitation; 2) Kidney: Urine production < 0.5 mL/kg body weight/hour for at least one hour after fluid resuscitation; 3) Lung: $\text{PaO}_2 \leq 75$ mm Hg (room temperature) or $\text{PaO}_2/\text{FiO}_2 \leq 250$ (organ dysfunction except lung), or $\text{PaO}_2/\text{FiO}_2 \leq 200$ (lung dysfunction); 4) Hematology: Platelets $< 80\ 000/\mu\text{L}$ or decrease $\geq 50\%$ platelets in 3 days; 5) Metabolic Acidosis: pH ≤ 7.30 or base excess ≥ 5 mmol/L; 6) Brain: Somnolence, agitation, confusion, coma. Refractory hypotension was permanent hypotension despite adequate fluid resuscitation, the criteria were 1) systole < 90 mmHg, 2) 40 mmHg under normal, 3) MAP ≤ 70 mmHg for ≥ 2 hours, 4) need vasopressor prescription to maintain the systole ≥ 90 mmHg or MAP ≥ 70 mmHg.

Examination and evaluation were done at 1st, 3rd and last day (the day when patient discharged or died or maximum 14th day). The patient was observed for maximum 14 days to measure the

outcome whether getting better (recover from sepsis), worsened (still in sepsis condition) or died (during observation). Statistical analysis for all variables used Spearman's rho correlation test with software SPSS 20. $P < 0.05$ for significant value.

RESULTS

Based on clinical severity at day 1, there were 15 sepsis patients (50%), 14 severe sepsis patients (46.67%), and 1 septic shock patient (3.33%).

The most common cause was urinary tract stone, there were 18 cases (60%), include 9 cases

(30%) of kidney stone and 9 cases (30%) of ureteral stone, the most common complication was hydronephrosis in 23 patients (76.7%).

In this study, clinical outcome was evaluated based on clinical severity at the end of the observation period. From 30 samples, 18 patients (60%) got better, 8 patients (26.7%) got worse and 4 patients (13.33%) died.

Based on the clinical severity, the mean value of CRP in SIRS/no sepsis patient was 41.25 ± 45.1 mg/L. It was the lowest mean value. In sepsis group, the mean value was 118.89 ± 74.3 mg/L and higher mean value in severe sepsis patient was 143.39 ± 87.9 mg/L. The mean value of total

Table 1. Baseline characteristic.

	Sample		Min	Max	Mean \pm SD
	N	%			
Sex					
male	23	76.7			
female	7	23.3			
Age (years)	30	100	23	70	48.4 ± 11.1
MAP (mmHg)	30	100	60	133	93.1 ± 14.8
Leucocyte ($\times 10^3/\text{mm}^3$)	30	100	2.7	35.1	21.0 ± 7.8
BUN (mg/dL)	30	100	7.0	122	45.0 ± 36.5
SC (mg/dL)	30	100	0.5	28.0	5.19 ± 6.5
SGOT (U/L)	30	100	13	62	26.7 ± 14.3
SGPT (U/L)	30	100	7	48	22.8 ± 10.8
CRP h-1 (mg/L)	30	100	10.3	313.7	115.6 ± 81.6
Kol h-1 (mg/dl)	30	100	47	137	107.2 ± 26

Table 2. Description of clinical assessment.

Assessment	Frequency	%
Urinary tract stone	18	60.0
Scrotal abscess	2	6.7
Peri/para renal abscess	2	6.7
Kidney abscess	1	3.3
Renal carcinoma	1	3.3
Penile carcinoma	1	3.3
Bladder carcinoma	5	16.7

Table 3. Outcome of urosepsis patient.

Clinical Severity	Outcome			Total
	Better	Worse	Died	
Sepsis	13	2	0	15
Severe sepsis	5	6	3	14
Septic shock	0	0	1	1
Total	18	8	4	30

Table 4. Total cholesterol level and CRP based on clinical severity.

