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Assessment of Selected Haemostasic Parameters in Pre and Post Operated Patients in Unimedthc, Ondo.

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Abstract: ***Excessive bleeding following surgery can be a significant complication, often linked to deficiencies in clotting factors. Perioperative hemostasis monitoring is crucial to enhance patient safety during surgical procedures.***

This study aimed to assess changes in Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), and platelet count in patients before and after surgery at UNIMEDTHC Ondo. A total of 45 patients (42 females and 3 males) admitted to various wards at UNIMEDTHC Ondo consented to participate. Data was collected over a two-month period using questionnaires and blood samples. Blood samples (6 mL) were drawn pre-operatively and 24 hours post-operatively. PT, aPTT, and platelet counts were analyzed manually using Agape reagents. Statistical analysis was performed using SPSS version 25. Results indicated a slight increase in PT and INR post-operatively, a decrease in aPTT, and a significant increase in platelet count. However, no statistically significant differences were observed in PT, aPTT, and platelet count between pre- and post-operative patients. Furthermore, no significant differences were found in these parameters based on age or gender.

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Introduction and Literature Review

Surgical interventions, even minor procedures, can lead to significant bleeding complications, particularly in patients with underlying coagulation disorders. Effective hemostasis management is crucial to prevent adverse outcomes, especially in closed anatomical compartments where even small amounts of bleeding can have serious consequences (Tiwari et al., 2021).

Both bleeding and thrombotic events pose substantial risks for surgical patients. Traditional coagulation tests, such as Prothrombin Time (PT) and Activated Partial Thromboplastin Time (aPTT), while valuable, have limitations in assessing the dynamic nature of hemostasis. These tests may not always accurately predict bleeding or thrombotic risk, especially in patients with subtle coagulation abnormalities or those on anticoagulation therapy.

PT evaluates the extrinsic and common pathways of the coagulation cascade, while aPTT assesses the intrinsic pathway. Thrombin Time (TT) measures the final step of coagulation, the conversion of fibrinogen to fibrin. These tests, along with International Normalized Ratio (INR), are essential for preoperative assessment, monitoring anticoagulation therapy, and identifying potential bleeding risks (Mohammed, 2020; Mustafa et al., 2015; Matcas, 2009; Thiruvenkatarajan et al., 2014; Roberts et al., 2021).

Despite advancements in surgical techniques and perioperative care, a comprehensive understanding of the dynamic changes in coagulation profiles before and after surgery remains elusive. This study aims to address this knowledge gap by analyzing hemostasis profiles of surgical patients. By identifying patterns and trends in coagulation parameters, we hope to improve the management of bleeding and thrombotic risks, ultimately leading to better patient outcomes.

Materials and Methods Study area

This study was carried out in University of Medical Sciences Teaching Hospital Complex (UNIMEDTHC). It is located in Ondo city, Ondo west local government, Ondo state. Ondo state South West Nigeria. The state lies within latitudes 50 45' and 80 15' North and longitudes 40 45' and 6' East. Ondo State.

Study Design

This research employs a cross-sectional, experimental design, as it was conducted within a one-year period. It is a probability-based simple random sampling study, allowing each participant an equal chance of selection, thus minimizing potential bias. The study is experimental in nature because it includes both test and control samples for comparative analysis.

Study Population

The study population comprises patients who are scheduled for surgery and those who have already undergone surgery at the

Ondo City. Informed consent was obtained from all participants prior to their involvement in the study.

Ethical Approval

Ethical approval was granted by the UNIMED Research Ethics Committee, with approval ID NHREC/TR/UNIMED-HREC-ONDO St/22/06/21. Written informed consent was obtained from all subjects after the study procedures and objectives were explained in a clear language, including English, Yoruba, and Pidgin, to ensure participant understanding.

Sample Size

The study sample consists of pre- and post-operative patients at the University of Medical Sciences Teaching Hospital Complex (UNIMEDTHC). The sample size was calculated using the following formula:

$$S = \frac{a^2 \times b \times c}{d^2}$$

where:

- S = desired sample size,
- a = 1.96, corresponding to a 95% confidence level (Akinbodewa et al., 2021),
- b= prevalence of 3% based on UNIMEDTHC Records (2024),
- c = 1−b
- d = degree of accuracy (0.05) (Akinbodewa et al., 2021).

