Journal of Carcinogenesis
Covering Genesis to Therapeutics

Journal of Carcinogenesis, ISSN: 1477-3163
2025; Vol 24: Issue 3, https://carcinogenesis.com/

Laboratory Testing For Lupus Anticoagulants. A Study From Tertiary Care Referral Centre

Kandikatla Sailaja[1*], Dr. Pramod Kumar Pamu[2*], Dr. K.K.Radhika[3], Dr. Shantveer G.Uppin[4]

[*1]Consultant pathologist, Telangana Diagnostics,

Email ID: kandikatlashailaja7@gmail.com

[*2]Associate Professor, Department of Pathology, Nizam's Institute of Medical Sciences, Hyderabad,

Email ID: pramodkumarpamu@gmail.com .

[3]Associate Professor, Clinical Hematology, Nizam's Institute of Medical Sciences, Hyderabad,

Email ID: radhika_setti@yahoo.com

[4]Professor &Head of the department, Department of Pathology, Nizam's Institute of Medical Sciences, Hyderabad

ABSTRACT

Background: Lupus anticoagulants (LA) are autoantibodies associated with an increased risk of thrombotic events, and their detection is crucial in the diagnosis of antiphospholipid syndrome (APS).

Aim and Objectives: The aim of this study is to analyze the referral patterns for Lupus Anticoagulant (LA) testing within our hospital, with a focus on evaluating and comparing the performance of Partial Thromboplastin Time-Lupus Anticoagulant (PTT-LA) and Dilute Russell's Viper Venom Time (dRVVT) in detecting LA. Additionally, the study seeks to assess the role and optimal sequence of mixing studies within the testing algorithm, providing insights into refining diagnostic accuracy for Lupus Anticoagulant.

Methods: A total of 1,000 subjects were included in the study. The study employed tests such as the Dilute Russell Viper Venom Time (DRVVT) and Partial Thromboplastin Time-LA (PTT-LA) for screening and confirming the presence of lupus anticoagulants.

Results: The mean Prothrombin Time (PT) was 16.31 ± 8.77 seconds, Activated Partial Thromboplastin Time (APTT) was 34.13 ± 14.01 seconds, and Thrombin Time (TT) was 21.94 ± 30.50 seconds. Lupus anticoagulant testing revealed that 33.5% of patients were positive, 58.5% negative, and 8.0% probable positive. Among the positive cases, the DRVVT screening test had a sensitivity of 100% and a specificity of 67.0%, with an area under the ROC curve of 0.8176. The PTT-LA screening test showed a sensitivity of 70.8% and a specificity of 76.1%, with an area under the ROC curve of 0.7246. Statistically significant differences were observed in the end results based on ACL-IgM and β2 Glycoprotein-IgG tests ($p < 0.05$).

Conclusion: The DRVVT screening test demonstrated higher accuracy, sensitivity, and specificity compared to the PTT-LA screening test. The study concluded that DRVVT is a more reliable method for detecting lupus anticoagulants and predicting thrombotic risk in patients.

Keywords: *Lupus Anticoagulants (LA), Dilute Russell Viper Venom Time, Partial Thromboplastin Time, Antiphospholipid Syndrome, Systemic Lupus Erythematosus, Thrombotic Risk.*

How to Cite: Kandikatla Sailaja, Dr. Pramod Kumar Pamu, Dr. K.K.Radhika, Dr. Shantveer G.Uppin, (2025) Laboratory Testing For Lupus Anticoagulants. A Study From Tertiary Care Referral Centre, *Journal of Carcinogenesis, Vol.24, No.3,* 175-786

1. INTRODUCTION

Lupus anticoagulants (LA) are a type of antiphospholipid antibody (aPL) that interfere with phospholipid-dependent coagulation assays, increasing the risk of thrombotic events and recurrent pregnancy loss in affected individuals [1,2]. These autoantibodies are a hallmark of antiphospholipid syndrome (APS), an autoimmune disorder characterized by venous and arterial thrombosis, as well as complications during pregnancy, such as miscarriage and preeclampsia [1]. The presence of LA is one of the primary diagnostic criteria for APS, underscoring the importance of accurate and reliable laboratory tests in its detection [3,4].

The detection of LA typically involves a series of phospholipid-dependent coagulation tests, with the Dilute Russell Viper Venom Time (DRVVT) and Partial Thromboplastin Time-Lupus Anticoagulant (PTT-LA) being the most commonly used [5,6]. DRVVT is highly specific for LA as it directly assesses the inhibition of the coagulation cascade in the presence of phospholipids [4]. Conversely, the PTT-LA test, while sensitive, can be influenced by other factors such as coagulation factor deficiencies and the presence of other anticoagulants, potentially leading to false-positive results [7,8].

Accurate laboratory detection of LA is crucial for guiding clinical management, particularly in patients at risk of thrombosis. Misinterpretation or misdiagnosis can lead to inappropriate treatment, which may include unnecessary long-term anticoagulation therapy with its associated risks [9,10]. Consequently, it is essential to use confirmatory tests, such as mixing studies and specific phospholipid-dependent assays, to validate positive screening results and differentiate LA from other coagulopathies [11,5].