Clinical severity	Day 1			Day 3			Last Day			Total		
	N	Kol (mg/dL)	CRP (mg/L)	N	Kol (mg/dL)	CRP (mg/L)	N	Kol (mg/dL)	CRP (mg/L)	N	Kol (mg/dL)	CRP (mg/L)
SIRS/no Sepsis	0	-	-	16	132.2 ± 22.1	52.1 ± 51.4	18	154.8 ± 25.7	31.6 ± 37.4	34	144.2 ± 26.4	41.3 ± 45.1
Sepsis	15	121.80 ± 14.07	105.9 ± 76.6	7	93.14 ± 13.25	136.4 ± 69.9	1	92	190	23	111.8 ± 19.3	118.9 ± 74.3
Severe sepsis	14	95.14 ± 26.36	130.4 ± 88.7	4	89.5 ± 19.23	116.25 ± 59.6	7	80.9 ± 10.9	184.9 ± 95.8	25	90.2 ± 22.2	143.4 ± 87.9
Septic shock	1	56.0	53.0	3	54.3 ± 7.5	152.8 ± 113.9	4	51.0 ± 6.16	141.9 ± 105.6	8	52.9 ± 6.05	134.9 ± 98.04

Tabel 5. Total cholesterol level and CRP based on outcome.

	Better			Worse			Death			p	rho
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
CRP d-1 (mg/L)	18	88.10	74.41	8	146.74	62.82	4	177.18	107.37	0.011	0.459
CRP d-3 (mg/L)	18	56.28	50.15	8	148.88	63.15	4	127.10	106.28	0.002	0.543
CRP d-last/14 (mg/L)	18	31.58	37.37	8	185.50	88.71	4	141.88	105.61	0.000	0.686
Δ CRP (d14-d1) (mg/L)	18	-56.52	70.20	8	38.76	59.02	4	-35.3	97.53	0.047	0.365
Chol d-1 (mg/dL)	18	119.50	17.81	8	101.38	20.51	4	63.25	14.15	0.000	-0.633
Chol d-3 (mg/dL)	18	128.61	23.61	8	93.62	10.68	4	56.00	6.98	0.000	-0.755
Chol d-last/14 (mg/dL)	18	154.83	25.71	8	82.25	10.9	4	51	6.16	0.000	-0.874
Δ Kol (d14-d1) (mg/dL)	18	35.3	21.46	8	-19.13	18.45	4	-12.25	11.59	0.000	-0.754

cholesterol in SIRS or no sepsis condition was 144.18 ± 26.4 mg/dL; in sepsis condition, it was 111.78 ± 19.3 mg/dL; in severe sepsis, it was 90.24 ± 22.2 mg/dL and in septic shock, it was 52.88 ± 6.05 mg/L (table 4).

Based on the clinical outcome, CRP level in day-1 in patient with better outcome was the lowest mean value, 88.10 ± 74.41 mg/L. Patient with worse outcome had higher CRP level, 146.74 ± 62.82 mg/L. While CRP level in death patient was 177.18 ± 107.37 mg/L ($p = 0.011$). Total cholesterol level in day-1 in patient with better outcome was the greatest mean value, 119.5 ± 17.81 mg/dL, while total cholesterol level in patient with worse outcome was 101.38 ± 20.51 mg/dL and it was 63.25 ± 14.15 mg/dL in died patient ($p = 0.000$). The change of total cholesterol level and CRP level was completely described in table 5.

From statistical analysis, correlation coefficient value of CRP level was lower than value of total cholesterol level, day-1 (0.459 vs -0.633), day-3 (0.543 vs -0.755) and last day (0.686 vs -0.874), while Δ CRP compared to Δ cholesterol (0.365 vs -0.754).

DISCUSSION

Male to women proporsion in this study was 76.7% vs 23.3%. Mean age in this study was 48.43

years old and the range was between 23–70 years old. This characteristic was not different than other study by Dwimantoro 2014 in Soetomo General Hospital Surabaya, where the mean age was 47.12 years old and the range was between 25–65 years old.¹¹ The mean age of patient in worse category and died category were older than patients in better category (55.12 and 52.50 vs 44.56 years-old). The prognosis of urosepsis can be affected by age, getting older getting worse in response to sepsis condition.¹² The most common predisposition factor of urosepsis in this study was urinary tract stone (60%). Serniak et al described the most common predisposition factor was urinary tract obstruction due to stone (43%).¹³ The most common pathogen in this study was Escherechia coli (38.5%) which known as the most common negative – gram bacteria found in urinary tract.¹⁴

