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Research Article

Assessment of Fibrinogen Level, Platelet Count and Thrombin Time in Women with Leiomyoma Uteri in Owerri, Nigeria

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Abstract:

Background: Leiomyoma uteri, commonly referred to as uterine fibroids, are benign smooth muscle tumors constituting the most frequent gynecological neoplasm among women of reproductive and perimenopausal age. These tumors are hormonally responsive and may influence systemic hemostatic and inflammatory parameters through mechanisms including abnormal uterine bleeding, local tissue remodeling, and chronic inflammatory responses. Dysregulation of coagulation factors and platelet function in women with leiomyomas has been reported, suggesting potential implications for both thrombotic and hemorrhagic risk.

Objective: This study aimed to evaluate key hemostatic parameters plasma fibrinogen, platelet count, and thrombin time in adult females with leiomyoma uteri compared with healthy age-matched controls in Owerri, Nigeria.

Methods: A cross-sectional comparative study was conducted among 60 adult women: 30 diagnosed with leiomyoma uteri and 30 age-matched healthy controls. Six milliliters of venous blood was collected aseptically. EDTA-anticoagulated blood was used for platelet counts, while serum separated from clotted blood was analyzed for fibrinogen and thrombin time using standard coagulation assays. Statistical analyses included mean ± standard deviation.

Results: Women with leiomyoma uteri exhibited significantly elevated fibrinogen levels (454.09 ± 47.51) mg/dL vs. (310.09 ± 26.93) mg/dL ($p < 0.0001$), increased platelet counts (431.83 ± 65.19) $\times 10^9$/L vs. (278.53 ± 48.78) $\times 10^9$/L ($p < 0.0001$), and prolonged thrombin time (18.72 ± 1.30) s vs. (15.06 ± 1.01)s ($p < 0.0001$) compared with controls. Hemostatic parameters did not vary significantly with age or duration of symptoms. No significant correlation was observed between platelet count and either fibrinogen or thrombin time.

Conclusion: Leiomyoma uteri is associated with hypercoagulable and inflammatory hematologic changes, including elevated fibrinogen, thrombocytosis, and prolonged thrombin time. These alterations may contribute to increased thrombotic risk and complicate surgical or medical management. Routine evaluation of coagulation parameters in women with fibroids is recommended to improve clinical outcomes.

Keywords: leiomyoma uteri; uterine fibroid; fibrinogen; platelet count; thrombin time; coagulation

1.Introduction

Leiomyoma uteri, also known as uterine fibroids, are the most common benign tumors of the female reproductive tract, affecting up to 70% of women by the age of 50 [12]. These tumors arise from the smooth muscle cells of the myometrium and are hormonally responsive, with growth primarily influenced by estrogen and progesterone3,4 While generally benign, fibroids are associated with a wide range of clinical manifestations including menorrhagia, pelvic pain, infertility, and abnormal uterine bleeding, which can significantly impair quality of life5,6. In many cases, fibroids may remain asymptomatic and be detected incidentally during imaging for unrelated conditions [7], underscoring variability in clinical presentation. Epidemiologically, the prevalence of leiomyoma uteri

