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Association of Serum Concentration of Total Bilirubin and Low Density Lipoprotein Cholesterol with Myocardial Infarction

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Abstract: We examined serum bilirubin and low density lipoprotein cholesterol (LDL-C) as possible risk factors in 27 patients of myocardial infarction and 50 healthy individuals served as control. An inverse relationship between increase in total bilirubin and serum levels of LDL-C was observed. There is possibility of bilirubin playing a role in the pathogenesis of coronary heart disease through LDL-C levels.

Key words: Bilirubin · low density lipoprotein · myocardial infarction

INTRODUCTION

Oxidative modification of low density lipoprotein cholesterol (LDL-C) as a causative agent in atherogenesis leading to coronary heart disease (CHD) has recently been documented [1]. It is not known whether bilirubin has a role in preventing CHD; however, recent studies indicate an inverse correlation between total bilirubin plasma concentration and prevalence of CHD [2]. Bilirubin is a naturally occurring antioxidant and could as such have a role in protecting lipids and lipoproteins against oxidation and against plaque formation in human beings [2]. The antioxidant protection of LDL by endogenous metabolic generation of bilirubin from haemoglobin breakdown has also been elucidated [2]. Strong evidence indicates that high LDL concentration initiate atherogenesis and promote atherosclerosis at every stage, low bilirubin could be associated with increase in oxidised lipids and lipoproteins [1, 2]. Since bilirubin production and excretion is a continuous process, the present study is therefore aimed at estimating LDL-C a causative agent in atherogoenic process in relation to various normal levels of serum total bilirubin in patients with CHD.

MATERIALS AND METHODS

Twenty seven cases of acute myocardial infarction (MI) admitted in Intensive Cardiac Care Unit at Postgraduate Institute of Medical Sciences, Rohtak (India) and 50 healthy volunteers were included in the present study. Serum total bilirubin [3] and serum LDL-C [4] were estimated before starting thrombolytic therapy. Serum AST, ALT, lactate dehydrogenase (LDH) and creatine kinase (CK) were also determined to assess the liver functions [5]. Those individuals with deranged liver functions were excluded from the present project. Results were statistically analysed using student's t-test and regression analysis was carried out.

RESULTS

Observations were categorized into five groups ranging from serum total bilirubin levels from 0.2 to > 1.5 mg (Table 1). However, the healthy range for total bilirubin was presumed to be 0.2-0.8 mg % for total bilirubin. An inverse relationship could be observed with increase in serum bilirubin and serum levels of LDL-C in case of MI ($r = -1.005$, $p<0.001$). Whereas in healthy control a significant positive correlation was observed ($r = 3.22$, $p<0.001$).

Table 1: Bilirubin and LDL cholesterol levels

Group	Total bilirubin (mg%) mean	LDL-C (mg%) mean	No. of cases
Control	0.7±0.45	101.69±22.95*	50
MI	0.9±0.48	134.22±50.58*	27
Range			
(i)	0.2-0.4	147.5	2
(ii)	0.5-0.7	145.88	8
(iii)	0.8-1.0	141.18	11
(iv)	1.1-1.5	114.67	3
(v)	>1.5	141.35	3

*Mean ± SD

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DISCUSSION

Bilirubin is an effective antioxidant possibly protecting lipids and lipoproteins against oxidation and against plaque formation in human beings [6]. Activity of hem oxygenase (HO) have been implicated in physiology and pathology of the cardiovascular system [7]. *In vivo* and *in vitro* studies have demonstrated that bilirubin exhibits potent antioxidant properties preventing the oxidative damage triggered by a wide range of oxidant-related stimuli [7]. There are indirect evidences as to the action of alphatoocopherol, ascorbate, urate, SH group and bilirubin in prevention of oxidation of LDL [2]. Nevertheless, the role of vitamin E and vitamin C may be a possible mechanism in the protection of LDL from lysophosphatidyl choline a causative factor in myocardial vasoconstriction released from oxidized LDL. Therefore reversal of oxidized LDL induced impairment of endothelium - dependent relaxation by removal of lysophosphatidyl choline from oxidized LDL by antioxidants could possibly prevent or slow the progression of atherosclerosis [8, 9]. Normally, low serum bilirubin concentrations have been associated with good health and only high concentrations have had any diagnostic significance. Bilirubin is an effective antioxidant possibly protecting lipids and lipoproteins against oxidation and against plaque formation in human beings [1, 7, 9]. Also, peroxyl radical-trapping antioxidant abilities of bile pigments have been reported to be much higher than those of the serum albumin [10]. It is possible that either bilirubin concentration itself or changes in concentration of other components in the bilirubin synthetic pathway i.e. heme, biliverdin, CO, iron (which are regulated by heme oxygenase) are involved in the protective activities [2]. The present findings may therefore direct towards the protective action of bilirubin as a result of prevention of such an oxidation process which eventually may be protective against the process of atherosclerosis even before the appearance of clinical jaundice. Such a mechanism may explain the significance of protective effect of bilirubin in cases where liver involvement remains a remote possibility. The complex interactions between HO -expression, the circulating concentration of its substrate and products and their effects on vasculative, lipid metabolism and cardiovascular system will hopefully be the focus of future research.

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