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# PLASMA TESTOSTERONE AND SERUM LIPIDS IN MALE SURVIVORS OF MYOCARDIAL INFARCTION

U. L. POGGI, A. E. ARGÜELLES, J. ROSNER, NILSE P. DE LABORDE, J. H. CASSINI and M. CRISTINA VOLMER

Unidad de Vasculopatias (D.I.G.I.D.; Mrio. Defensa) y Farmacologia Clinica (Universidad de Buenos Aires), Hospital Aeronautico Central and I.L.A.F.I.R., Universidad del Salvador, Buenos Aires, Argentina

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## SUMMARY

The concentration of blood testosterone and its correlations with plasma lipids were studied in 23 middle aged survivors of myocardial infarction. They had significantly higher mean cholesterol, triglycerides and total lipids than controls. Plasma triglycerides were highest in five patients who showed the lowest plasma testosterone values. The mean plasma testosterone was significantly lower ($P < 0{\cdot}001$) in the myocardial infarction patients ($\bar{X}$: 436·3; S.E.: 584·9pg/ml) than in control group of similar ages ($\bar{X}$: 688·4; S.E.: 484·9pg/ml). Many of these patients, although fully recovered, seemed to have a reduced testosterone secretion.

## INTRODUCTION

The elevated serum lipid and lipoprotein concentrations in patients with myocardial infarction suggest an important role for lipids in the pathogenesis of coronary atherosclerosis. Sex hormones produce changes in lipid metabolism and oestrogens are probably one cause of increased triglycerides as well as a decrease in post-heparin lipolytic activity (P.H.L.A.) [1]. Bersohn *et al.* [2] reported a decreased oestradiol and oestrone with normal oestriol excretion in men with myocardial infarction. On the other hand little attention has been given to changes to testosterone concentration in patients with coronary disease.

We have found only one published paper on testosterone levels in survivors of myocardial infarction and this was concerned with urinary excretion [3]. The present paper reports testosterone concentrations in blood and its correlation with plasma lipids in male survivors of myocardial infarction.

## MATERIAL AND METHODS

A group of 23 male patients (aged 31–59 years), survivors of myocardial infarction was studied.

Most of them held part-time jobs while others did not work at all. They were examined from 3 months to 2 years after their myocardial infarctions. The diagnosis of myocardial infarction has been supported by the clinical history, the electrocardiographic changes and a rise in serum enzyme levels. A thorough clinical and electrocardiographic examination was performed under basal conditions and after exercise. The patients were taken off treatment at least 2 weeks before investigation. Patients who suffered from liver, kidney or thyroid gland disease were excluded from the present study.

A control group consisted of 23 male subjects aged 31 to 52. All of them performed regularly more or less sedentary working activities as physicians, chemists or office jobs.

Blood samples were obtained between 0800 h–0900 h.

*Biochemical methods.* (1) Plasma testosterone was estimated by radioimmunoassay [4]. Plasma samples were frozen at −20°C until assayed. [$^3$H]-Testosterone for recovery measurements was added to each sample. Plasma were extracted 3 times with 10 vol. hexane–ether (8:2 v/v). The ether extracts were chromatographed on cyclohexane:ethyl ether (50:50 v/v). The testosterone area was eluted with aqueous methanol and 0·5 ml aliquot were pipetted into 2 ml tubes for R.I.A. Rabbit testosterone antiserum in phosphate buffer pH 7·8 and a final dilution of 1:10·000 in overnighting incubation in the cold room.

(2) Blood lipids. These were estimated by the following methods: Total lipids, Postma *et al.*[5]; Cholesterol, Abell[6]; Triglycerides, Carlsson *et al.*[7]; Free fatty acids, Dole[8]. The lipoprotein electrophoretic pattern was performed according to Bertrand[9] using cellulose acetate.

## RESULTS

The mean value found for the various estimations in the control subjects and the survivors are shown with the significance of the changes in Table 1. In the case of triglycerides the upper limit of normal was exceeded in only 39% of the subjects and for the free fatty acids the normal range was exceeded in only 55·4%. The five patients with the lowest testosterone values showed the correspondingly highest blood triglyceride concentrations of the whole group (Figs. 1 and 2).

