

# ABO blood groups and risk of deep venous thromboembolism in Chinese Han population from Chaoshan region in South China

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## ABSTRACT

**الأهداف:** للتدليل على تحكم فصائل الدم ABO مع الجلطات الدموية الوريدية العميقة لدى سكان ووهان في الصين.

**الطريقة:** أجريت دراسة استيعادية بين يناير 2010 ومارس 2015 في مستشفى الأول التابع لكلية الطب في جامعة شانتو في منطقة شانتو مقاطعة غوانغدونغ في جنوب الصين. وأدرج 89 من المرضى الذين يعانون من تأكيد التشخيص من الجلطات الدموية الوريدية العميقة. تم تحديد تردد من فصائل الدم.

**النتائج:** من 89 مريضاً مع الجلطات الدموية الوريدية العميقة، كان 28 مريضاً من فصيلة الدم A 31.5%، وكان 28 فصيلة الدم B 31.5%، وكان 13 مريضاً زيارتها فصيلة الدم AB 14.6%، و 20 مريضاً فصيلة الدم O 22.5%. مقارنة مع فصيلة الدم O، وكانت نسب الأرجحية من الجلطات الدموية الوريدية العميقة AB، A، B 2.23 (95% CI, 1.27-3.91)، 2.34 (95% CI, 1.34-4.09) و 4.43 (95% CI, 2.24-8.76).

**الخلاصة:** هناك خطر أكبر للجلطات الدموية الوريدية في فصائل الدم الأخرى أكثر من مجموعة O.

**Objectives:** To demonstrate the prevalence of ABO blood groups with deep venous thromboembolism in Chinese Han population.

**Methods:** A retrospective study was conducted between January 2010 and March 2015 in The First Affiliated Hospital of Shantou University Medical College in Chaoshan District of Guangdong Province in South China. Eighty nine patients with confirmed diagnosis of deep venous thromboembolism were included. Frequency of blood groups was determined.

**Results:** Of 89 patients with deep venous thromboembolism, 28 patients had blood group A (31.5%), 28 patients had blood group B (31.5%), 13 patients had blood group AB (14.6%), and 20 patients had blood group O (22.5%). Compared with O blood type, the odds ratios of deep venous thromboembolism

for A, B and AB were 2.23 (95% CI, 1.27-3.91), 2.34 (95% CI, 1.34-4.09) and 4.43 (95% CI, 2.24-8.76).

**Conclusion:** There is a higher risk of venous thromboembolism in non-O blood groups than O group.

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Deep vein thrombosis (DVT) is a major health concern worldwide and results in significant morbidity and mortality in patients. The annual incidence of DVT is geographic and racial variable, from 48 per 100000 in metropolitan Worcester, Massachusetts<sup>1</sup> to as high as 124 per 100000 in Western France.<sup>2</sup> Unlike in Caucasians, DVT is regarded as rare in Chinese. It was reported that DVT occur approximately 17.1 per 100000 population in Hong Kong.<sup>3</sup> The common risk factors for DVT included increasing age, obesity, previous venous thromboembolism (VTE), surgery, trauma, and immobility.<sup>4</sup> Some studies have addressed the potential role of ABO blood groups in DVT. Compared with blood group O, non-O blood groups have higher risk for DVT.<sup>5-8</sup> However, the

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association between ABO blood groups and DVT vary significantly among geographic region and race. It remained unknown regarding the effect of ABO blood groups on DVT susceptibility in Chinese Han population. In this study, we aimed to demonstrate the prevalence of blood groups among the patients with DVT in Chaoshan District of Guangdong Province in South China.

**Methods.** Through a retrospective descriptive study between January 2010 and March 2015 in the First Affiliated Hospital of Shantou University Medical College in South China. One hundred and 15 patients with diagnosed DVT were included and reviewed to detect data of patients. There were 26 patients not to perform the ABO blood group detection, which were excluded. The diagnosis of DVT was carried out based on typical clinical symptoms and the ultrasonograph findings. The study was performed according to principles of Helsinki Declaration and approved by the ethics committee of Shantou University Medical College. The ABO blood groups distribution for controls was selected from the Chaoshan district data.<sup>9</sup> The prior related studies regarding ABO blood groups and

DVT were searched in medline. Data are presented as the number of patients/controls. Differences between groups were assessed by Student t-test and Chi-square tests using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 16. Odds ratio (OR) with 95% confidence intervals (CI) were reported, *p* value <0.05 was considered significant.

