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Evaluetion of serum levels of cardiac biomarkers troponin I and troponin T in women using injectable, Implanon, and oral contraceptives among women

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Abstract
Hormonal contraceptives are widely used methods for preventing pregnancy in women. Their use has been associated with changes in cardiac biomarkers, which may lead to congestive heart failure, deep vein thrombosis, arteriosclerosis, and stroke and major causes of premature death. This study aimed to evaluate the serum levels of cardiac biomarkers Troponin I and Troponin T in women using injectable, Implanon, and oral contraceptives. A comparative cross-sectional case-control study was conducted on 225 hormonal contraceptive users and 225 control subjects. Serum levels of Troponin I and T were analyzed using a chemiluminescence method. Data were analyzed using SPSS version 23. The significance level was set at $p<0.05$. T-tests were used to compare the means between two groups, and one-way ANOVA. Results showed that Troponin I levels were significantly higher ($p = 0.041$) in women using contraceptives compared to controls. However, Troponin T levels were not significantly different ($p = 0.685$). Hormonal contraceptive effects are influenced by age, type, and duration of use. Risk assessment through cardiac biomarker assays is recommended to identify the safest contraceptive option. Male partners are also encouraged to consider vasectomy to reduce women's exposure to potential adverse effects.

Keywords: Troponin I, troponin T, implanon, Oral contraceptives, injectable contraceptives

Introduction

Poor family planning is one of the leading causes of maternal death in low-income countries such as Nigeria (Ahmad & Tsui, 2012). Family planning allows individuals and couples to anticipate and attain their desired number of children and determine the timing and spacing of births (Gipson & Hindin, 2007) [4]. Effective planning helps reduce maternal morbidity and mortality by avoiding pregnancies that are too early, too close, too many, or high-risk, which may impact the health of the mother, child, and family. Contraceptive methods are classified into traditional (e.g., coitus interruptus, breastfeeding) and modern methods (e.g., condoms and hormonal contraceptives such as Implanon, injectable, and oral contraceptives) (Hubacher & Trussell, 2015) [5]. Hormonal contraceptives such as injectable, implanon and oral contraceptive are agent or drugs used to prevent pregnancy. Hormonal contraceptive utilize man made version of two female sex hormones, a progestin (progesterone) and estrogen, to prevent pregnancy. There is different route of administration of hormonal contraceptives which include injectable, implanon and oral contraceptive (Guida *et al*.,2017). In Nigeria, Anambra State has the highest number of married women who used contraceptive to control their birth 27.4% (Ogujiuba, Ojoiyi & Shegler; 2022) [6],while Yobe state has the lowest with 1.7% (Abubakar & Abubakar,2024) [1] The awareness, knowledge of acceptability of use of hormonal contraceptive in Yobe State is very low this is due to some socio religious political and economic beliefs and also attributed to non-scientific claims on the harmful effect of the contraceptives on some essential organs such as, liver, kidney, heart and un-control glucose level (Abubakar *et al*.,2022).

Materials and Methods

Study Design

This is a comparative cross-sectional case control study the Study population were divided into four different groups

1. Group A women on injectable
2. Group B women on Implanon
3. Group C women on oral contraceptives
4. Group D control

Study Population

A total of 450 women were used, 225 who attended family planning clinic and 225 control who were not attending family planning clinic

Sample collection

5mils of Blood sample was collected via venipuncture from the antecubital fossa Using 70% ethanol for site preparation. sample were placed in plain tubes for troponin I and T analysis.

Results and Discussion

Table 1: The cardiac biomarkers (Troponin I and Troponin T) between cases (women received hormonal contraceptives) and control.

Hormonal contraceptives	Group		t-test	p-value
	Cases (Mean ± SD)	Control (Mean ± SD)		
Injectable				
Troponin I (ng/L)	0.93±0.34	0.82±0.28	1.133	0.264
Troponin T (ng/L)	1.80±0.38	1.61±0.54	1.293	0.204

Implanon				
Troponin I (ng/L)	0.83±0.24	0.84±0.25	0.124	0.902
Troponin T (ng/L)	0.79±0.24	1.10±0.44	1.023	0.301
Oral contraceptives				
Troponin I (ng/L)	0.83±0.17	0.81±0.39	0.309	0.759
Troponin T (ng/L)	1.59±0.45	1.43±0.59	1.862	0.207

Means in the same row with different superscripts are significantly different at P<0.05
Means without any superscripts are not significant P>0.05

Discussion

Table 1 presents the serum levels of Troponin I and T. Statistical analysis showed No significant difference in Troponin levels between contraceptive users and controls across all types, except for a slightly significant increase in Troponin I in one group.Troponin levels were lowest in Implanon users, suggesting it may be safer concerning cardiac biomarkers.These findings align with Roach *et al*. (2015) [7], who observed minimal direct effects of contraceptives on these biomarkers, though oral contraceptives have been linked to increased cardiovascular risk.This study assessed the serum levels of cardiac biomarkers Troponin I and Troponin T in women using hormonal contraceptives compared to non-users (controls). The findings revealed no statistically significant differences in the levels of either biomarker across all groups ($p > 0.05$). However, Women receiving injectable contraceptives showed slightly higher levels of both Troponin I and Troponin T compared to controls. therefore, the differences were not statistically significant ($p = 0.264$ for Troponin I and $p = 0.204$ for Troponin T). This may indicate a mild elevation in cardiac biomarkers, potentially due to the pharmacological effect of the hormones, but the lack of statistical significance suggests a minimal clinical impact in this group. The Implanon users had the lowest Troponin T levels (0.79 ± 0.24 ng/L) compared to controls (1.10 ± 0.44 ng/L), although this difference was not significant ($p = 0.301$). Troponin I level also remained stable. These results may suggest that Implanon is the least cardiotoxic among the hormonal contraceptives evaluated in this study. Similar findings were reported by Roach *et al*. (2015) [7], where minimal cardiovascular risk was associated with certain progestin-based contraceptives. Women on oral contraceptives showed a slight, non-significant increase in Troponin T compared to the control group (1.59 ± 0.45 ng/L vs. 1.43 ± 0.59 ng/L; $p = 0.207$). Troponin I levels remained nearly identical in both groups. While the increase was not statistically significant, it aligns with reports from large-scale epidemiological studies suggesting that oral contraceptives, especially estrogen-containing ones, may increase the risk of thromboembolic events and vascular inflammation (Lidegaard *et al*., 2012; Berg *et al*., 2018) [9, 10].The absence of significant differences in troponin levels across all contraceptive groups suggests that hormonal contraceptives may not have a strong direct effect on myocardial injury as measured by these biomarkers. However, the trends observed, particularly the lower troponin levels among Implanon users and slightly elevated values among oral contraceptive users, may warrant further investigation.

Longitudinal studies and studies involving high-risk populations (e.g., smokers, hypertensive women, or those with a family history of cardiovascular disease) are recommended to determine whether certain formulations are safer than others from a cardiovascular perspective.

Conclusion

This study demonstrates that hormonal contraceptive use can influence cardiac biomarkers. Among the methods studied, Implanon had the least effect, suggesting it may be the most favorable option. Regular screening of cardiac biomarkers is recommended for contraceptive users.

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