Despite advances in laboratory testing, the detection of LA remains challenging due to variability in test performance and the potential for both false-positive and false-negative results [4,11]. This variability highlights the need for standardized testing protocols and a comprehensive diagnostic approach to accurately identify LA and assess the risk of thrombotic events in patients [3].

Given the critical role of LA in the pathogenesis of APS and the potential for serious clinical outcomes, this study aims to evaluate the efficacy of DRVVT and PTT-LA tests in detecting LA among patients at a tertiary care referral center. The findings of this study are expected to contribute to the optimization of diagnostic accuracy and the improvement of clinical management strategies for patients with suspected LA [1].

2. MATERIALS AND METHODS

Place of Study: The study was conducted in the Department of Pathology at Nizam's Institute of Medical Sciences, Hyderabad.

Study Population: All patients referred for Lupus Anticoagulant (LA) testing to the Department of Pathology, Nizam's Institute of Medical Sciences, Hyderabad, from August 2020 to January 2022 were included in the study.

Study Design: This was a prospective study.

Sample Size: The study included 1000 participants.

Sampling Method: Participants were consecutively recruited through convenient sampling until the sample size was achieved.

Inclusion Criteria:

- Patients aged 18 years and older of both sexes.
- Tested for Lupus Anticoagulant during the study period.

Exclusion Criteria:

- Patients whose initial routine coagulation screen suggested the effect of therapeutic Heparin or Vitamin K antagonists.

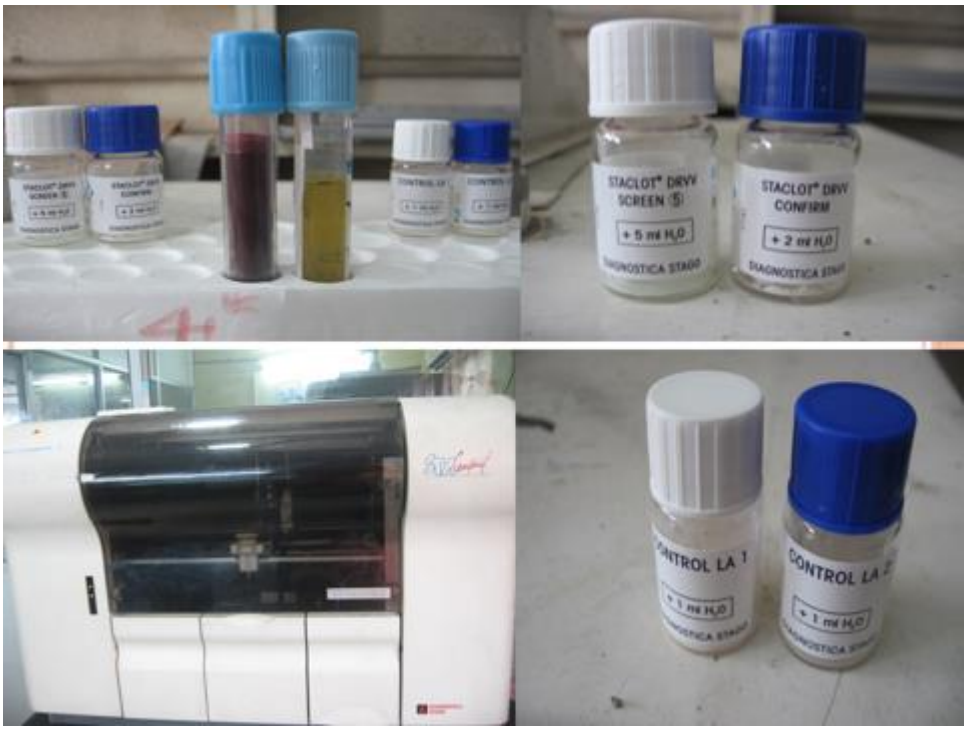
Methodology:

The study commenced after receiving approval from the Institutional Ethics Committee. Clinical findings, other investigation results (especially ACL levels and Beta-2-Glycoprotein), treatment, and follow-up details were collected from medical records. Venous blood was collected in 0.109 M sodium citrate at a 9:1 ratio, followed by double centrifugation to prepare platelet-poor plasma (PPP). Samples were processed within 4 hours, or PPP was stored at -80°C if not immediately analyzed. Frozen plasma was thawed to 37°C before testing. The STA COMPACT MAX 2 machine was utilized for all tests.