varies globally but is notably higher in women of African descent. Some studies suggest that up to 80% of Black women develop uterine fibroids by age 50, with symptomatic disease affecting approximately 25–50%12,13. In Nigeria, hospital-based studies indicate prevalence rates ranging from 20% to 35% among women attending gynecological clinics[15]. Risk factors for fibroid development include age, early menarche, nulliparity, obesity, positive family history, and vitamin D deficiency.13,14 The high prevalence in African populations has been linked to both genetic susceptibility and environmental factors, including lifestyle and dietary influences12,13. From a pathophysiological perspective, fibroid growth is a complex process involving abnormal smooth muscle proliferation, excessive extracellular matrix (ECM) deposition, local angiogenesis, and inflammatory mediators [16,17]. Fibroids are hormonally responsive: estrogen enhances fibroid growth by upregulating growth factors such as platelet-derived growth factor (PDGF) and vascular endothelial growth factor (VEGF), while progesterone contributes by promoting anti-apoptotic signaling and increased ECM synthesis [18]. Platelets, in addition to their classical role in hemostasis, are believed to contribute to fibroid growth through secretion of cytokines, chemokines, and growth factors that promote smooth muscle proliferation and ECM deposition [19]. Chronic inflammation associated with fibroid growth may lead to elevated plasma fibrinogen an acute-phase protein synthesized by the liver thereby increasing blood viscosity and enhancing coagulation potential [20,21]. Hematological alterations in women with leiomyomas are clinically important. Reactive thrombocytosis, elevated fibrinogen, and prolonged thrombin time have been documented in multiple studies of fibroid disease [22,23]. These changes may reflect compensatory responses to chronic blood loss, tissue repair, or systemic inflammation [24]. Importantly, such alterations may have clinical consequences including increased risk of thromboembolic events or complications during surgical interventions [25,26]. Despite the high prevalence of fibroids in Nigeria, there is a paucity of data evaluating their impact on coagulation parameters in the South-East region. Understanding these changes is critical for improving clinical management, optimizing surgical outcomes, and reducing morbidity associated with abnormal bleeding or hypercoagulable states. This study aims to fill this gap by evaluating fibrinogen levels, platelet count, and thrombin time in adult women with leiomyoma uteri in Owerri, Nigeria, compared with healthy age-matched controls. By delineating the hematologic profile associated with fibroids, this study provides insight into potential clinical interventions, risk stratification, and targeted management strategies for women affected by leiomyomas. Leiomyomas are among the most prevalent benign tumors affecting women worldwide, especially during reproductive years [12]. Global estimates suggest that up to 70–80% of women will develop fibroids by the age of 50, with symptomatic disease affecting roughly 25–50%12,13. The incidence and prevalence are notably higher among women of African descent, who tend to develop fibroids at younger ages and often with greater tumor burden compared with Caucasian women [12,13]. Several risk factors have been consistently identified across populations: advanced age (though pre-menopausal), early menarche, nulliparity, obesity, positive family history, and vitamin D deficiency [13,14]. Lifestyle factors such as high dietary intake of red meat and low consumption of green vegetables have also been implicated[14]. In Nigeria, hospital-based gynecological studies report prevalence rates between 20–35%, especially among women in the 35–50-year age bracket [15]. These data underscore the high burden of fibroids in African populations and the need for region-specific studies assessing both clinical and hematologic implications. Fibroid growth is a multifactorial process involving abnormal smooth muscle proliferation, excessive extracellular matrix (ECM) deposition, local angiogenesis, and inflammatory responses [16,17]. Hormonal influences (oestrogen and progesterone) play pivotal roles: oestrogen enhances fibroid growth by upregulating growth factors such as PDGF and VEGF; progesterone augments growth via anti-apoptotic signaling and increased ECM synthesis [18]. Additionally, ECM accumulation, especially collagen and fibronectin contributes to fibroid stiffness and growth, mediated by transforming growth factor-beta (TGF-β) and other profibrotic cytokines. Platelets contribute beyond their hemostatic function. They act as active mediators, releasing cytokines, chemokines, and growth factors (PDGF, TGF-β, vascular growth factors) that stimulate smooth muscle proliferation and ECM deposition [19]. This paracrine signalling may enhance fibroid growth and promote local inflammation. The chronic inflammation associated with fibroid growth has been shown to upregulate acute-phase reactants such as fibrinogen [20,21]. Elevated fibrinogen increases plasma viscosity, enhances platelet aggregation, and may promote a hypercoagulable state, potentially contributing to thrombotic complications in patients with significant fibroid burden [21].

Several studies have documented alterations in hemostatic parameters among women with uterine fibroids. Reactive thrombocytosis, elevated fibrinogen, and prolonged thrombin time have been reported consistently in different populations [22,23]. These hematologic changes may arise from:

1. Chronic Blood Loss: Heavy or prolonged menstrual bleeding can lead to compensatory increases in platelet production and fibrinogen synthesis [22].

2. Tissue Repair and Inflammation: Fibroid growth and extracellular matrix remodeling are accompanied by local inflammatory responses, leading to increased synthesis of acute-phase proteins such as fibrinogen [21,24].

3. Platelet-mediated Growth Factor Release: Platelets release PDGF and TGF-β, which not only promote fibroid growth but may also exert systemic effects on coagulation pathways [20,24].

Prolonged thrombin time (TT) a measure of the time taken for fibrinogen to be converted to fibrin has been attributed to functional alterations in fibrinogen, reflecting either quantitative increases or qualitative modifications of the protein[25]. These changes can influence clot formation, bleeding risk, and potential for thrombotic events. Moreover, the magnitude of hemostatic alterations may vary based on fibroid characteristics (size, number, vascularity) and patient factors such as age, nutritional status, and comorbidities [25,26]. The documented hemostatic alterations in women with fibroids have significant clinical implications. Elevated fibrinogen and platelet count may increase blood viscosity and susceptibility to thrombosis, whereas prolonged thrombin time may interfere with effective hemostasis, particularly in the setting of surgery or interventional procedures26,27. This is of particular concern in low-resource settings such as many regions in Nigeria where access to comprehensive coagulation panels is limited, and perioperative support may be suboptimal. Incorporating routine coagulation parameter assessments in the clinical evaluation of women with symptomatic fibroids could aid in early identification of those at risk for thromboembolic or hemorrhagic complications, improving surgical planning and postoperative outcomes.

