

doi: 10.13241/j.cnki.pmb.2020.02.019

# ABO 血型正反定型及交叉配血实验在外科病人手术输血中应用 \*

李晨雪<sup>1</sup> 李淑萍<sup>1</sup> 李松涛<sup>1</sup> 赵艳艳<sup>1</sup> 王珍凤<sup>2</sup>

(1 首都医科大学附属北京同仁医院输血科 北京 100730; 2 首都医科大学附属北京儿童医院检验科 北京 100045)

**摘要 目的:**探讨 ABO 血型正反定型及交叉配血实验在外科手术患者输血中的应用效果及影响因素。**方法:**选取我院自 2017 年 2 月-2019 年 2 月收治的 80 例行 ABO 正反定型与交叉配血治疗的外科手术患者,记录 ABO 反定型与交叉配血不合的标本,使用 2-Me 处理被患者自身冷抗体凝集的红细胞,同时使用微柱凝胶法、凝聚胺法对血型不规则抗体以及特异性进行筛选和鉴定。分析 ABO 血型反定型不符合以及交叉配血不合的影响因素。**结果:**对正反定型完全无凝集反应的 80 例血清标本进行交叉配血实验,其中 8 例存在凝集反应,配血不合情况;导致外科手术患者输血中 ABO 血型反定型不符交叉配血不合的主要因素包括自身冷抗体、血型抗原性减弱、血型不规则抗体以及血型抗体效价减弱等。**结论:**ABO 血型正反定型及交叉配血治疗中的患者中,大部分配血一致,少数的交叉配血不合,主要与自身冷抗体、血型抗原性减弱、血型不规则抗体以及血型抗体效价减弱等因素相关。

**关键词:**ABO 血型;血型正反定型;交叉配血

中图分类号:R457 文献标识码:A 文章编号:1673-6273(2020)02-295-04

## Application of ABO Blood Group Positive and Negative Typing and Cross Matching Test in the Surgical Transfusion\*

LI Chen-xue<sup>1</sup>, LI Shu-ping<sup>1</sup>, LI Song-tao<sup>1</sup>, ZHAO Yan-yan<sup>1</sup>, WANG Zhen-feng<sup>2</sup>

(1 Department of Blood Transfusion, Beijing Tongren Hospital, Capital Medical University, Beijing, 100730, China;

2 Department of Clinical Laboratory, Beijing Children's Hospital, Capital Medical University, Beijing, 100045, China)

**ABSTRACT Objective:** To explore the application effect and influencing factors of ABO blood group positive and negative stereotypes and cross-matching blood test in blood transfusion of surgical patients. **Methods:** Eighty patients who underwent ABO positive and negative stereotypes and cross-matching treatments from February 2017 to February 2019 in our hospital. The specimens with ABO anti-type and cross-matching were recorded. Red blood cells agglutinated by the patient's own cold antibody were treated with 2-Me, and the blood group uses the microcolumn gel method and the condensed amine method were used to screen and identify blood type irregular antibodies and specificity. Analyze the influencing factors of ABO blood group inversion and cross-matching. **Results:** Eighty-eight of serum samples with no agglutination reaction in the positive and negative stereotypes were cross-matching experiments. Eight of them had agglutination reaction and mismatched blood. The main factors leading to the inconsistency of ABO blood group inversion in transfusion in urgical patients include self-cold antibodies, weaker blood group antigens, irregular blood antibodies, and weaker titer of blood group antibody. **Conclusion:** Among the patients with ABO blood group positive and negative stereotypes and cross-matching blood treatment, most of them have the same blood distribution, and a few cross-matching bloods are not combined. The reason is mainly related to factors such as self-cold antibody, weaker blood group antigenicity, blood type irregular antibody and blood type antibody titer.

**Key words:** ABO blood type; Blood type positive and negative stereotype; Cross matching

**Chinese Library Classification(CLC):** R457 **Document code:** A

**Article ID:**1673-6273(2020)02-295-04

### 前言

ABO 血型系统根据红细胞表面有无特异性抗原(凝集原)A 和 B 来划分的血液类型<sup>[1]</sup>,ABO 血型系统是人类第一个血型系统,根据凝集原 A、B 的分布把血液分为 A、B、AB、O 四型,血型实质上是不同的红细胞表面抗原<sup>[2,3]</sup>。输血是外科危重症患者最主要的干预方式之一,虽然成分输血一定程度提升了治疗

的安全性,但是也会出现溶血性输血反应、免疫抑制等不良反应,严重者还会对治疗效果以及患者的生命造成不利影响<sup>[4-6]</sup>。

血型鉴定是输血安全的基础<sup>[7]</sup>,但是在实际的检查过程中会出现 ABO 血型正反定型不符以及交叉配血不合的情况,从而对输血治疗的安全性造成影响<sup>[8,9]</sup>。本研究回顾性分析自 2017 年 2 月~2019 年 2 月外科手术患者 ABO 血型正反定型不符以及交叉配血不合的 80 例资料,分析其原因并制定相应

\* 基金项目:北京市医院管理中心“青苗”计划专项(QML20180206)

作者简介:李晨雪(1984-),女,本科,初级技师,研究方向:临床输血,电话:13811667243,E-mail:li1984chenxue1118@163.com

(收稿日期:2019-07-23 接受日期:2019-08-18)