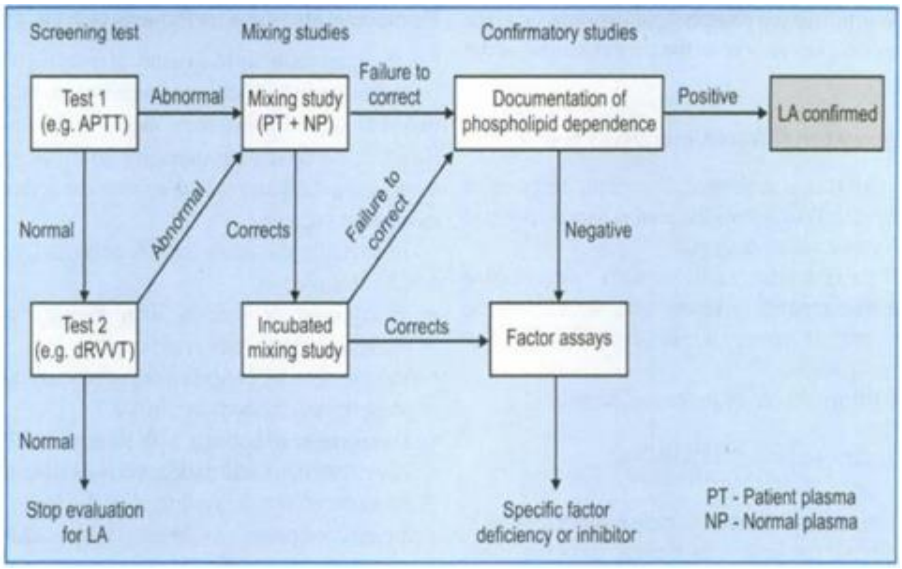
Table 1: Tests Performed

Test	Reagents Used	Interpretation
Routine Coagulation Screening Tests		
Prothrombin Time (PT)	STA-NeoPTimal	PT-LA screen considered positive if screen ratio >1.20
Activated Partial Thromboplastin Time	STA-C.K.Prest	PTT-LA screen negative if screen ratio ≤1.20

(APTT)		
Thrombin Time (TT)	STA-Thrombin reagent	-
Screening Tests		
PTT-LA screen	-	Positive if screen ratio >1.20
DRVVT screen	-	Positive if screen ratio >1.20
Mixing Study	1:1 mixture of patient plasma and pooled normal plasma (PNP)	Positive if Rosner index ≥15
Confirmatory Tests	DRVVT confirmatory test for positive cases	Positive if normalized ratio ≥1.20



Interpretation of Results: The presence of Lupus Anticoagulant (LA) was confirmed following the recommendations of the scientific and standardization committee. The test results were categorized as negative, probable positive, or positive based on the screening and confirmatory test outcomes, as detailed in Tables 2, 3, and 4. Persistent positive tests were verified by repeating them after at least 12 weeks. The results were interpreted according to the patient's clinical and biological states.



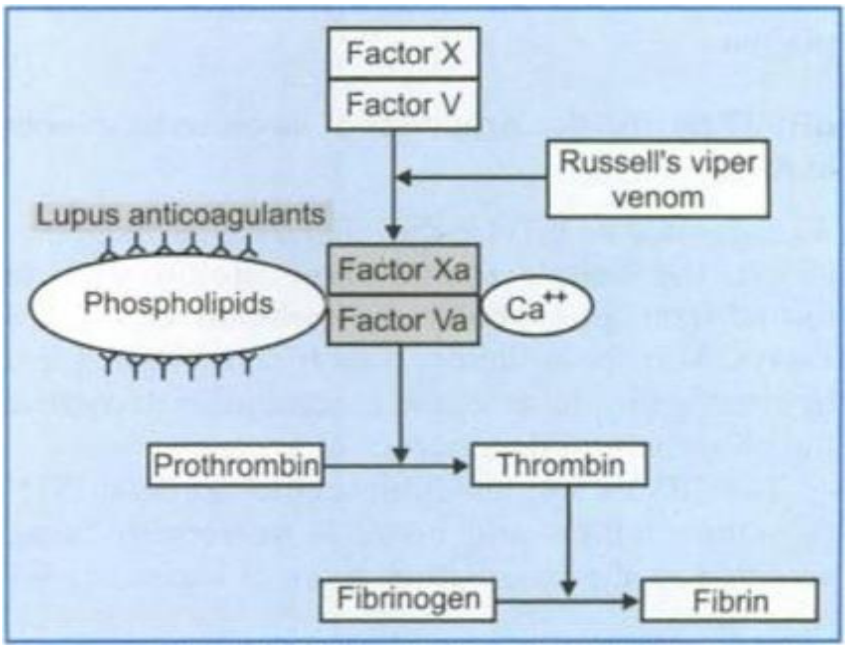


Table 2: Negative Lupus Anticoagulant Test Results

Tests	LA Interpretation
PTT-LA screen: Negative	Negative
DRVVT screen: Negative	
PTT-LA screen: Positive	Negative
PTT-LA mixing: Negative	
DRVVT screen: Negative	
PTT-LA screen: Negative	Negative (Irrespective of DRVVT mixing studies)
DRVVT screen: Positive	
DRVVT confirm: Negative	
PTT-LA screen: Positive	Negative (Irrespective of DRVVT mixing studies)

PTT-LA mixing: Negative	
DRVVT screen: Positive	
DRVVT confirm: Negative	

Table 3: Probable Positive Lupus Anticoagulant Test Results

Tests	LA Interpretation
PTT-LA screen: Positive	Probable Positive
PTT-LA mixing: Positive	
DRVVT screen: Negative	
PTT-LA screen: Positive	Probable Positive (Irrespective of DRVVT mixing studies)
PTT-LA mixing: Positive	
DRVVT screen: Positive	
DRVVT confirm: Negative	