Thus, the sample size calculation is as follows:

$$S = \frac{(1.962 \times 0.03 \times 0.97)}{0.052S}$$

Thus, in this study the desired sample size = 45

All pre and post-operated patients were counseled about the relationship between clotting profile test and platelet count. A total of 45 patients were screened ranging from 18 - 65 years in this study. Patients that were unwilling to consent for the blood test were excluded from this study.

Data Collection Data Collection Procedure

Data was gathered over a period of two months through structured interviews using questionnaires. The questionnaires were composed primarily of multiple-choice "yes" or "no" questions aimed at collecting socio-demographic information, including age, gender, and the duration of each patient's hospital stay. This allowed for an efficient gathering of essential participant information.

Blood Sample Collection

A randomized sampling approach was used to select pre- and postsurgery patients at the University of Medical Sciences Teaching Hospital (UNIMEDTH). Blood samples from all participants were collected for laboratory analysis to measure Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), and platelet counts, providing a basis for evaluating coagulation profiles in both pre- and post-operative stages.

Sample Processing

For each participant, 4.5 mL of blood was drawn aseptically from the cubital vein and collected into a sodium citrate tube with a 5 mL capacity. The samples were accurately labeled with identification information, including participant ID and name, to maintain traceability. To prepare for analysis, samples were then centrifuged at 3,000 revolutions per minute (rpm) for five minutes, which separated the plasma for further testing.

Clotting Profile Testing

Strict quality control measures were maintained for each batch of reagents used in Prothrombin Time (PT) and Activated Partial Thromboplastin Time (aPTT) tests. This included verifying reagent expiration dates, LOT numbers, manufacturer information, production dates, and proper storage guidelines, with all reagents kept between 2-8°C. Reagents were stored according to ISO 9001:2015 and EN ISO 13485:2016 standards to ensure test accuracy and consistency.

Prothrombin Time (PT)

The PT test measures the time needed for fibrin formation following factor VII activation, which evaluates the integrity of the "extrinsic" and "common" clotting pathways, specifically factors VII, V, X, prothrombin, and fibrinogen.

Principle

This test initiates the coagulation process in a plasma sample by introducing tissue factor (apoprotein and phospholipid) and calcium chloride ($CaCl_2$), leading to clot formation. The time to form a stable clot, measured in seconds, reflects the PT result.

Procedure (Agappe Product)

Tubes and reagents were warmed to 37°C before testing to maintain consistent results. For the PT test, 100 µL of plasma was placed in a prewarmed tube and incubated for three minutes at 37°C. Then, 200 µL of prewarmed prothrombin reagent was added, and the clotting time was recorded, generally ranging from 12 to 15 seconds.

Activated Partial Thromboplastin Time (aPTT)

The aPTT test measures the time required for fibrin formation via the intrinsic coagulation pathway. Factor XII is activated by an external agent like kaolin, which selectively initiates factor XII without involving factor VII. A phospholipid emulsion is used to replicate platelet function within the coagulation process. Unlike traditional PTT tests, which involved high variability, the aPTT test uses an external activator for improved precision.

Principle

In the aPTT test, coagulation is activated in the plasma sample using a platelet substitute (such as silica), a factor XII activator, and calcium chloride ($CaCl_2$). The resulting stable clot formation time, recorded in seconds, provides the aPTT result. The absence of tissue factor in this process gives it the designation "partial."

Procedure (Agappe Product)

Reagents, including calcium chloride and aPTT reagents, were prewarmed to 37°C. To conduct the test, 100 µL of plasma was added to a prewarmed tube, followed by 100 µL of prewarmed aPTT reagent. After three minutes of incubation, 100 µL of prewarmed calcium chloride solution was introduced, and clotting time was measured, typically ranging from 25 to 35 seconds.

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Platelet Count

The platelet count test involves using ammonium oxalate to lyse red and white blood cells, enabling clearer visualization of platelets.

