The influence of ABO blood groups and some demographic characteristics on deep vein thrombosis: hospital-based study

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INTRODUCTION

Deep Vein Thrombosis (DVT) is a major contributor to disease burden accounting for about 1 in 4 death globally.[¹] Report from Centre for Disease Control (CDC) in United State put venous-thromboembolic (VTE) related mortality between 60,000-100,000 annually, with about 5-8% of the population having at least one genetic risk for DVT.[²] A 7 year post-mortem retrospective study in Nigeria reported a VTE prevalence of less than 3%.[³]

A complex of multiple inter-relating risk factors is known to influence the occurrence of DVT. These include but not limited to the following; trauma, prolonged immobilization, surgery, cancer, obesity and certain medical conditions.[⁴] Overall, the incidence of first

ABSTRACT

Background: Deep venous thrombosis (DVT) is a disease of public health importance contributing significantly to disease burden globally. DVT like many other diseases have been associated with ABO blood groups, a major determinant of plasma von Willebrand factor (vWF) concentration, which is a procoagulant protein. Aim: To determine the influence of ABO blood groups, age and gender on patients diagnosed with DVT. Methods: Demographic characteristics (age, sex, educational level) and the ABO blood groups of the patients diagnosed with DVT over a one-year period (January to December 2015) were retrospectively reviewed. Results: There were 50 patients with Doppler ultrasound scan confirmed DVT of the lower limb of which a greater proportion, 27 (54%) were males. Majority of the subjects, 39(78%) were aged 40 years and above. Subjects with post primary education and those aged 40 years and above were significantly associated with the occurrence of DVT. (p=0.0000 in both cases). However the association of ABO blood groups and gender on the occurrence of DVT were not statistically significant. (p=0.5713 and 0.2546 respectively). Conclusion: The association of gender and ABO blood groups on the risk of occurrence of DVT was not statistically significant. However, age greater than 40 years remains a significant risk factor in the occurrence of DVT.

Key words: Deep vein thrombosis, ABO blood type, von Willebrand Factor, clotting factors, thromboembolism, obesity
time venous thrombosis is similar in both sexes.\cite{5, 6} However, when different age groups are compared, sex differences becomes quite obvious. The risk of first and recurrent venous thrombosis is higher in males than females.\cite{6}

ABO blood group have been linked to several diseases and clinical entities including peptic ulcer disease, pancreatic cancer, HIV sero-prevalence and VTE among others.\cite{7,8,9,10,11} Akhigbe et al.,\cite{10} in their study to determine the link between malaria, haemoglobin genotype and ABO blood group, reported a high prevalence of malaria parasitemia but low prevalence of severe malaria among subjects with O-blood group compared with the non-O group. Equally, Adu et al.,\cite{11} in their study reported that O-blood group was the predominant blood group among a cohort of seropositive HIV subjects. Thus, further affirming blood group O as the predominant blood group in that region.

The association between ABO and VTE was first described in the early 1960s. Since then, several other studies have demonstrated the influence of ABO blood group on haemostasis, being a major determinant of plasma von Willebrand factor (vWF) level.\cite{8,12,13} Sixty percent variation in the plasma level of vWF is genetically determined and 30% of this has been attributed to the ABO blood group.\cite{14} Indeed the non-O blood group individuals have 25-35% higher levels of vWF than blood group-O individuals in the general population.\cite{15} vWF, FVIII and fibrinogen are procoagulant proteins and studies have shown that high plasma concentration of procoagulant proteins are independent risk factors for VTE.\cite{16} In circulation, vWF is the carrier protein for FVIII and act as a critical bridge between activated platelets at the sites of vascular injury and the subendothelial structure of injured vessels.\cite{17} Also, the influence of race and ethnic differences in the plasma concentration of vWF and FVIII have been reported by some authors with blacks having a higher plasma levels of these procoagulant proteins than their caucasian counterpart.\cite{18} Furthermore, Payne et al.,\cite{19} in their study to assess the association of vWF, FVIII and fibrinogen levels and risk of VTE as well as differences in the risk by race, found that high levels of both FVIII and vWF were independent predictors of VTE risk in blacks while elevated plasma FVIII was a risk factor for VTE in caucasian.