Table 4: Positive Lupus Anticoagulant Test Results

Tests	LA Interpretation
PTT-LA screen: Negative	Positive (Irrespective of DRVVT mixing studies)
DRVVT screen: Positive	
DRVVT confirm: Positive	
PTT-LA screen: Positive	Positive (Irrespective of DRVVT mixing studies)
PTT-LA mixing: Positive or Negative	
DRVVT screen: Positive	
DRVVT confirm: Positive	

3. RESULTS

A total of 1000 patients were included in the study

Table 5: Distribution of PT, APTT and TT in the study population (N=1000)

Variables		Frequency	Percentage
PT	11 to 16 sec	801	80.1%
	>16 sec	199	19.9%
APTT	20 to 25 sec	78	7.8%
	26 to 40 sec	803	80.3%
	>40 sec	119	11.9%
TT	13 to 14 sec	25	2.5%
	15 to 19 sec	843	84.3%
	>19 sec	132	13.2%

The PT with mean (±SD) of 16.31 (±8.77) seconds and median (IQR) of 15 (14, 16) seconds. The APTT with mean (±SD) of 34.13 (±14.01) seconds and median (IQR) of 31 (28, 35) seconds. The TT with mean (±SD) of 21.94 (±30.50) seconds and median (IQR) of 16 (16, 18) seconds.

Table 6: Distribution of ACL and β2 glycoprotein in study population (N=1000)

Variables		Frequency	Percentage
ACL-IgM	Positive	219	21.9%
	Negative	580	58.0%
	ND	201	20.1%
ACL-IgG	Positive	90	9.0%
	Negative	702	70.2%
	ND	208	20.8%
B2 Glycoprotein-IgM	Positive	21	2.1%
	Negative	603	60.3%
	ND	376	37.6%
B2 Glycoprotein-IgG	Positive	3	0.3%
	Negative	620	62.0%
	ND	377	37.7%

Majority of cases were negative for both tests . Among positive tests majority were positive for ACL-IgM

Table 7: PTT-LA screening test in the study population (N=1000)

PTT-LA screening	Frequency	Percentage
Positive	457	45.7%
Negative	543	54.3%

In PTT-LA screening test, negative samples were slightly more than positive

Table 8: DRVVT screening test in the study population (N=1000)

DRVVT screening	Frequency	Percentage
Positive	569	56.9%
Negative	431	43.1%

In DRVVT screening test, positive samples were slightly more than negative

Table 9: PTT-LA mix test in the study population (N=457)

PTT-LA mix	Frequency	Percentage
Positive	319	69.8%
Negative	113	24.7%
ND	25	5.5%

Among 457 samples which were positive in PTT-LA screening test,majority were positive for mixing studies

Table 10: DRVVT mix test in the study population (N=569)

DRVVT mix	Frequency	Percentage
Positive	328	57.6%
Negative	226	39.7%
ND	15	2.6%

Among 569 samples which were positive in DRVVT screening test, majority were positive for mixing studies

Table 11 : DRVVT confirm test results according to DRVVT mixing studies results

DRVVT mix	DRVVT confirm test		P-value
	Positive	Negative	
Positive (n=328)	234(71.3%)	94(28.7%)	**<0.001**
Negative (n=226)	95(42.0%)	131(58.0%)	
ND (n=15)	6(40.0%)	9(60.0%)	

Among 328 cases with positive DRVVT mix test, 71.3% were positive in DRVVT confirmatory test whereas among 226 cases with negative DRVVT mix test, 42% were positive in DRVVT confirmatory test. There was statistically significant difference in proportion of DRVVT confirm result according to the mixing studies(P<0.001)

Table 12: End result in the study population (N=1000)

End result	Frequency	Percentage
Positive	335	33.5%
Negative	585	58.5%
Probable positive	80	8.0%

Among 1000 patients, Majority of samples were negative for lupus anticoagulant test

Table 13: End result according to ACL and β2 glycoprotein-IgG

Variables		End result			P-value
		Positive	Negative	Probable positive	
ACL-IgM	Positive (n=219)	93(42.5%)	109(49.8%)	17(7.8%)	**0.014**
	Negative (n=580)	186(32.1%)	345(59.5%)	49(8.4%)	
	ND (n=201)	56(27.9%)	131(65.2%)	14(7%)	
ACL-IgG	Positive (n=90)	47(52.2%)	37(41.1%)	6(6.7%)	**0.002**
	Negative (n=702)	228(32.5%)	415(59.1%)	59(8.4%)	
	ND (n=208)	60(28.8%)	133(63.9%)	15(7.2%)	
β2 Glycoprotein-IgM	Positive (n=21)	18(85.7%)	2(9.5%)	1(4.8%)	**<0.001**
	Negative (n=603)	208(34.5%)	345(57.2%)	50(8.3%)	
	ND (n=376)	109(29%)	238(63.3%)	29(7.7%)	

β2 Glycoprotein-IgG	Positive (n=3)	3(100%)	0(0%)	0(0%)	**0.021**
	Negative (n=620)	223(36%)	347(56%)	50(8.1%)	
	ND (n=377)	109(28.9%)	238(63.1%)	30(8%)	

There was statistically significant difference in proportion of end result according to ACL-IgM and β2 Glycoprotein- test ($p<0.05$).