Procedure

A sample was prepared by combining 380 µL of ammonium oxalate solution with 20 µL of blood in a clean test tube, mixing thoroughly. A drop of the mixture was then placed on a Neubauer counting chamber and examined under a microscope at 10x magnification. Normal platelet counts range from 150,000 to 400,000 platelets per microliter of blood.

Data Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) software, version 25. Analysis of Variance (ANOVA) was used to assess variations in Prothrombin Time (PT), aPTT, and platelet counts. Relationships between variables were examined using Pearson's Chi-Square test, with a significance threshold set at 0.05 to determine statistical significance.

Results

Sociodemographic characteristics of respondents The socio-demographic characteristics of respondent is presented in table 1. 6.7% the respondents were male while 93.3% were female. The majority of the surgeries conducted were Caesarian surgeries, accounting for 82.2%, while orthopedic surgeries made up 17.8%. Age-wise, the participants were categorized into four groups: 24-40 years, 41-50 years, 51-60 years, and 61-70 years. The largest age group was 24-40 years, comprising 73.3%. This was followed by the 41-50 years group at 15.6%, the 61-70 years group at 6.7%, and the 51-60 years group, which had the smallest representation at 4.4%. With respect to patients pre- and post-operation, the mean age of the patients is 38 year. For Prothrombin time, the pre-operated mean is 13.73 seconds (SD = 1.67, SE = 0.25), which slightly increases postoperation to 14.14 seconds (SD = 1.54, SE = 0.23). The Activated partial thromboplastin time (APTT) shows a decrease from a preoperated mean of 34.86 seconds (SD = 5.44, SE = 0.81) to a postoperated mean of 33.59 seconds (SD = 6.96, SE = 1.03). Platelet counts increase significantly post-operation, with a pre-operated mean of 173.87 (SD = 57.28, SE = 8.54) and a post-operated mean of 208.76 (SD = 71.22, SE = 10.62). The International Normalized Ratio (INR) shows a slight increase from a pre-operated mean of 1.06 (SD = 0.19, SE = 0.03) to a post-operated mean of 1.09 (SD =
0.19, SE = 0.03).

Table 1: Sociodemographic Characteristics of Respondents

Variables	Category	Frequency	Percentage
Gender	Male	3	6.7
	Female	42	93.3
Surgery Type	Caesarian surgery	37	82.2
	Orthopedic surgery	8	17.8
Age	24-40	33	73.3
	41-50	7	15.6
	51-60	2	4.4
	61-70	3	6.7

Statistics	N	Pre-Operated		Post-Operated	
		Mean ± SD	S. E	Mean ± SD	S. E
Age	45	38.44 ± 10.14	1.51		
Prothrombin time	45	13.73 ± 1.67	0.25	14.14 ± 1.54	0.23
APTT	45	34.86 ± 5.44	0.81	33.59 ± 6.96	1.03
Platelets	45	173.87 ± 57.28	8.54	208.76 ± 71.22	10.62

INR	45	1.06 ± 0.19	0.03	1.09 ± 0.19	0.03

Patients' pre- and post-operative profiles time (PT), 11.1% of patients had a short PT pre-operation, 68.9% had normal PT, and 20% had prolonged PT. Post-operation, 6.7% of Table 2 compares pre- and post-operative profiles of various blood patients had a short PT, 66.7% had normal PT, and 26.7% had parameters with their respective reference ranges. For Prothrombin

prolonged PT, with the reference range being 12-15 seconds. For Activated partial thromboplastin time (APTT), 40% of patients had a short APTT pre-operation, 57.8% had normal APTT, and 2.2% had prolonged APTT. Post-operation, 62.2% of patients had a short APTT, 31.1% had normal APTT, and 6.7% had prolonged APTT, with the reference range being 25-35 seconds. The International Normalized Ratio (INR) remained stable with 97.8% of patients having normal INR pre- and post-operation and only 2.2% showing a short INR, consistent with the reference range of 0.8-1.5. For platelet count, 57.8% of patients had normal counts pre-operation and 42.2% had low counts. Post-operation, 71.1% of patients had normal counts, and 28.9% had low counts, with the reference range being 150,000-400,000 platelets per microliter of blood.

