

## Correlation of Platelet Aggregation with Serum Lipids Level in Women Taking Hormonal Contraception

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### ABSTRACT

Increased platelet functional activity has been noticed as an initial disorder in women taking hormonal contraception leading to hypercoaguable state in these subjects. This is due to direct effect of estrogen present in oral contraceptive pills on platelet functional activity while progesterone, by changing plasma lipids level has indirect role in the genesis of thromboembolism. Present study was conducted in women taking oral Pills (Group B) and injectable contraceptive preparations (Group C) and their results were compared with Control (Group A). Platelet hyperaggregation was determined by using ADP and collagen as agonist. Serum lipids levels were also measured. A positive correlation between platelet hyperactivity and raised lipids level had been observed. Statistically, p value ( $< 0.01$ ) was significant in Group B and Group C as compared to Group A.

**Key words:** Serum lipid level, contraception, platelet aggregation

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### INTRODUCTION

The most important purpose of recent developments in hormonal contraceptive drugs have been directed towards lowering the dosage of these steroid hormones, in order to minimize their risk potentials like ischemic heart disease stroke, MI, and thromboembolism and changes in blood clotting mechanism<sup>1</sup>. Among all these thromboembolism is the most important fatal complication<sup>2</sup>.

The first and most important disorder in the pathogenesis of thromboembolism is increased platelet aggregation<sup>3</sup>. The hyperactivity of platelet is due to direct effect on estrogen present in hormonal contraceptive drugs on platelet functions. Progesterone on the other hand, by altering serum lipids level enhances platelet aggregation<sup>4</sup> and hence thrombosis thereby shortening bleeding<sup>5</sup>.

Estrogen and progesterone level present in these drugs have different and some time opposite effect on lipid metabolism e.g., estrogen increase serum level of HDLc while progesterone, in turn reduces HDLc level and increases serum LDLc leading to increase chances of thromboembolism<sup>6</sup>. Estrogenic component of these drugs is responsible for venous thrombosis while arterial complications are due to both estrogen and progesterone<sup>7</sup>. It is the dosage of estrogen which is important in this regard as higher doses lead to ischemic disorder by arterial spasm<sup>8</sup>. Progesterone by changing lipid fractions causes atherosclerosis<sup>9</sup>.

Ratio of total serum cholesterol to HDLc is a better prediction to the extent of atherosclerosis and

thromboembolism. The dynamic balance between proatherogenic and antiatherogenic factors may allow a clear understanding of actual impact of these drugs on thromboembolism<sup>10</sup>.

### MATERIALS AND METHODS

The present study was conducted on sixty women for a period of six months. These women were taken from different local hospitals of Lahore city. Among these twenty were taking low dose oral contraception pill (Lo-femenal (Group B), twenty women were on injectable preparation (Norigest) (Group C). Twenty normal subjects not taking HRT were considered as control (group A). Platelet aggregation was carried out using different dilution of ADP as primary agonist and collagen as secondary agonist. Serum lipids level were determined and their correlation was calculated. The result of group B and group C were compared with control group (Group A), who had never taken hormonal contraception.

### RESULTS

Platelet hyperaggregation response had been seen by with ADP by assessing spontaneous platelet aggregation, percentage aggregation and slope of aggregation. Similarly hyperfunctioning of platelets were determined with collagen by estimating lag phase, percentage aggregation and slope of aggregation. Enhanced platelet activity was found in 90% of Group B and 85% of group C. Statistically this hyperaggregability of platelet was highly significant in group B ( $P < 0.001$ ) and significantly raised in group C ( $P < 0.05$ ) as compared to group A.

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Serum cholesterol triglyceride and LDLc fraction had been estimated. These values were highly significant ( $P < 0.001$ ) in group B and C. A positive correlation between platelet hyperfunctioning and raised serum lipids level had been found.

Statistically correlation of serum lipids like cholesterol triglyceride, HDLc and LDLc with platelet hyperactivity showed a significant value ( $P < 0.05$ ). The ratio between total cholesterol and HDLc had been significant raised group C ( $P < 0.001$ ) as compared to group A and B ( $P < 0.05$ ).