Table 14: End result according to PT-LLA screening and DRVVT screening test

Variables		**End result**			**P-value**
		Positive	**Negative**	**Probable positive**	
PTT-LA screening	Positive (n=457)	237(51.9%)	140(30.6%)	80(17.5%)	**<0.001**
	Negative (n=543)	98(18.0%)	445(82.0%)	0(0.0%)	
DRVVT screening	Positive (n=569)	335(58.9%)	193(33.9%)	41(7.2%)	**<0.001**
	Negative (n=431)	0(0.0%)	392(91.0%)	39(9.0%)	

Among 457 PTT-LA screening positive cases, 18% were found probable positive in the end result. Among 569 DRVVT screening positive cases, 58.9% were found positive in the end result

Table 15: Accuracy, sensitivity, specificity, PPV and NPV of DRVVT screening test in predicting end result

Parameter	**Estimate [95% CI]**
Accuracy	79.0[76.3,81.6]
Sensitivity	100.0[98.9,100.0]
Specificity	67.0[63.0,70.8]
PPV	63.5[59.3,67.6]
NPV	100.0[99.1,100.0]

Note: Probable positive cases are excluded

The area under ROC curve of DRVVT screening test in predicting end result was 0.8176.

Figure 1: ROC curve in assessing predictive accuracy of DRVVT screening in predicting end result

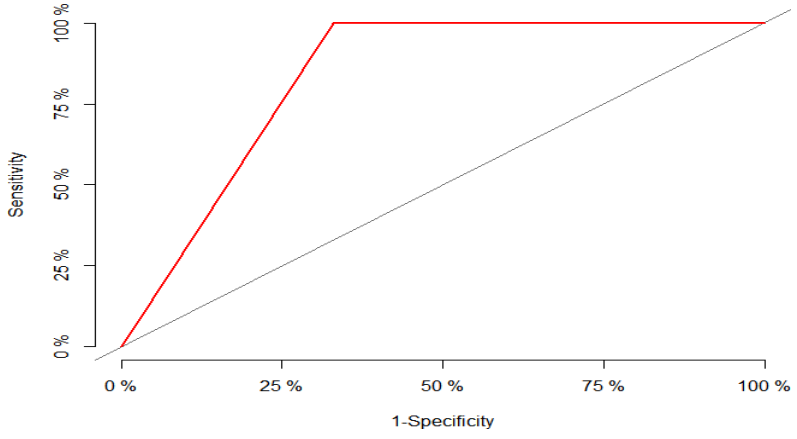
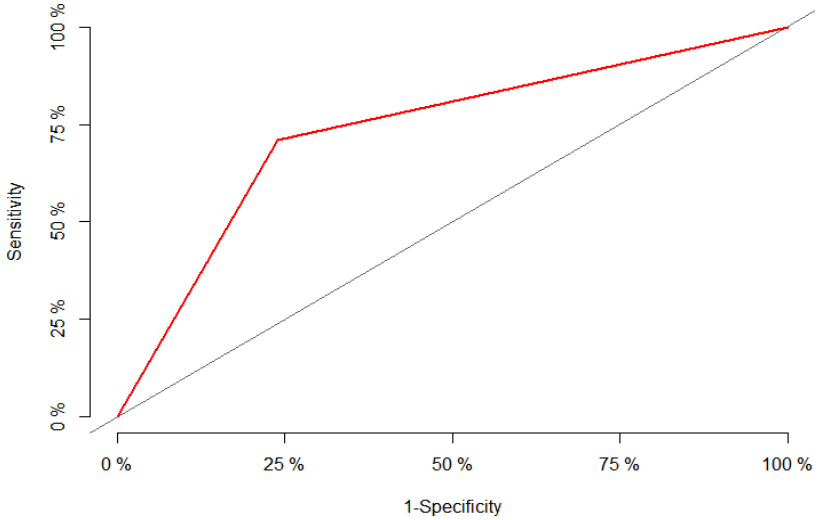


Table 16: Accuracy, sensitivity, specificity, PPV and NPV of PTT-LA screening test in predicting end result

Parameter	Estimate [95% CI]
Accuracy	74.2[71.2,77.0]
Sensitivity	70.8[65.7,75.6]
Specificity	76.1[72.4,79.5]
PPV	63.0[57.9,67.8]
NPV	82.0[78.5,85.1]

The area under ROC curve of PTT-LA screening test in predicting end result was 0.7246.

Figure 2: ROC curve in assessing predictive accuracy of PTT-LA screening in predicting end result



4. DISCUSSION

When examining patients with thrombotic diseases and/or repeated spontaneous abortions, the ability of a laboratory to detect the presence of a lupus anticoagulant (LA) is critical. Antiphospholipid antibody testing is commonly ordered by clinicians as part of a thrombophilia panel, either alone or in combination with additional tests. Antiphospholipid antibodies (APLAs) include LA, anticardiolipin antibodies (ACLs), and anti-2-glycoprotein antibodies I (aβ2GPI) [12]. These antibodies, when accompanied by clinical symptoms, are a key component of the antiphospholipid syndrome (APS) diagnosis [13]. However, APLAs can also be detected in healthy individuals or in those with conditions that do not present with clinical signs of APS. Consequently, the pathophysiology of thrombotic symptoms in LA-positive individuals remains unclear, and the clinical significance of APLA positivity is still not fully understood.

