CHANGES AND IMPACT OF SERUM HDL CHOLESTEROL IN ADULT PATIENTS WITH SEVERE BURNS

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SUMMARY

A prospective study was conducted on 58 adult patients with severe burns admitted to an Intensive care unit (ICU), National Burns Hospital. The results showed that over time after burns, total cholesterol levels were within the physiological limits. Meanwhile, HDL cholesterol levels significantly decreased from the 7th day after burns reached to the lowest level of 0.58mmol/l on the 14th day (p < 0.01), then recovered but was still below the normal range on the 21st-day afterburn (0.88mmol/l).

The proportion of patients with decreased HDL cholesterol levels gradually increased and peaked on the 14th-day afterburn (96.36%). HDL cholesterol levels decreased remarkably in the group of inhalation injury and the older patients on the 14th day after burns (p < 0.05) and was not affected by burn severity and gender. Statistically significantly lower HDL cholesterol levels were recorded at almost every time of testing amongst non-survivors (p < 0.05).

HDL cholesterol level decreased per unit (mmol) resulted in increased mortality of 3.11, to 6.29 units. However, this reverse correlation was a week to moderate. Further studies need to be conducted to investigate the prognosis role and intervention for decreased HDL cholesterol amongst severe burn patients.

Keywords: *Severe burn, serum cholesterol, HDL*

1. INTRODUCTION

The hypermetabolic response begins within the first 48 - 72 hours after burn. The degree of hypermetabolism in burns is considered to be the greatest amongst any trauma or surgery [1], [2]. In patients with extensive burns, levels of cortisol, glucagon and catecholamine increased significantly [6]. These changes lead to increased lipolysis, the release of fatty acids into the plasma. Some studies showed that after bun, serum cholesterol levels decreased directly proportionally to burn severity [4], [5].

On the other hand, changes in serum cholesterol levels were also correlated with sepsis, multiple organ failure and mortality [6]. However, these studies were mainly in pediatric burn patients and also not categorized the role of total cholesterol or a specific type of cholesterol. This study

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evaluated changes and the impact of serum HDL cholesterol levels on outcomes of adult patients with severe burns.

2. PATIENTS AND METHODS

A prospective study was carried out on 58 adult burn patients with burn surface area ≥ 20% total body surface area (TBSA), without comorbidities or co-trauma, hospitalized within the first 72 hours after-burn. Patients were treated at the Intensive care unit, National Burns Hospital from 6/2016 to 8/2018. Plasma levels of total cholesterol and HDL cholesterol were measured at the following times: 3rd (D3), 7th (D7), 14th (D14) and 21st day (D21) after-burn.

The cholesterol levels of 2.6 - 5.2mmol/l were considered to be normal range and below 1mmol/l was considered to be decreased level. Data were collected and analyzed to determine the relationship between patient demographic, burn features, outcomes and HDL cholesterol levels at different times by comparing the mean or median by using Stata 14.0 software with a p-value < 0.05 was considered to be statistically significant.

3. RESULTS

Table 1. Patient characteristics (n = 58)

Parameters	Mean	Min-Max
Age (year)	35.5 ± 1095	19 - 58
Gender (male/ female)	44/14	
Admission time (hour)	7.03 ± 6.5	1 - 38
Burn extent (% TBSA)	50.88 ± 18.02	20 - 95
Deep burn area (% TBSA)	19.03 ± 16.82	0 - 69
Inhalation injury, n (%)	8 (13.79)	
Death, n (%)	11 (18.97)	

** TBSA: Total body surface area*

The patient's demographic characteristics and burn features are indicated in Table 1. Among 58 patients, a male was predominance with the mean age of 35.5 years old. There were 8 patients (13.79%) who suffered inhalation injury with an overall mortality rate of 18.97%.

Table 2. Plasma level of cholesterol overtime after burn

Timepoint	Cholesterol (mmol/l)	HDL cholesterol (mmol/l)	HDL cholesterol < 1mmol/l (n,%)
D3 (n = 58)	3.99 ± 1.13	1.07 ± 0.82	36 (62.06)
D7 (n = 58)	3.19 ± 0.89	0.94 ± 1.73	53 (91.37)
D14 (n = 55)	3.21 ± 0.88	0.58 ± 0.32*	53 (96.36)
D21 (n = 43)	3.85 ± 1.20	0.88 ± 0.68	32 (74.42)

**: p < 0.05 as comparing with D3*

Along the time after burn, serum cholesterol level changed but was still within the physiological limit. Meanwhile, serum HDL cholesterol level decreased on the 7th day, reaching the lowest value of 0.58 ± 0.32mmol/l, which was statistically significantly lower compared with that on the 3rd day (p < 0.01). HDL cholesterol then recovered but was still lower than the normal range (0.88mmol/l) on the 21st-day after-burn. There was 62.06% of patients reduced HDL cholesterol level on the 3rd day and this rate increased to 96.36% on the 14th day, then decreased to 74.42% on the third week after burns (Table 2).