Studies by various authors have shown that individuals with non-O blood group are more predisposed to developing DVT than group O individuals. Wautrecht et al.\cite{20} reported that the frequency of non-O blood type in patients with DVT was significantly higher than that of the healthy blood donors. Kostner et al.\cite{21} reported similar findings in addition to demonstrating that blood group-O individuals have a lower plasma concentration of both vWF and VIII compared to the non O individuals and the former may be protected to some extent from venous thrombotic events. Furthermore, some authors believes that the ABO blood typing should be considered in the evaluation of thrombophilia especially in subjects with A A\textsuperscript{1}/ A B and BB genotypes due to raised vWF antigen.\cite{22} Miller et al.,\cite{23} in their studies on the effect of ABO blood type and race on plasma vWF levels, also found that the African- Americans (Blacks) had a much higher levels of the vWF proteins than the caucasian, and thus are more potentially predisposed to VTE.

Given the increase in Doppler ultrasound scan-confirmed DVT of the lower limb in our centre, we sought to determine the influence of ABO blood groups, age, gender and educational level on the risk of occurrence of DVT among these patients. It is our belief that this study will add to the existing body of knowledge especially in our environment where there is paucity of information on this subject.

**METHODOLOGY**

**Study site**

The study was conducted in the Department of Haematology, University of Uyo Teaching Hospital a tertiary health facility in South-South region of Nigeria. The hospital provides specialized healthcare services to its indigenes as well as those of neighbouring states.

**Study design**

The study design was retrospective. Data was obtained from the case notes of all patients managed for DVT of the lower limbs confirmed by DUSS who attended the Haematology Out-Patients Clinic of UUTH over a one year period (January to December 2015) There were 50 of such patients in the period under review. A positive DUSS for DVT was made if non-
compressibility of the lumen of the veins with the suspected blood clots under gentle probe pressure was demonstrated. If no residual lumen was observed upon gentle probe pressure, the vein was considered to be fully compressible, which indicates the absence of venous thrombosis.[24]

**Data collection**

Information relating to the demography (age, gender, educational status) and the ABO blood type of the patients were obtained and recorded in a proforma designed for the study.

**Inclusion and exclusion criteria**

Only patients with Doppler-confirmed DVT of the lower limb and who had complete clinical data were included in the study.

**Ethical consideration**

Ethical approval was obtained from the Institutional Health Research Ethical Committee (IHREC) of the University of Uyo Teaching Hospital.

**Statistical analysis**

The data obtained was analysed using STATA software for windows version 10.0 and presented in simple tables. Descriptive statistics (mean and standard deviation) was calculated for continuous variables (age) while categorical variables (age groups, gender and educational level) were summarized in frequencies and proportions. One sample test of proportion using Z-test was used to determine the differences between two proportions at a level of significance of p< 0.05.

**RESULTS**

A total of 50 patients with Doppler ultrasound scan confirmed DVT of the lower extremities were reviewed. The mean age of the subjects was 52.98 ± 14.57. There were significantly more respondents 40 years and above and those with post primary education had DVT (78%, z=9.5590, p= 0.0000, and 80%, Z = 10.6066 p <0.000 respectively). There were relatively more male than female patients (54% and 46% respectively) (table 1).

Majority (52%) of the patients had non-O blood type. There was no statistical significant difference between the number of patients with DVT who had O blood type and those with DVT with non- O blood group (p= 0.5713) (table 2).

**DISCUSSION**

Studies have shown that the incidence and prevalence of VTE is age-related.[25, 26] The mean age of patients in this study was 52.98± 14.57years. This value was slightly lower than the mean age of 65 years reported by Bayer et al.[27] There was a significant association between advancing age (40 years and above) and the risk of developing DVT (p =0.0000). Several interrelated factors have been attributed to the increase risk of VTE with advancing age including; increasing immobility resulting in venous stasis, reduction in regular exercise as well as enhanced systemic activation of the blood coagulation system.[28] In the Framingham study, fibrinogen a plasma protein was found to increase significantly with advancing age from a mean value of 280mg/dL in persons aged 47-54 years to more than 300mg/dL in those aged 65-79 years.[29] Thus, an elevated plasma level of fibrinogen may be considered contributory to cardiovascular risk in elderly persons.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency (%)</th>
<th>Statistical Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;40 years</td>
<td>11 (22.0)</td>
<td>Z= 9.5590</td>
</tr>
<tr>
<td>≥40 years</td>
<td>39 (78.0)</td>
<td>p= 0.0000</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>27 (54.0)</td>
<td>Z = 1.1350</td>
</tr>
<tr>
<td>Female</td>
<td>23 (46.0)</td>
<td>p = 0.2546</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>10 (20.0)</td>
<td>Z = 10.6066</td>
</tr>
<tr>
<td>Post-secondary</td>
<td>40 (80.0)</td>
<td>p = 0.0000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blood Groups</th>
<th>Number of Subjects With DVT (%)</th>
<th>Statistical Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Group</td>
<td>24 (48.0)</td>
<td>Z=0.5661</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P=0.5713</td>
</tr>
<tr>
<td>Non O Group</td>
<td>26 (52.0)</td>
<td></td>
</tr>
<tr>
<td>Total (n)</td>
<td>50 (100.0)</td>
<td></td>
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</tbody>
</table>
Equally, the plasma level of some coagulation factors including factors V, VII, VIII and vWF have been shown to increase significantly with age.\(^{[27]}\) Furthermore, a decline in the plasma fibrinolytic protein concentration and an increase in platelet reactivity have been reported with advancing age. All these alteration favours thrombus formation.\(^{[29,30]}\)