To detect LA, tests such as the dilute Russell's viper venom time (DRVVT) and the STACLOT LA assay, which is based on the activated partial thromboplastin time (APTT), are commonly used. Both of these tests require expensive equipment and reagents, whereas a less costly APTT approach is widely used in many hospitals [14]. The present study aimed to compare the performance of the Partial Thromboplastin Time-Lupus Anticoagulant (PTT-LA) and DRVVT in detecting lupus anticoagulant.

The study included 1,000 subjects, primarily aged between 21 and 50 years, with a majority being female. This demographic is consistent with similar studies; for example, Kempers et al. [15] studied 2,139 subjects with a mean age of 39.6 ± 18.1 years and found a female predominance (75%). Aljabry et al. [16] reported a median age of 46 years and a female predominance in their study of 274 subjects, while V. Pengo et al. [17] found a mean age of 46.1 ± 16.2 years with similar gender distribution in their 302-subject study. These findings align with the demographic characteristics observed in the present study.

In our study, systemic lupus erythematosus (SLE) was the most common condition, followed by early pregnancy loss and venous thrombosis. Kempers et al. [15] found autoimmune disorders in 21.8% of their subjects, with preeclampsia/HELLP at 20%, recurrent pregnancy loss at 14.5%, venous thrombosis at 16.4%, arterial thrombosis at 7.3%, other conditions at 14.5%, and unknown causes at 3.6%. V. Pengo et al. [17] found thromboembolism in 60% of their subjects, followed by

SLE in 19%, connective tissue disorders in 8%, and obstetric complications in 5%. Differences in clinical diagnoses may be attributed to geographic variations and sample sizes.

Diagnostic accuracy in detecting LAs is crucial in vascular medicine, as their presence is a key step in diagnosing APS, especially in patients with venous or arterial thromboembolism on two occasions within a 12-week period. Despite advancements in laboratory medicine, the effectiveness of LA tests remains limited due to pre-analytical and analytical variables, such as reagent characteristics and clot detection principles. Furthermore, variability in anti-lupus antibodies and their interactions with phospholipid-associated proteins means that no single LA test can detect all forms. Therefore, it is recommended that at least two tests be performed using separate criteria to confirm the presence of LAs [18]. Our laboratory evaluated two testing methods: DRVVT and PTT-LA.

The DRVVT test identified 57.6% of subjects as positive. Tay Z et al. [19] found a 67% positivity rate (70 out of 104) using DRVVT. In our study, only 18% of PTT-LA screening positive cases were confirmed as probable positives, while 58.9% of DRVVT positive cases were confirmed. These findings suggest that DRVVT is more efficient than PTT-LA in detecting positive cases and distinguishing them from normal samples. The accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for the DRVVT test were 79%, 100%, 67%, 63.5%, and 100%, respectively. Ferreira et al. [18] reported DRVVT sensitivity of 69.9%, specificity of 80.6%, PPV of 42.6%, and NPV of 92.8%, with a cutoff limit of 1.16. Ratzinger et al. [20] found sensitivity, specificity, and PPV of 67.8%, 76.3%, and 85%, respectively, with a cutoff of 0.77. Although these results are comparable, Ferreira et al.'s higher cutoff limit might be due to the inclusion of patients on anticoagulant therapy, which was excluded in our study.

For PTT-LA, the accuracy, sensitivity, specificity, PPV, and NPV were 74.2%, 70.8%, 76.1%, 63%, and 82%, respectively. Ratzinger et al. [20] reported sensitivity of 73.5%, specificity of 82.4%, PPV of 84.2%, NPV of 71%, and a cutoff of 0.84. The effectiveness of these tests in screening versus confirmation is debated. Research suggests that sensitivity is more critical in LA screening to minimize false negatives, but high sensitivity may lead to false positives. Therefore, confirmatory tests with high specificity are necessary to confirm LA presence accurately [18, 19].

Mixing studies revealed a statistically significant difference in the proportion of DRVVT confirmatory results ($P < 0.001$). Zhang et al. [21] indicated that abnormal DRVVT results on neat plasma were tested further with a DRVVT mixing study, considering DRVVT positive only if the normalized ratio (NR) was more than 1.0. Kaczor et al. [22] found that StaclotLA was positive in 7 of 9 samples negative by DRVVT after mixing, suggesting false-negative results with DRVVT. Routine mixing studies may sometimes mask weak inhibitors, leading to false-negative results.

Our study found statistically significant differences in the proportion of positive results based on gender ($P < 0.05$), but no significant difference by age group ($P > 0.05$). Tay Za et al. [19] found a mean age of 38 ± 16 years for DRVVT-positive cases, with male predominance, while other studies suggest increased LA positivity in older females. Recent studies reveal ambiguity in LA positivity due to varying methodologies across different regions.