2.0 Materials and Methods

2.1 Study Area

The study was conducted at the Gynecology Clinic of Imo State Specialist Hospital, Umuguma, Owerri-West, Imo State, Nigeria. The hospital is a public secondary care facility providing comprehensive gynecological, obstetric, and general medical services, with 24-hour emergency and outpatient gynecological care. It serves a diverse population drawn from both urban and rural areas, making it representative of the broader community. The facility includes a functional laboratory capable of performing hematological and basic coagulation assays, which was essential for the present study.

2.2 Study Design

A hospital-based cross-sectional comparative study design was adopted. The study was conducted between September and October 2024. Participants included 30 women with sonographically or histologically confirmed leiomyoma uteri (cases) and 30 apparently healthy, age-matched women (controls). Controls were selected from women attending routine gynecological checkups with no history of abnormal uterine bleeding, uterine pathology, coagulopathy, chronic inflammatory disorders, or anticoagulant use.

2.3 Inclusion and Exclusion Criteria

Inclusion criteria:

- Women aged 30–70 years
- Sonographic or histologic diagnosis of leiomyoma uteri (for cases)
- For controls: no history of uterine fibroids, abnormal uterine bleeding, or gynecologic pathology
- No history of bleeding disorders or anticoagulant therapy in the preceding three months
- Informed consent provided

Exclusion criteria:

- Pregnancy or use of hormonal therapy
- History of chronic liver disease, renal disease, systemic inflammatory disorders, malignancy, or hematological disorders
- Recent surgery (<3 months) or blood transfusion

2.4 *Sample Collection*

Six milliliters (6 mL) of venous blood was drawn aseptically from each participant. The blood was divided as follows:
- 2mL into EDTA-anticoagulated tubes for platelet count
- 4 mL into plain (clot) tubes for serum separation to determine fibrinogen and thrombin time

The collected clot blood was allowed to stand at room temperature for 30 minutes to clot, then centrifuged at 3,000 rpm for 10 minutes. Serum was separated and stored at 2–8 °C if delayed analysis, but all assays were completed within 48 hours to minimize pre-analytical variation.

2.5 *Laboratory Assays*

- Fibrinogen: Measured using the Clauss method[23]. This method involves adding a high concentration of thrombin to diluted plasma and recording clotting time; clotting times are inversely proportional to fibrinogen concentration. Standard calibration was done using commercial control plasmas.
- Platelet Count: Determined manually using a hemocytometer method[24]. EDTA-anticoagulated blood was diluted appropriately with ammonium oxalate solution, and platelet counts were read using a light microscope under 40× magnification. Each count was done in duplicate for accuracy.
- Thrombin Time (TT): Measured using a standard coagulation assay[25]. Citrated plasma was incubated with standardized thrombin reagent, and the time required for clot formation was recorded in seconds.

2.6 Quality Control

Reagents were checked for expiry and integrity prior to use. Standard control samples with known fibrinogen concentrations and platelet counts were included in each batch of assays to ensure reliability. All blood samples were measured in duplicate, and mean values were used for statistical analysis. Laboratory personnel performing assays were blinded to the clinical status of participants to reduce observer bias.

2.7 Statistical Analysis

Data were entered and analyzed using SPSS version 21 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD). Independent t-tests were used to compare mean values of fibrinogen, platelet counts, and thrombin time between cases and controls. Pearson correlation coefficients were calculated to assess relationships among hematologic parameters. A p-value of less than 0.05 was considered statistically significant. Subgroup analyses were performed based on age groups (30–39, 40–49, ≥50 years) and duration of fibroid symptoms (≤5 years vs. >5 years).

2.8 Ethical Considerations

Ethical approval was obtained from the Imo State Specialist Hospital Ethics Committee. Informed written consent was obtained from all participants prior to enrolment. Confidentiality of participant information was maintained by assigning coded identifiers; no personal names were used. Participation was voluntary, and participants had the right to withdraw at any time without impact on their medical care.

2.9 Characteristics of Participants

Sixty women participated in the study: 30 with confirmed leiomyoma uteri (cases) and 30 healthy age-matched controls. The ages ranged from 32 to 68 years, with a mean ± SD of 48.3 ± 9.4 years across all participants. Among the leiomyoma group, duration of reported fibroid-related symptoms ranged from 1 to 10 years (median 4.5 years). In the fibroid group, 60% of participants reported heavy menstrual bleeding, 30% reported pelvic pain, and 10% reported infertility; none of the controls reported gynecologic symptoms or abnormal bleeding.