The mean value of CRP level in day-1 increased from normal level (> 9 mg/L), as high as 115.6 ± 81.55 mg/L, similar to Pova study in 1998 (CRP increased ≥ 50 mg/L).¹⁵ CRP is an acute – phase protein synthesized by liver as a systemic response of tissue damage and infection. CRP synthesis is stimulated by inflammatory cytokine, TNF and IL-6.¹⁵

The mean value of CRP level in SIRS/no sepsis patient was the lowest value of all severity groups (SIRS vs sepsis vs severe sepsis: 41.25 ± 45.1

mg/L vs 118.89 ± 74.3 mg/L vs 143.39 ± 87.9 mg/L). From Povoia study (2005), the value of CRP level in SIRS/no sepsis patient was 31 ± 3 mg/L; in sepsis patient was 152 ± 82 mg/L; in severe sepsis was 203 ± 109 mg/L; and in septic shock patient was 233 ± 87 mg/L. Thus, it can be concluded that the greater sepsis severity, the higher CRP level. However, in septic shock condition, the mean value of CRP was 134.86 ± 98.04 mg/L, lower than that in severe sepsis. It may be caused by several factors affecting CRP value such as hemodynamic state, biochemical response and immune/inflammation state. In inadequately treated sepsis, there will be a transient immune paralysis due to B cell, CD4, T-helper and dendritic cell were apoptosis, so the CRP level become lower.¹⁵

The increase of CRP concentration requires minimum 12–18 hours and slowly increases during sepsis condition and reaches peak level in 36–50 hours. Its concentration will drop fast with 19 hours half time if the stimuli diminished. Therefore, CRP is an independent characteristic and only affected by therapy or treatment that can overcome inflammation process. High level of CRP in urosepsis patient can predict the mortality (>70 mg/L).¹⁶

In this study, CRP level in day 1 in patient with better outcome was the lowest mean value than those in patient with worse outcome and those in died patient (88.10 ± 74.41 mg/L vs 146.74 ± 62.82 mg/L and 177.18 ± 107.37 mg/L). There was a pattern that CRP level getting lower in patient with better outcome from examination in day-3 and last day (56.28 ± 50.15 mg/L and 31.58 ± 37.37 mg/L). Meanwhile, in patient with worse outcome, the CRP level kept raising (148.88 ± 63.15 mg/L and 185.50 ± 88.71 mg/L). In died patient, the CRP level increased from 127.10 ± 106.28 mg/L to 141.88 ± 105.61 mg/L in the last day ($p < 0.05$). It can be concluded that low CRP level correlates with better prognosis, while higher CRP level correlates with worse prognosis until mortality, either CRP level in day-1, 3 or last day. The high level of CRP showed damage of many organs.¹⁷

Total cholesterol level of day-1 had mean value as high as 107.17 ± 26.04 mg/dL. It was lower than the optimal total cholesterol level determined by American Heart Association (1994): 160-200 mg/dL.¹⁸ The result was similar to a study by Sabari Das which set the cut-off point of total cholesterol level for sepsis patient was < 130 mg/dL.¹⁹

Decrease of total cholesterol level were basically decrease of HDL, LDL, and VLDL cholesterol which caused by multifactorial, there were

the increase of cholesterol usage in sepsis condition, decrease of its synthesis, and metabolic change.^{6,7}

In sepsis condition, decrease of total cholesterol level occurred since bacterial toxin enter the circulation, and more detoxified in severe sepsis patient with MODS.⁹ Endotoxin (lipopolysaccharides) of negative-gram bacteria and lipotechoic acid (LTA) of positive-gram bacteria will be bound with cholesterol (lipoprotein) known as lipopolysaccharide protein binding (LBP).^{8,20} the binding to neutralize toxin produced by microorganism and minimize cellular response.⁸ LBP present endotoxin monomer (LPS) to membrane-bound CD 14 in monocyte, neutrophils, and macrophage,²¹ then bacterial invasion can be prevented and managed.²² Decrease of cholesterol synthesis in the liver were related to the increase of cytokine mediators like TNF α , IL-1 and interleukin 6.^{7,10} Decrease of cholesterol will be detected after liver cells exposed to TNF α , IL-1, and IL-6.²³ TNF also causes specific increase in degradation of cholesterol, especially LDL.¹⁰

In this study, lower total cholesterol level will be found in more severe condition, and higher cholesterol level were found in patients with SIRS or no sepsis condition (septic shock vs severe sepsis vs not sepsis) (52.88 ± 6.05 vs 90.24 ± 22.2 vs 111.78 ± 19.3 vs 144.18 ± 26.4 mg/dL).