Among patients with SLE, 37.6% were positive for LA, and 6% were probable positives. Matsuura et al. [23] found LA in 29.8% of SLE outpatients using KCT and DRVVT methods. Statistically significant differences were noted in the proportion of end results related to SLE, autoimmune hemolytic anemia (AIHA), late pregnancy loss, and arterial thrombosis ($P < 0.05$). Epidemiological research typically includes cases meeting all four laboratory diagnostic criteria for LA, but inconsistent results in tests (screening, mixing, and phospholipid neutralization assays) often lead to "indeterminate LA" cases. The therapeutic implications of such results remain unclear [24].

Despite strong associations between LA activities and IgG-ACL levels, many LA-positive samples were ACL-negative, suggesting other variables contribute to LA activity. Conversely, numerous LA-negative samples had positive ACLs, indicating ACL with minimal or no LA activity. Bas De Laat et al. [25] noted that only a subset of anti-2-GPI antibodies exhibited LA activity. Additionally, Soulier and Boffa's 1980 study linked LA to recurrent pregnancy loss, with subsequent research validating this association with second-trimester pregnancy loss, fetal growth restriction, and severe preeclampsia [26]. However, there is no consensus on which autoantibody profiles predict outcomes in APL-associated pregnancies [27, 28]. A recent analysis argued that triple positivity (LAC, ACL, and anti-2GP-I) is the best predictor [27, 29], while a Saudi Arabian study advocated for broadly defined LA [28].

5. CONCLUSION

The present study included 1000 subjects for the final analysis. The mean age of the study population was 32.20 ±10.94 years, and majority of them were aged between 21-50 and females .

The clinical diagnosis found majority of the participants to have SLE followed by early pregnancy loss , Venous thrombosis and others.Among them there was statistically significant difference in proportion of end result according to SLE, AIHA, late pregnancy loss and artery thrombosis ($p<0.05$).

In the present study among the distribution 21.9% of the patients showed ACL-IgM positive, 9% were ACL-IgG positive, B2 glycoprotein positive less cases. DRVVT mixing test were to be done to those which were positive in DRVVT

screening test. Among those 57.6% were found DRVVT mix test positive. Among PTT-LA screening positive cases, 18% were found mixing studies positive, which were interpreted as LA test probable positive .

Among DRVVT mixing positive cases 71.3% cases were positive for DRVVT confirm test.Among DRVVT mixing negative tests 58% cases were for DRVVT confirm test.There was statistically significant difference in proportion of DRVVT confirm result according to the mixing studies($P<0.001$). Among DRVVT screening positive cases, 58.9% were found positive in the end result. Hence these results found DRVTT to have a better efficiency over PTT-LA in detecting positive cases and differentiating positive cases from the normal samples.

The accuracy, sensitivity, specificity, PPV and NPV of DRVVT screening test in predicting end result was 79%, 100%, 67%, 63.5% and 100% respectively. The area under ROC curve of DRVVT screening test in predicting end result was 0.8176.

In PTT-LA screening test, 45.7% of the patients were found positive. Among those 69.8% were found PTT-LA mix test positive. The accuracy, sensitivity, specificity, PPV and NPV of PTT-LA screening test in predicting end result was 74.2%, 70.8%, 76.1%, 63% and 82% respectively. The area under ROC curve of PTT-LA screening test in predicting end result was 0.7246.

Ethical Clearance :

Ethical Clearance Certificate was obtained from the Institutional Ethics Committee(IEC) prior to commencement of study

Conflict of Interest : Nil - No conflict of interest

Source of funding : Self

REFERENCES

[1] Merrill JT, Erkan D. Antiphospholipid Syndrome. N Engl J Med. 2016;375(21):1927-1938.

[2] Ruiz-Irastorza G, Crowther M, Branch W, et al. Antiphospholipid syndrome. Lancet. 2010;376(9751):1498-1509.

[3] Devreese KMJ, de Groot PG, de Laat B, et al. Guidance from the SSC of the ISTH for diagnosing antiphospholipid syndrome. Thromb Haemost. 2018;118(6):1127-1134.

[4] Pengo V, Biasiolo A, Pegoraro C, et al. Laboratory testing for lupus anticoagulants: a review of the literature. Clin Chem. 2007;53(9):1629-1635.

[5] Moore GW. Recent guidelines and recommendations for laboratory detection of lupus anticoagulants. Semin Thromb Hemost. 2014;40(2):163-171.

[6] Triplett DA. Current issues in lupus anticoagulant testing. Clin Chem. 1995;41(1):87-90.

[7] Tebo AE, Jaskowski TD, Hill HR. Diagnostic performance of phosphatidylserine-dependent antiprothrombin antibodies for the diagnosis of antiphospholipid syndrome. Am J Clin Pathol. 2008;129(4):676-682.

[8] Tripodi A, Chantarangkul V, Clerici M, et al. Laboratory control of oral anticoagulant therapy. Haematologica. 1999;84(1):12-20.