3.0 Results

Parameter	30–40 yrs (n=10)	41–50 yrs (n=10)	51–60 yrs (n=10)	F-value	p-value
Fibrinogen (mg/dL)	446.91 ± 55.16	452.20 ± 52.97	463.16 ± 35.66	0.289	0.751
Platelet (×10⁹/L)	444.10 ± 84.18	431.90 ± 69.90	419.50 ± 37.24	0.340	0.715

Parameter	30–40 yrs (n=10)	41–50 yrs (n=10)	51–60 yrs (n=10)	F-value	p-value
Thrombin Time (s)	19.26 ± 1.11	18.68 ± 1.16	18.22 ± 1.52	1.670	0.207

Key
*: Significant p-value
SD: Standard Deviation

Table 3.1 Mean Values of Fibrinogen, Platelet Count, and Thrombin Time in Leiomyoma Uteri Patients versus Controls (Mean ± SD)

Table 3.1 shows the mean values of fibrinogen, platelet count, and thrombin time in adult females with leiomyoma uteri compared to apparently healthy controls. The mean fibrinogen level was significantly higher in leiomyoma uteri patients (454.09 ± 47.51) mg/dL compared to controls (310.09 ± 26.93) mg/dL (t=14.44; p<0.0001).

Platelet count was also significantly increased in leiomyoma uteri patients (431.83 ± 65.19) × 10⁹/L compared to controls (278.53 ± 48.78) × 10⁹/L (t=10.31, p<0.0001).

Similarly, thrombin time was significantly prolonged in leiomyoma uteri patients (18.72 ± 1.30) s when compared to controls (15.06 ± 1.01) s (t=12.14; p<0.0001).

Parameter	30–40 yrs (n=10)	41–50 yrs (n=10)	51–60 yrs (n=10)	F-value	p-value
Fibrinogen (mg/dL)	446.91 ± 55.16	452.20 ± 52.97	463.16 ± 35.66	0.289	0.751
Platelet (×10⁹/L)	444.10 ± 84.18	431.90 ± 69.90	419.50 ± 37.24	0.340	0.715
Thrombin Time (s)	19.26 ± 1.11	18.68 ± 1.16	18.22 ± 1.52	1.670	0.207

Key:
*: Significant p value
SD: Standard Deviation

Table 3.2: Mean Values of Fibrinogen, Platelet Count and Thrombin Time in Leiomyoma Uteri Patients by Age Group (Mean±SD).

Table 4.2 shows the mean values of fibrinogen, platelet count, and thrombin time in adult females with leiomyoma uteri based on age categories.

Parameter	30–40 years (Mean ± SD)	41–50 years (Mean ± SD)	51–60 years (Mean ± SD)	F value	p value
Fibrinogen (mg/dL)	446.91 ± 55.16	452.20 ± 52.97	463.16 ± 35.66	0.289	0.751
Platelet count (×10⁹/L)	444.10 ± 84.18	431.90 ± 69.90	419.50 ± 37.24	0.340	0.715
Thrombin time (sec)	19.26 ± 1.11	18.68 ± 1.16	18.22 ± 1.52	1.670	0.207

Note: Values are expressed as mean ± standard deviation. Statistical comparison was performed using one-way ANOVA. A p value < 0.05 was considered statistically significant.

Table 3.3: Mean Values of Fibrinogen, Platelet Count and Thrombin Time in Leiomyoma Uteri Patients by Duration of Condition (Mean±SD).

Parameter	<3 yrs (n=10)	3–6 yrs (n=10)	>6 yrs (n=10)	F-value	p-value
Fibrinogen (mg/dL)	438.41 ± 45.58	451.89 ± 51.19	471.97 ± 44.05	1.289	0.292
Platelet (×10⁹/L)	410.60 ± 66.97	439.70 ± 78.85	445.20 ± 47.14	0.802	0.459
Thrombin Time (s)	18.30 ± 1.43	18.72 ± 1.18	19.14 ± 1.29	1.039	0.367

Key:
*: Significant p value
SD: Standard Deviation

Table 3.4 shows the Pearson correlation analysis of platelet count with fibrinogen level and thrombin time among leiomyoma uteri patients.

Table 3.3 shows the mean values of fibrinogen, platelet count, and thrombin time in adult females with leiomyoma uteri based on the duration of the condition.