Table Correlation of platelet aggregation with serum cholesterol, triglyceride, HDL-C and LDL-C

	Serum cholesterol	Serum triglyceride	HDLc	LDLc
'r' value	+0.327	+0.347	-0.228	+0.367
'p' value	<0.01	<0.01	<0.01	<0.01s

## DISCUSSION

Enhanced platelet aggregation is an initial disorder before any evidence of vascular injury<sup>11</sup>. It is directly related to the dosage of estrogen and type of progesterone present in these contraceptive drugs<sup>12</sup>. Modern contraceptive preparation have less side effects but the risk of hypercoaguable state including decreased antithrombin III and increased production of II, V, VIII, in the body still exist<sup>13</sup>.

Endothelial cells, smooth muscle cells, cardiac myocytes and fibroblasts, the cellular components of blood vessels and the heart, play important roles in cardiovascular health and disease. During the development and progression of cardiovascular disease, changes occur both in the structure and function of these cells, resulting in a wide range of abnormalities, which affect growth, death and physiological function<sup>14</sup>.

Present study observed a significant correlation of platelet aggregation with serum cholesterol and triglycerides level in women taking HRT. A number of studies agreed with our study. A group of workers<sup>15</sup> found a correlation was found between increased estrogen level and decreased total cholesterol, triglyceride, and LDL-C levels; HDL-C levels remained unchanged. There was a positive correlation between the estradiol levels and free fatty acid elevation. It is reported that the oxidation of low-density lipoprotein (LDL) might play an important role in the development of atherosclerosis<sup>16</sup>. Estradiol has a protective effect against LDL oxidation, although only at pharmacological dosages. Progesterone or medroxyprogesterone acetate did not limit the E(2) action. The size of the LDL particles remained unaltered after each E(2) dose, but MPA, and not P, was associated with a diminution<sup>17</sup>. Studies reporting that endogenous human estrogens could be rendered fat-soluble by esterification with fatty acids in vivo, and the subsequent detection of such esters in blood and fat tissue suggested a possible mechanism explaining how estrogens might protect LDL. Because of their lipophilicity, esterified estrogens may become incorporated in the

lipoprotein structure, providing antioxidant potential for the particles<sup>18</sup>.

A study reported that a positive correlation between platelet hyper functioning and raised lipid level gives a guideline as follow up investigation in the subjects especially those who gave the family history of thrombolism<sup>19</sup>. Another study proposed that the sex steroid hormones, including estrogen, progesterone, and androgen, mediate their biological effects on cell proliferation, differentiation, and homeostasis through their respective nuclear receptors. Their study observed that there is a rapid non-genomic signaling action of sex steroids, including novel membrane receptors and interactions of nuclear steroid receptors with membrane and cytoplasmic signaling molecules such as adapter proteins, G proteins, ion channels, and protein kinases<sup>20</sup>. This study is promoted by a group of workers. They confirmed that prototypical non-genomic actions of sex steroids at this level include the induction of rapid vasodilatation as well as anti-inflammatory and antiatherogenic actions<sup>21</sup>.

Another study stated that cardiovascular diseases (CVDs) may have their origin before birth: the combination of being small at birth and having an overly rich post-natal diet increases the likelihood of obesity and of acquiring a specific metabolic syndrome in adulthood that carries an increased risk of CVD<sup>22</sup>.

Platelet hyperaggregation is more commonly seen in oral contraceptive pill user due to direct effect of estrogen on them as compared to subjects on injectable preparations<sup>23</sup>. Thrombosis of microvessels of vital organs like brain and heart lead to fatal is ischemic complications<sup>24</sup>.

## CONCLUSION

- Platelet aggregation study should be done routinely in subject taking hormonal contraception.
- Platelet aggregation should be conducted in subject with family history of thrombophilic

disorders the lack of protein C and S, antithrombin III and factor V mutation. Other family member should also be screened.

- Serum cholesterol, triglyceride, LDLc and HDLc should regularly be done.