Table 3. Relationship between HDL cholesterol levels and age, gender, burn features*

Parameters	Subgroup	D3	D7	D14	D21
Gender	Female (n = 14)	2.20	1.93	1.66	2.01
	Male (n = 44)	2.08	1.74	1.84	2.26
Age (year)	16 - 40 (n = 37)	1.99	1.62	1.82	2.39
	41 - 60 (n = 21)	2.29	1.86	1.72**	1.72
Burn extent (%TBSA)	< 50% (n = 31)	2.01	1.86	2.01	2.36
	≥ 50% (n = 27)	2.10	1.48	1.67	2.19
Deep burn area (%TBSA)	< 20% (n = 37)	2.06	1.80	2.02	2.28
	≥ 20% (n = 21)	2.12	1.74	1.60	1.44
Inhalation injury	No (n = 50)	2.03	1.78	1.82	2.20
	Yes (n = 8)	2.33	1.41	1.48**	2.02

**: Values are presented as median, **: p < 0.05*

Data from Table 3 indicated that there were no differences in the serum HDL levels between subgroups of sex, total burn area (p > 0.05). The patients with deep burn area ≥ 20% TBSA had lower HDL cholesterol levels and longer recovery time compared with the patients with deep burn area < 20%. However, the difference was not statistically significant (p > 0.05). The HDL cholesterol levels decreased considerably in the inhalation injury group and 41 - 60 years old group on day 14 after burns (p < 0.05).

Table 4. The relationship between HLD cholesterol level and outcome*

Times	Survival (n = 47)	Death (n = 11)	p	r	Coeficient
D3	0.97	0.71	0.01	- 0.028	3.11
D7	0.65	0.55	0.7	- 0.101	
D14	0.66	0.30	0.02	- 0.244	5.36
D21	0.82	0.2	0.023	- 0,407	6.29

**: Values are presented as median*

The relationship between HLD cholesterol level and outcome is shown in Table 4. Mean serum HDL level in the death group was lower than that in the survival group at all testing times ($p < 0.05$, except on D7). HDL cholesterol level decreased per unit (mmol) on D3, D14 and D21 resulted in increased mortality of 3.11, 5.36 and 6.29 units, respectively. However, this reverse correlation was a week to moderate (from -0.028 to -0,0407).

4. DISCUSSION

The relationship between hypercholesterolemia and cardiovascular risks was largely accepted, but the risks associated with hypocholesterolemia was not thoroughly understood. Reduction in serum cholesterol can be found in many acute and chronic diseases.

Hypocholesterolemia was mentioned in different morbidities such as HIV, cancers, leukemia, lymphoid tumors, sepsis. This resulted from the decreased synthesis in the liver, increased catabolism of cholesterol-rich lipoprotein, the consequence of an increased metabolic response [3],[4].

A study by Khubchandani A and colleagues on 250 burn patients showed that serum levels of total cholesterol, HDL and LDL declined. HDL cholesterol dropped in the first week and remained low in the second and third weeks after burns [7]. Similarly, a reduction in serum cholesterol levels in a patient with severe burns was also mentioned in many other studies [8].

In our study, overtime after burns, serum cholesterol levels were in the physiological range, but the serum HDL cholesterol levels declined on day 7 after burns ($p < 0.01$ compared with that on 3rd day), hit the lowest point on day 14, then recovered but still lower than the normal value at the third weekend after burns. The proportion of patients with reduced HDL cholesterol peaked at 96.36% on day 14 after burns. At the same time, HDL cholesterol levels decreased significantly in the inhalation injury group and the older patients on the 14th day after burns. Hypocholesterolemia has been seen as a predictor of sepsis, MOF and increased mortality. In burn patients, a study by Kamolz L.P and colleagues on 220 burn patients showed that patients with serum cholesterol levels decreased from 150mg/L to 100ml/L had a 2.7 folds higher risk of death ($p < 0.001$) [9].

In our study, the HDL levels in the death group were greater than that in the survival group and the difference was statistically significant at almost every time of testing. HDL cholesterol level decreased per unit (mmol) resulted in increased mortality of 3.11, to 6.29 units. However, this reverse correlation was a week to moderate (from -0.028 to -0,0407).

5. CONCLUSION

In adult patients with severe burns, the total serum cholesterol level does not significantly change. Meanwhile, serum HDL cholesterol levels decreased dramatically, prolonged, significantly increased the risk of death compared with the survival group. Further studies need to be conducted to investigate the prognosis role and intervention for decreased HDL cholesterol amongst severe burn patients.

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