There was no significant difference in the mean values of fibrinogen among the <3 years (438.41 ± 45.58 mg/dL), 3–6 years (451.89 ± 51.19 mg/dL), and >6 years (471.97 ± 44.05 mg/dL) groups of leiomyoma uteri patients (F=1.289, p=0.292).

There was no significant difference in the mean values of platelet count among the <3 years (410.60 ± 66.97 ×10⁹/L), 3–6 years (439.70 ± 78.85 ×10⁹/L), and >6 years (445.20 ± 47.14 ×10⁹/L) groups of leiomyoma uteri patients (F=0.802, p=0.459).

There was no significant difference in the mean values of thrombin time across <3 years (18.30 ± 1.43 sec), 3–6 years (18.72 ± 1.18 sec), and >6 years (19.14 ± 1.29 sec) groups of leiomyoma uteri patients (F=1.039, p=0.367).

3.4 Pearson Correlation of Platelet Count with Fibrinogen and Thrombin Time in Leiomyoma Uteri Patients.

There was no significant correlation of platelet count with fibrinogen (r=–0.24, p=0.199) and thrombin time (r=–0.26, p=0.168) in leiomyoma uteri patients.

Dependent Variable	n	r-value	p-value
Fibrinogen	30	–0.24	0.199
Thrombin Time	30	–0.26	0.168

Key:
r: Pearson Correlation Coefficient
p: Significance value

Table 4.4 Pearson Correlation of Platelet Count with Fibrinogen and Thrombin Time in Leiomyoma Uteri Patients.

4.0 Discussion

This study demonstrates significant alterations in systemic hemostatic parameters among women with leiomyoma uteri. The markedly raised fibrinogen levels, elevated platelet counts, and prolonged thrombin time seen in these patients support the notion that leiomyoma is associated with a systemic pro-inflammatory and hypercoagulable state [18]. Elevated fibrinogen is consistent with the view that fibroids, through chronic tissue remodeling, local inflammation, and persistent bleeding, stimulate hepatic acute-phase reactant production [18]. Fibrinogen, as both a coagulation factor and an inflammatory marker, when elevated, can increase blood viscosity, promote platelet aggregation, and raise thrombotic risk [13]. The significantly higher platelet counts among fibroid patients are likely reactive, resulting from chronic or recurrent uterine bleeding inducing bone marrow stimulation and increased thrombopoiesis [14]. Prolongation of thrombin time, despite high fibrinogen levels, suggests complex alterations in coagulation beyond simple quantitative changes. Possible explanations include qualitative changes in fibrinogen (e.g., altered fibrinogen molecules or fibrin polymerization defects) [7], presence of fibrin degradation products, or inhibitors interfering with clot formation [21]. The lack of correlation between fibrinogen concentration, platelet count, and thrombin time implies that these changes may result from multiple independent mechanisms; inflammatory, hematologic, and coagulation pathway modulation, rather than a single linear process [12].

Age-stratified analysis showed that the hemostatic changes were consistent across age groups, indicating that the presence of fibroid pathology, rather than age, is the key driver of coagulation alterations [12]. Similarly, symptom duration (≤5 years vs. >5 years) did not significantly affect the degree of derangement, suggesting that these changes may occur early in the course of disease and persist regardless of chronicity [15].

5.0 Clinical Implications

The findings have significant clinical relevance:

Thrombotic risk: Elevated fibrinogen and platelet counts may predispose women with fibroids to venous thromboembolism, especially in settings of immobilization, surgery, or other risk-enhancing conditions[22].

Surgical Planning: For women undergoing myomectomy or hysterectomy, preoperative coagulation screening may identify those at risk of perioperative bleeding or thrombosis, enabling

prophylactic measures (anticoagulation, blood product planning, close monitoring)[15].

Perioperative Care: Prolonged thrombin time may complicate surgical hemostasis; recognition may prompt extended monitoring or correction before major procedures[21].

General Management: Clinicians should consider integrating routine hematologic evaluation (fibrinogen, platelet count, thrombin time) in the assessment of women with symptomatic fibroids particularly those with heavy menstrual bleeding to guide treatment decisions and improve outcomes[20].

6.0 Conclusion

This study provides clear evidence that women with leiomyoma uteri in Owerri, Nigeria, exhibit systemic hemostatic alterations characterized by elevated fibrinogen levels, thrombocytosis, and prolonged thrombin time. These findings indicate a shift toward a pro-inflammatory and hypercoagulable state, which may contribute to increased thrombotic risk and complicate surgical or medical management. Therefore, routine evaluation of coagulation parameters in women with fibroids should be considered for better risk stratification and informed clinical decision-making.

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