The influence of gender on the frequency of occurrence of VTE is rather inconclusive. While some studies have reported the female gender as being a protective variable towards developing VTE, others have reported a slightly higher rate among men; yet other studies have shown no consistent differences in the incidence of VTE among men and women.\(^{[25,26]}\) The Worcester DVT study did not show any difference in the incidence of DVT between men and women.\(^{[31]}\) Also, a systematic review of published literature on various studies on VTE found no systematic differences in the incidence of VTE between sexes.\(^{[32]}\) However, a population-based study in Minnesota, reported that men had a higher age-adjusted incidence rate than women. In addition, the study also showed that the incidence of VTE was relatively higher among women than men before age 45.\(^{[33]}\) Thus, when different age groups are considered and compared, gender differences may become quite obvious and pronounced.

In this study, though there was a slight male dominance among patients with DVT, the influence of gender on the risk of DVT was not statistically significant (p=0.2546). This finding perhaps may be due to the small sample size of patients in the study.

Educational status of a person has been shown to be an important determinant of his health seeking behaviour.\(^{[34]}\) Akande et al.\(^{[35]}\) in their study reported that respondents with a higher educational status presented early to health facility than their not too educated or uneducated counterparts. In our study, most of the patients were educated up to the post-primary level and thus this may have influenced their presenting more frequent to the hospital. Therefore, the association between educational status and the risk of DVT might perhaps due to the health seeking behaviour of patients.

ABO blood group have been linked to several disease entity including VTE.\(^{[8]}\) ABO blood type exert a significant influence on haemostasis being a major determinant of plasma vWF levels.\(^{[12,13]}\) A recent study among a cohort of 100 blood donors in an African population showed that the mean plasma concentration of vWF was higher in the non-O blood group donors than the blood group O donors.\(^{[36]}\) Hence, some authors have attributed the high plasma level of vWF among persons with non-O blood type to be one of the factors responsible for the high incidence of VTE observed among these individuals.

Findings from previous studies\(^{[37,38]}\) have shown that subjects with non-O blood type have higher thrombotic events than those with O-blood type. Findings from the Hoorn study equally showed that cardiovascular mortality was 2-fold higher in the non-O blood group phenotype compared with O-blood group.

Furthermore, Morelli et al.\(^{[38]}\) reported that carriers of non-O alleles have a 2-fold increased risk of a first episode of DVT and a strong association between the non-OO genotype and the risk of thrombosis in FV Leiden carriers.

In the present study, the proportion of subjects with non-O blood type who had DVT was relatively higher than those with the O-blood type (52% vs 48% respectively). However, this difference was not statistically significant (p =0.5713). Perhaps, this observation may be due to the fact that all our patients were blacks of African descent and are predominantly of O-blood type with relatively higher plasma concentration of vWF and FVIII that potentially predisposes them to the risk of venous thrombosis.\(^{[18,19]}\) Hence, we may adduced from our findings that ABO blood group did not influence the development of DVT in these patients and may not be considered in assessing a patient for thrombophilia.

**CONCLUSION**

This study has shown that patient’s gender and the ABO blood group did not have any significant influence on the risk of development of DVT. However, the study reaffirms the age long notion that advancing age remains a significant risk that may influence the occurrence of DVT. The major limitations observed in this study were its retrospective nature and the small sample size of the patients. We hereby recommend that a large multicentre prospective study on
the influence of gender and ABO blood group on the risk of occurrence of DVT be performed in Nigeria and other countries in Sub-Saharan Africa for the purposes of validating our findings.

REFERENCES


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Conflict of Interest: None declared
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