Table 2: Patients' pre- and post-operative profiles

Profile	Category	Pre-Operated	Post-Operated	Reference range
PT	Short	5 (11.1)	3 (6.7)	12-15 seconds
	Normal	31 (68.9)	30 (66.7)	
	Prolonged	9 (20.0)	12 (26.7)	
APTT	Short	18 (40.0)	28 (62.2)	25-35 seconds
	Normal	26 (57.8)	14 (31.1)	
	Prolonged	1 (2.2)	3 (6.7)	
INR	Short	1 (2.2)	1 (2.2) 44	0.8-1.5
	Normal	44 (97.8)	(97.8)	
	Prolonged	0 (0.0)	0 (0.0)	
Platelet count	Normal	26 (57.8)	32 (71.1)	150,000-400,000 platelets per microliter of blood
	Low	19 (42.2)	13 (28.9)	

Hypothesis Testing

Decision rule: If the P< 0.05 the null hypothesis (H0) will be rejected, otherwise the null hypothesis be accepted.

Hypothesis One

Null Hypothesis (H0): There is no significant difference in Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), and platelet count between pre-operative and post-operative patients. As shown in Table 3, there are no statistically significant differences in the means of pre-operative PT (pre-PT) and preoperative aPTT (pre-APTT). For pre-PT, Levene's test for equality of variances results in an F-value of 0.158 and a significance level (Sig.) of 0.692, indicating that the assumption of equal variances is met. The t-test for equality of means,

Table 3: Independent samples t-test for pre-operative PT and APTT.

	Levene's Test for Equality of Variances		T-test for equality of Means			
	F	Sig.	t	df	p-value	Std. Error Difference
pre-PT(S)	Equal variances assumed	.158	.692	-1.194	88	.236	.339
	Equal variances not assumed			-1.194	87.461	.236	.339
pre-APTT(S)	Equal variances assumed	.710	.402	.959	88	.340	1.318

	Equal variances not assumed	.959	83.215	.340	1.318

Hypothesis Two

H0 - There is no significant difference in the Prothrombin time, Activated partial thromboplastin time and platelet count in pre- and post-operated patients based on age.

The ANOVA analysis for Prothrombin time (PT), Activated partial thromboplastin time (APTT), and platelets reveals the following findings. For PT, the F-value is 1.282 with a significance level (Sig.) of 0.293, indicating no significant difference between groups. For APTT, the F-value is 0.956 with a Sig. of 0.422, suggesting no significant difference between groups. For platelets, the F-value is 0.702 with a Sig. of 0.556, also indicating no significant difference between groups. Therefore, the null hypothesis is accepted. There is no significant difference in the Prothrombin time, activated partial thromboplastin time and platelet count in pre- and post-operated patients based on age (Table 4).

Table 4: The ANOVA analysis for Parameters

ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
PT	Between Groups	1.170	3	.390	1.282	.293
	Within Groups	12.474	41	.304		
	Total	13.644	44			
APTT	Between Groups	.718	3	.239	.956	.422
	Within Groups	10.260	41	.250		
	Total	10.978	44			
Platelets	Between Groups	.536	3	.179	.702	.556
	Within Groups	10.442	41	.255		
	Total	10.978	44			

Hypothesis Three

Null Hypothesis (H_0): There is no significant difference in Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), and platelet count between pre- and post-operative patients when analyzed by gender.

Independent t-tests were conducted on PT, aPTT, and platelet count to compare mean values between genders, revealing no significant differences.

- Prothrombin Time (PT): Levene's test for equality of variances produced an F-value of 2.478 and a significance level (Sig.) of 0.123, indicating that equal variances can be assumed. The t-test for equality of means under this assumption yielded a p-value of 0.778, showing no significant gender difference in mean PT. When equal variances were not assumed, the p-value remained at 0.290, confirming the lack of significant difference. • Activated Partial Thromboplastin Time (aPTT): Levene's test returned an F-value of 0.872 with a Sig. of 0.356, again supporting the equal variance assumption. The t-test under this assumption produced a p-value of 0.754, indicating no significant difference in mean aPTT by gender. With the assumption of unequal variances, the pvalue was 0.805, reaffirming this finding.
- Platelet Count: For platelet count, Levene's test yielded an F-value of 0.382 with a Sig. of 0.540, also supporting equal variances. The t-test assuming equal variances resulted in a p-value of 0.386, indicating no significant gender-based difference in mean platelet count. This outcome held even without assuming equal variances, with a p-value of 0.517.