## REFERENCE

1. Roshan TM, Nomah J, Rehman A, Naing L. Effect of menopause on platelet activation markers determined by flow cytometry. *Am J Hematol.* 2005 Dec;80(4):257-61. Links
2. Speroff L. Oral Contraceptives and arterial and venous thrombosis. A clinical formulation *Am J Obstet Gynecol* 1998;179:S25-36.
3. Fruzzeti F, Ricci C, Nicoletti, Fioretti P. Clinical and metabolic effects of a triphasic pill containing gestodene. *Contraception* 1992;46(4):335-47.
4. Kuhl H. Hormonal contraception and substitution therapy; the importance of progesterone for cardiovascular disease. *Geburtshilfe. Frauenheilkd* 1992;52(11):653-62.
5. Heisteringer M, Stockenhuber F, Schneider B et al. Effects of conjugated estrogen on platelet function and prostacyclin generation in CRF. *Kidney int* 1990;38(6):1181-6.
6. Berga SL. Metabolic and endocrinal effects of desogestrel containing oral contraceptive Mircette. *Am J Obstet Gynecol* 1998;179:S9-17.
7. Daly and Bonnar J. Comparative studies of 30 micrograms ethinyl estradiol combined with gestodene and desogestrel on blood coagulation, fibrinolysis and platelets. *Am J Obstet Gynecol* 1990;163(1 pt 2):430-7.
8. Kluft C, Lansink M. Effects of oral contraceptives on haemostasis variable. *Thromb Haemost (VQ7)* 1997;78(1):315-26.
9. Burkman RT, Bell WR, Zaccaro RA, Kimball AW. Oral contraceptives and antithrombin III: Variation by dosage and ABO blood group. *Am J Obstet Gynecol* 1989;164:1453-60.
10. Adams MR, Clarkson TB, Shively CA, Parks JS, Kaplan JR. Oral contraceptives lipoproteins and atherosclerosis. *Am J Obstet Gynecol* 1990;163:1388-93.
11. Prasad RN, Koh S, Ratnam SS. Effects of three type of combined oral contraceptive pills, on blood coagulation, fibrinolysis and platelet function. *Contraception* 1989;39(4):369-83.
12. Bonnar J. Coagulation effects of oral contraception. *Am J Obstet Gynecol* 1987;157:1042-81.
13. Bloemenkamp KW, Rosendaal FR, B'uller HR, Helmerhorst FM, Colly LP, Vandenbrouche JP. Risk of current low dose oral contraceptives is not explained by diagnostic suspicion and referred bias. *Arch intern Med* 1998;159(1):65-70.
14. Ling S, Komesaroff P, Sudhir. Cellular mechanisms underlying the cardiovascular actions of oestrogens. *Clin Sci (Lond).* 2006 Aug;111(2):107-18.
15. Tadmor OP, Kleinman Y, Barr I, Gal M, Brooks BA, Diamant YZ. Side effect of ovarian hyperstimulation: Hormonal and lipid profile changes. *Biochim Biophys Acta* 1999 Aug 18;1439(3):331-40.
16. Eshre Capri Workshop Group. Hormones and cardiovascular health in women. *Hum Reprod Update* 2006 Sep-Oct;12(5):483-97.
17. Hermenegildo C, Garcia-Marinez MC, Tarin JJ, Llacer A, Cano A. The effect of oral hormone replacement therapy on lipoprotein profile, resistance of LDL to oxidation and LDL particle size. *Maturitas.* 2001 May 30;38(3):287-95.
18. Helisten H, Hockerstedt A, Wahala K, Tiitinen A, Adlercreutz H, Jauhiainen M, Tikkanen MJ. Accumulation of high-density lipoprotein-particles. *J Steroid Biochem Mol Biol.* 2006 Jul;100(1-3):59-66. Epub 2006 May 26.
19. Bloemenkamp KW, Rosendaal FR, Helmerhorst FM, Koster T, Bertina RM, Vandenbrouche JP. *Thromb-Haemost*, 1998;80(3):382-7.
20. Boonyaratanakornkit V, Edwards DP. Receptor mechanisms mediating non-genomic actions of sex steroids. *Semin Reprod Med.* 2007 May;25(3):139-53.
21. Fu XD, Simoncini T. Non-genomic sex steroids actions in the vascular system. *Semin Reprod Med.* 2007 May;25(3):178-86.
22. Eshre Capri Workshop Group. Hormones and cardiovascular health in women. *Hum Reprod Update* 2006 Sep-Oct;12(5):483-97.
23. Taechakraichana N, Limpaphyom K, Ninlagam T, Panyakhamlerd K, Chaikittisilpa S, Dusitsin N. A randomized trial of oral contraceptive and hormone replacement therapy on bone mineral density and coronary heart disease risk factor in postmenopausal women. *Obstet Gynecol* 2000;95(1):87-94.
24. Davis MK, Thomas AC, Knapman PA, Hangartner JP. Intramyocardial platelet aggregation in patients with unstable angina suffering sudden ischemic cardiac death. *Circulation* 1986;73:418-27.