**Results.** Of 89 patients with DVT in this study, 49 patients (55.1%) were female and 40 patients (44.9%) were male. The frequency of ABO blood group in patients with DVT was as follows: 28 patients had blood group A (31.5%), 28 patients had blood group B (31.5%), 13 patients had blood group AB (14.6%), and 20 patients had blood group O (22.5%). Age, gender, and risk factors such as surgery, immobility, and cancer between different ABO blood group phenotype were not significant. Primary clinical characteristics and risk factors for DVT are summarized in Table 1. The differences of ABO blood group phenotype distribution between DVT patients and controls<sup>9</sup> were significant (Table 2). Compared with the O blood groups, the OR of A 2.23 (95% [CI]: 1.27-3.91), B 2.34 (95% [CI]: 1.34-4.09), AB 4.43 (95% [CI]: 2.24-8.76)

**Table 1** - Primary characteristics of patients with deep venous thromboembolism.

| Blood group            | A           | B           | AB          | O           | P-value |
|------------------------|-------------|-------------|-------------|-------------|---------|
| Total number           | 28          | 28          | 13          | 20          |         |
| Age (years, mean ± SD) | 60.93±14.84 | 52.71±17.99 | 57.31±17.80 | 59.90±17.36 | 0.290   |
| <b>Gender</b>          |             |             |             |             | 0.406   |
| Female                 | 13          | 19          | 7           | 10          |         |
| Male                   | 15          | 9           | 6           | 10          |         |
| Surgery                | 5           | 5           | 1           | 3           | 0.842   |
| Immobility             | 2           | 3           | 1           | 1           | 0.906   |
| Cancer                 | 7           | 5           | 0           | 3           | 0.258   |

**Table 2** - Blood group ABO distribution in patients with deep venous thromboembolism and health control.

| ABO Type | DVT       | Health control [9] | OR (95% CI)†     | χ <sup>2</sup> statistic | P-value              |
|----------|-----------|--------------------|------------------|--------------------------|----------------------|
| A        | 28 (31.5) | 3036 (26.5)        | 2.23 (1.27-3.91) | 20.36                    | 1.4×10 <sup>-4</sup> |
| B        | 28 (31.5) | 2893 (25.2)        | 2.34 (1.34-4.09) |                          |                      |
| AB       | 13 (14.6) | 710 (6.2)          | 4.43 (2.24-8.76) |                          |                      |
| O        | 20 (22.5) | 4837 (42.2)        |                  |                          |                      |
| Non-O    | 69 (75.5) | 6639 (57.9)        | 2.51 (1.55-4.07) | 14.04                    | 1.8×10 <sup>-4</sup> |
| O        | 20 (22.5) | 4837 (42.2)        |                  |                          |                      |

DVT - indicates Deep venous thromboembolism, CI - confidence interval, OR - odds ratio, † OR (95% CI) for A, B, AB and non-O type versus O type

and non-O group 2.51 (95% [CI]: 1.55-4.07). The result suggested that blood type O had a protective role for DVT.

**Discussion.** The DVT is a major health problem. Although risk factors for DVT have been well described, determining more risk factors including blood groups is important. The association between ABO blood groups and VTE was first reported in 1969 by Jick et al.<sup>10</sup> More and more studies have shown the relationship between ABO blood groups and DVT. However, the association between ABO blood groups and DVT were different. Some studies have showed that non-O blood groups were associated with higher incidence DVT than blood group O,<sup>5-8</sup> while in Wolpin's study the hazard ratios for DVT were similar in non-O group.<sup>11</sup> In pregnancy and the puerperium, there is also more high risk for DVT in blood groups A and AB than in blood group O.<sup>12</sup> When combined with inherited thrombophilia, cigarette smoking, factor V Leiden and prothrombin mutations, oral contraceptives in women and cancer in children, non-O blood groups had an additive effect on the risk of VTE.<sup>6,13-16</sup> Furthermore, non-O blood groups is associated with the recurrence of venous thromboembolism and residual vein obstruction after DVT.<sup>17,18</sup> However, the association of ABO-blood groups with DVT in Chinese Han population has not been addressed.

In present study, we investigated the possible connection between ABO phenotype and DVT. The study shows that the distribution of ABO blood group in patients with DVT has significant difference from the reported distribution of ABO groups in the population of Chaoshan district in South China.<sup>9</sup> There is a lower percentage of O blood type in DVT than health control.<sup>9</sup> In addition, A, B, and AB type individuals had a higher risk of DVT than O blood type, which may be helpful for identifying individuals with higher risk of DVT. The result was similar as that reported among other populations.<sup>7,8,11</sup>

The mechanisms that non-O blood groups have more high risk for DVT have not been fully elucidated. It has been reported that there were higher levels of Factor VIIIc (FVIII) and von Willebrand factor (VWF) in non-O blood group than O blood group,<sup>19</sup> which are risk factors for DVT. However whether there is a higher level of FVIII and VWF in non-O blood group in Chinese Han population still unknown. Further studies would be needed to determine the effects of levels of FVIII and VWF on DVT in Chinese Han population.

A few limitations were apparent in the present study.

First, though non-O blood groups have more higher risk for DVT than O blood groups, the population of the study is small, large sample would be needed to verify the relations between non-O blood groups and DVT. Secondly, it is a retrospective study, which made it that some risk factors were not included in the study. Lastly, owing to the geographic distribution difference of ABO blood groups and DVT, the association between non-O blood groups and DVT in Chinese Han population from Chaoshan region may be different from other regions in China.

In conclusion, the present study demonstrates that non-O blood groups have more high risk for DVT in Chinese Han population.

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## Supplements

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