Table 1. Values of plasmatic testosterone and blood lipids in controls and survivors of myocardial infarctions groups

| Groups | Testosterone (P) pg/ml | Total lipids mg/100 | Cholesterol mg/100 | Triglycerides mg/100 | Free fatty acids uEq/l | $\alpha$ Lipoprot. % | $\beta$ Lipoprot. % | Pre $\beta$ lipoprot. % |
|---|---|---|---|---|---|---|---|---|
| Controls | n: 23<br>6880·4<br>S.E.: 484·9 | n: 23<br>668·2<br>S.E.: 16·2 | n: 23<br>212·8<br>S.E.: 5·8 | n: 23<br>99·6<br>S.E.: 4·80 | n: 23<br>497·8<br>S.E.: 53·6 | n: 23<br>25·2<br>S.E.: 058 | n: 23<br>62<br>S.E.: 077 | n: 23<br>12·8<br>S.E.: 0·60 |
| Survivors | n: 23<br>4360·3<br>S.E.: 584·9 | n: 23<br>858·2<br>S.E.: 33·4 | n: 23<br>267·8<br>S.E.: 9·64 | n: 23<br>150·5<br>S.E.: 16·2 | n: 23<br>696<br>S.E.: 35 | n: 23<br>22·9<br>S.E.: 093 | n: 23<br>60·6<br>S.E.: 089 | n: 23<br>16·5<br>S.E.: 1·33 |
| Student test | <0·01 | <0·001 | <0·001 | <0·01 | <0·01 | <0·05 | — | <0·02 |
| Wilcoxon test | <0·01 | | | | | | | |

## DISCUSSION

There have been several reports on the levels of certain urinary and plasma C-19 steroids (androsterone and aetiocholanolone) but not of testosterone in acute and post-acute myocardial infarction [10,11]. In the only investigation we have come across (Morse *et al.* [3]) no significant difference was observed between the control and infarction groups in the urinary excretion of testosterone. Our finding of low blood testosterone in male survivors of myocardial infarction is in contrast to the results of Morse *et al.* [3] but in the studies of these authors, testosterone was assayed in urine and the mean age of their patients (57 years) was considerably older than of our cases (45 years).

The results of this investigation show that in patients who had a previous myocardial infarction, lower amounts of blood testosterone are present compared with healthy controls of equivalent age, and the five cases with the lowest plasma testosterone levels had the highest triglyceride values of the group.

Oestrogens produce elevation of the triglyceride concentration in blood [1] in contrast with the hypocholesterolemic and hypotriglyceridemic effect of androsterone [12] and dehydroepiandrosterone [13]. Testosterone could exert a similar action, opposing some endogenous oestrogen effects similar as the depression of P.H.L.P. and triglyceride increase [1] which have been shown to be an important risk factor for the development of atherosclerotic heart disease [14].

Testosterone could also increase post heparinic lipolytic activity and tissue lipoprotein lipase activity which is believed to be necessary for removal of glyceride from plasma. Gaylor *et al.*[15] have reported that testosterone inhibits the conversion of lanosterol and zymosterol into cholesterol.

A synthetic steroid derived from nor-testosterone, norethindrone acetate, produced a marked clearing of the hypertriglyceridaemia in patients with hyperlipoproteinaemia [16].

Although Fox *et al.*[17] suggest that a positive correlation exists between sexual activity and plasma testosterone readings, the decrease in the testosterone levels of our cases were more pronounced than those found in sexually inactive normal men. The patients

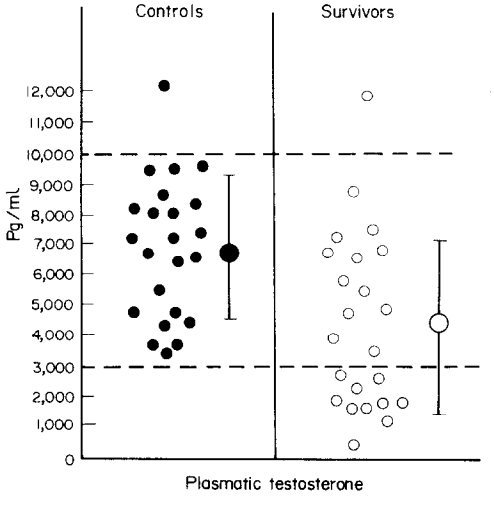


Fig. 1. Values of plasmatic testosterone in controls and survivors of myocardial infarction.

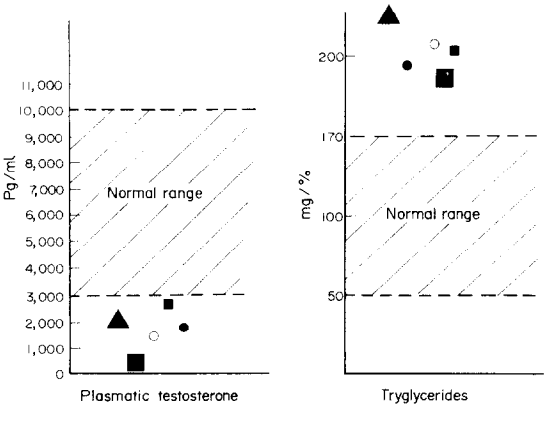


Fig. 2. Values of plasmatic testosterone and triglycerides of five patients, survivors of myocardial infarction.

of this study had good renal function so their subnormal testosterone levels could not be attributed to chronic uremia what is known to be associated with decreased testosterone production in men [18].

It should also be noted that the low levels of testosterone were not due to sampling affected by circadian variation, since the samples were drawn in the early morning when secretion is normally elevated.

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