[9] Giannakopoulos B, Krilis SA. How I treat the antiphospholipid syndrome. Blood. 2009;114(10):2020-2030.

[10] Khamashta MA, Cuadrado MJ, Mujic F, et al. The management of thrombosis in the antiphospholipid-antibody syndrome. N Engl J Med. 1995;332(15):993-997.

[11] Devreese KMJ. Standardization of lupus anticoagulant testing: A challenge. Clin Chem. 2014;60(1):63-71.

[12] Gebhart J, Posch F, Koder S, Perkmann T, Quehenberger P, Zoghlami C, et al. Increased mortality in patients with the lupus anticoagulant: The vienna lupus anticoagulant and thrombosis study (LATS). Blood. 2015;125(22):3477-3483.

[13] Miyakis S, Lockshin MD, Atsumi T, Branch DW, Brey RL, Cervera R, et al. International consensus statement on an update of the classification criteria for definite antiphospholipid syndrome (APS). J Thromb Haemost. 2006;4(2):295–306.

[14] Brandt JT, Triplett DA, Alving B, Scharrer I. Criteria for the diagnosis of lupus anticoagulants: an update. Thromb Haemost. 1995;74(10):1185–90.

[15] Kempers EK, Dalm VASH, van Rijn MJE, Mulders AGMGJ, Leebeek FWG, de Maat MPM, et al. Indication and outcome of lupus anticoagulant and antiphospholipid antibodies testing in routine clinical practice. Rheumatol Adv Pract [Internet]. 2021 Nov27;5(3).

[16] Aljabry MS. Current practices for lupus anticoagulant testing at a tertiary care hospital and impact on laboratory resources. Ann Saudi Med [Internet]. 2015;35(5):383–6.

[17] Pengo V, Biasiolo A, Gresele P, Marongiu F, Erba N, Veschi F, et al. on behalf of participating centers of

Italian Federation of Thrombosis Centers (FCSA). Survey on lupus anticoagulant diagnosis by central evaluation of positive plasma samples. J Thromb Haemost. 2007;5:925–930.

[18] Ferreira DS, Comar SR. Evaluation of mixing tests and the index of circulating anticoagulant in detecting lupus anticoagulants. J Bras Patol e Med Lab. 2021;57.

[19] Tay Za K, Jayaranee S, Shanmugam H. Practice and performance of lupus anticoagulant tests: A single centre experience. Malays J Pathol. 2020;42(1):51-57.

[20] Ratzinger F, Panic T, Haslacher H, Perkmann T, Schmetterer KG, Belik S, et al. Testing lupus anticoagulants in a real-life scenario-a retrospective cohort study. Biochem medica. 2017;27(3):522–34.

[21] Ling Zhang, MD, Janine G. Whitis, MT(HEW), H(ASCP), Mary B. Embry, MT(AMT), Sandra C. Hollensead, MD, A Simplified Algorithm for the Laboratory Detection of Lupus Anticoagulants: Utilization of Two Automated Integrated Tests, American Journal of Clinical Pathology, Volume 124, Issue 6, December 2005, Pages 894–901.

[22] Kaczor DA, Bickford NN, Triplett DA. Evaluation of different mixing study reagents and dilution effect in lupus anticoagulant testing. Am J Clin Pathol. 1991;95:408-411

[23] Matsuura Y, Nawata Y, Miike S, Hiraguri M, Kita Y, Kurasawa K, et al. Lupus anticoagulants in patients with systemic lupus erythematosus. Ryumachi. 1996;36(1):16- 24.

[24] Alkayed K, Kottke-Marchant K. Indeterminate lupus anticoagulant results: Prevalence and clinical significance. Korean J Hematol. 2011;46(4):239-243.

[25] Bas De Laat H, Derksen RHWM, Urbanus RT, Roest M, De Groot PG. β2- glycoprotein I-dependent lupus anticoagulant highly correlates with thrombosis in the antiphospholipid syndrome. Blood. 2004;104(12):3598-3602.

[26] Ganzevoort W, Rep A, De Vries JI, Bonsel GJ, Wolf H. Relationship between thrombophilic disorders and type of severe early-onset hypertensive disorder of pregnancy. Hypertens pregnancy. 2007;26(4):433-445.

[27] Ruffatti A, Calligaro A, Hoxha A, Trevisanuto D, Ruffatti AT, Gervasi MT, et al. Laboratory and clinical features of pregnant women with antiphospholipid syndrome and neonatal outcome. Arthritis Care Res (Hoboken). 2010;62(3):302-307.

[28] Al-Mishari AAA, Gader AGMA, Al-Jabbari AW, Al-Momen AKM, El Rab MOG, Babay ZH, et al. The prevalence of lupus anticoagulant in normal pregnancy and in women with recurrent fetal loss--recommendations for laboratory testing for lupus anticoagulant. Ann Saudi Med. 2004;24(6):429-433.

[29] Ruffatti A, Tonello M, Visentin MS, Bontadi A, Hoxha A, De Carolis S, et al. Risk factors for pregnancy failure in patients with anti-phospholipid syndrome treated with conventional therapies: a multicentre, case-control study. Rheumatology (Oxford). 2011;50(9):1684-1689.