Table 5: Levene's Test for Equality of Variances

Levene's Test for Equality of Variances				T-test for equality of Means			
		F	Sig.	T	df	p-value	Std. Error Difference
PT	Equal variances assumed	2.478	.123	-.283	43	.778	.336
	Equal variances not assumed			-1.071	41.000	.290	.089
APTT	Equal variances assumed	.872	.356	.316	43	.754	.302
	Equal variances not assumed			.278	2.220	.805	.342
Platelets	Equal variances assumed	.382	.540	.875	43	.386	.299
	Equal variances not assumed			.766	2.217	.517	.342

Discussion and Conclusion

Major surgical procedures cause a range of hemostatic changes due to factors like surgical stress, tissue injury, and inflammation. These changes can prompt a volume shift from extravascular to intravascular and interstitial spaces, leading to hemodilution of coagulation proteins (Colomina et al., 2021). Postoperative coagulation disorders may arise from pre-existing liver conditions, blood loss, transfusions, fluid infusions, and acquired coagulopathies, all of which can heighten the risk of bleeding and related complications (Weinberg et al., 2006; Grottke et al., 2015).

Preoperative coagulation screening tests are commonly used to identify patients at risk of excessive bleeding during surgery. By detecting acquired or congenital bleeding disorders, these tests allow healthcare providers to take preventive or therapeutic measures to manage bleeding risks during and after surgery (Zamudio et al., 2021).

In this study, 31.1% of participants showed abnormal Prothrombin Time (PT) before surgery, a rate differing from Eisenberg et al. (1982), who reported only 18% abnormal PT rates preoperatively. Elevated PT levels may signal liver disease, vitamin K deficiency, or deficiencies in clotting factors like II, V, IX, or X. Postoperatively, 6.7% of patients had shortened PT, 66.7% had normal PT, and 26.7% had prolonged PT, using a reference range of 12-15 seconds. This is consistent with Dutzmann et al. (2012), who found that 12% of patients with hemorrhagic complications had elevated PT before surgery, emphasizing the importance of monitoring coagulation postoperatively to prevent bleeding complications (Theusinger, 2013).

For Activated Partial Thromboplastin Time (aPTT), 2.2% of patients showed prolonged values, aligning with Zamudio et al. (2021), who reported a rate of 1.3%. Prolonged aPTT can be due to contamination, anticoagulant use, clotting factor deficiencies, lupus anticoagulant, or acquired inhibitors. After surgery, 62.2% of patients had shortened aPTT, 31.1% were within normal limits, and 6.7% had prolonged values, with the reference range being 25-35 seconds. The International Normalized Ratio (INR) remained largely stable, with 97.8% of patients showing normal INR values both pre- and post-surgery, while only 2.2% displayed a shortened INR, consistent with Harley et al. (2015), who observed elevated INR in 1.8% of patients.

Studies like Spezia et al. (2014) have also explored perioperative coagulation, finding that low platelet counts and reduced fibrinogen activity can cause significant intraoperative bleeding. In this study, 57.8% of patients had normal platelet counts preoperatively, a rate lower than that reported by Rohrer et al. (2002), where 92% of patients had normal platelet counts and 42.2% had low levels.

The hypothesis testing in this study indicated that age and gender had no significant impact on PT, aPTT, or platelet count, suggesting these demographic factors may not strongly influence coagulation status in surgical patients. This highlights the importance of individualized coagulation assessment based on specific clinical factors rather than demographic characteristics alone.

Conclusion

Patients with abnormal coagulation profiles are at heightened risk for postoperative bleeding, even with appropriate perioperative medical management, highlighting the importance of early identification. This study emphasizes the value of preoperative coagulation screening in identifying patients at elevated risk of bleeding during surgery. By monitoring PT, aPTT, and platelet counts, healthcare providers can implement targeted interventions to minimize postoperative hemorrhagic complications. These findings contribute to improved perioperative care strategies, ultimately enhancing patient outcomes in surgical settings.

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