Evaluation of total cholesterol level based on clinical severity on different days showed a consistent decreasing pattern along with the increase in sepsis severity. In sepsis condition the range for total cholesterol were 93 to 122 mg/dL, while in severe sepsis the range were between 80 to 95 mg/dL, and in septic shock the value were < 60 mg/dL. A study by Gordon et al in 2001 showed a correlation in inflammation degree with cholesterol value.⁷ Peter Fraunberger concluded that the decrease of cholesterol level in patients with shock or in septic condition were affected by TNF.¹⁰

Total cholesterol level is sensitive to onset of infection. Takatoshi Kitawa et al 2012 showed total cholesterol level at onset of bloodstream infection can be used as a prognostic marker.²⁴ Ongoing cholesterol decrease in more severe sepsis condition were caused by failure of several organ (MODS), such as liver, leading to failure of synthesis of cholesterol.⁶ Moreover, the ongoing sepsis process will lead to more proinflammation cytokines released, causing suppression of cholesterol production in liver, and further decrease of cholesterol level.¹⁰

In this study, mean total cholesterol day one in patients with better outcome was the highest compared to other patients with worse outcome, or died (119.5 ± 17.81 vs 101.38 ± 20.51 and 63.25 ± 14.15 mg/dL). On the third and the last days, there were a steady increase of total cholesterol levels in patients with better outcome, 128.61 ± 23.61 mg/dL to 154.83 ± 25.71 mg/dL. In patient with worse outcome, or died, the decrease of cholesterol level was consistent, 93.62 ± 10.68 mg/dL to 82.25 ± 10.9 mg/dL, and 56.0 ± 6.98 mg/dL to 51.0 ± 6.16 mg/dL. Disparity measurement (Δ , last-day subtracted by first-day cholesterol levels), shows a positive mean value in patients with better outcome, $+35.3 \pm 21.4$ mg/dL, while in patients with worse outcome or died, the disparity was negative, -19.17 ± 18.45 mg/dL and -12.25 ± 11.59 mg/dL. Statistical analysis showed significant correlation ($p < 0.05$). Thus, it can be concluded that lower total cholesterol level were correlated with worse prognosis and mortality.

Total cholesterol levels in died patients (4 patients): patient 1: 47 mg/dL on day 1, 50 mg/dL on day 3, and 46 mg/dL on the last day; on patient 2: 56 mg/dL on day 1, 50 mg/dL on day 3, and 49 mg/dL on the last day. Results of patient 3 was 73 mg/dL on the day 1, 63mg/dL on day 3, and 60mg/dL on the last day. Test on patient 4 resulted 77 mg/dL on day 1, 49mg/dL on day 3, and 61mg/dL on the last day. From all died patients, total cholesterol level < 80 mg/dL. Fraunberger et al 1999 concluded that patients with total cholesterol level < 100 mg/dL had 10 times higher mortality risk than septic patients with total cholesterol level more than 100 mg/dL. It shows that mortality rate for patients with total cholesterol level < 50 mg/dL was 100%, in level 50-79 mg/dL the mortality rate 75%. In level 80-120 mg/dL, the mortality rate 50%, and total cholesterol level > 120 mg/dL, mortality rate were about 20%.¹⁰ Dilek Memis et al 2007 showed that cholesterol levels were significantly lower among the nonsurviving patients than surviving patients with cut-off point ≤ 120 mg/dl. Memis concluded a significant prognostic value of total cholesterol day 1, with sensitivity 97.6% and specificity 100%, as a predictive factor for nonsurviving patients.⁹ Das Sabari 2011 used total cholesterol cut-off point 130 mg/dL, implying a significant decrease in patients who died (88%), compared to surviving patients.¹⁹

CONCLUSION

Low total cholesterol and high CRP levels can be used as poor prognostic in urosepsis patients.

Serial evaluations of total cholesterol and CRP will help in identifying patients condition and give additional information to increase aggressivity of therapy. Data analysis shows that total cholesterol level have higher correlation towards outcome compared to CRP, thus an evaluation on total cholesterol level is better to predict prognosis of urosepsis than CRP level.

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