的解决方案。

## 1 资料与方法

### 1.1 一般资料

回顾性分析自 2017 年 2 月~2019 年 2 月外科手术治疗 80 例出现 ABO 血型正反定型不符以及交叉配血不合患者临床资料,其中男性 46 例、女性 34 例,年龄在 21~76 岁间,平均(47.6±5.2)岁;烧伤外科患者 8 例、骨外科 15 例、胸心外科 21 例、泌尿外科 19 例、神经外科 17 例。纳入标准:均经 ABO、RhD 血型定型试剂卡对全体血液标本进行血型正反定型,筛选出正反定型不符的标本。初次鉴别为正反定型不符的血样标本重新采集,依据微柱凝胶卡的相关规范重复试验证实为正反定型不符<sup>[10,11]</sup>;试验经医院伦理委员会批准实施。排除标准:因技术失误、人为原因等主观因素导致的 ABO 血型正反定型不符者。

### 1.2 试剂与仪器

试验中使用的抗 A、抗 B 以及抗 A+B 等均由北京奥特姆提供;正反定型后细胞悬液由长春博德研究所提供。仪器:微柱凝胶卡+专用离心机均由达亚美(瑞士)提供;免疫微柱离心机、卡式专用离心机由贝克曼(美国)提供;免疫微柱孵育箱购买自长春博研科学仪器有限责任公司。

### 1.3 方法

**1.3.1 ABO 血型正反定型** 使用 ABO 血型正反定型、吸收放射试验、不规则抗体筛选以及唾液血型物质鉴定等多种方法,严格参照《临床检验技术操作规程》进行检验。所有的仪器、设备和试剂均严格质控。微柱凝胶卡,测定非抗凝材料。对于初次出现正反定型不符的标本需要重新采集,严格依照微柱凝胶卡的操作规范多次试验,排除因操作者主观因素导致的失误或错误。重新采集的血液样本需要再行血型物质鉴定<sup>[12,13]</sup>。

**1.3.2 盐水法交叉配血试验**<sup>[14,15]</sup> 取 2 支试管,分别标记为 "

主"、"次"字样,将受检者血清、红细胞置于 37℃ 水浴中约 10 min,然后用微柱凝胶法行交叉配血试验。ABO 正反定型、交叉配血不相符的则再行第 3 次鉴定,使用 2-Mc 处理被患者自身抗体凝集的红细胞,分别使用微柱凝胶法、凝聚胺法等对血型不规则抗体进行特异性鉴定。凝聚胺交叉配血试验:按照试剂盒说明书进行操作,分别取 2 支试管,同上标记为 "主"、"次" 字样,主侧试管加入患者血清以及供血者的红细胞悬液;次侧试管中则加入供血者的血清和患者的红细胞悬液,分别向 2 支试管中加入凝聚胺溶液、低离子强度溶液,离心处理后取上层清液,然后加入重悬液,充分振荡后观察。同时使用氯喹放散法测定被自身抗体掩盖的同类抗体。

### 1.4 检查鉴定标准

检测标准均严格依照《临床输血诊疗技术》<sup>[16]</sup>、《全国临床检验操作规程》<sup>[17]</sup>中的内容实施。

### 1.5 统计学方法

采用 SPSS19.0,计数资料用%表示,行  $\chi^2$  检验,计量资料用( $\bar{x} \pm s$ )表示,用 t 检验, $P < 0.05$  为差异有统计学意义。

## 2 结果

### 2.1 血型 ABO 血型抗体检测

经正反定型检测,红细胞为 A 型 23 例,其中检出抗 B 者 17 例,6 例未检出抗 B,抗 B 检出率为 73.91%,正反定型不相符者 1 例(4.35%)。红细胞定型为 B 型者 30 例,其中抗 A 检出率 22 例,未检出抗 A 者 7 例,检出率为 73.33%,正反定型不相符者 2 例(6.67%)。红细胞定型为 O 型者 27 例,抗 A 抗 B 同时检出率为 19 例(70.37%),仅检出 A 抗体,仅检出 B 抗体,未检出抗 A 和抗 B 者 0 例,正反定型不相符者 1 例(3.70%)。具体见表 1。

表 1 80 例血清标本 ABO 抗体检出情况

Table 1 Detection of ABO antibody in 80 cases of serum samples

| Blood type | Antibody detection mode |        | Number of detections | Detection rate of blood group antibody | Positive and negative stereotypes do not match |
|------------|-------------------------|--------|----------------------|----------------------------------------|------------------------------------------------|
|            | Anti A                  | Anti B |                      |                                        |                                                |
| A(23)      | -                       | +      | 17                   | 73.91                                  | 4.35                                           |
| B(30)      | +                       | -      | 22                   | 73.33                                  | 6.67                                           |
| O(27)      | +                       | +      | 19                   | 70.37                                  | 3.70                                           |
|            | +                       | -      | 2                    | 7.41                                   |                                                |
|            | -                       | +      | 1                    | 3.70                                   |                                                |
|            | -                       | -      | 0                    |                                        |                                                |

### 2.2 血清正反定型和反应时间的相关性分析

分别选取正反定型为 A 血清标本 20 例,正反定型为 B 型血清标本 20 例,行正反定型检测,结果显示反应时间和凝集反应标本数量呈正相关关系。实验中分别截取了反应时间为 5 min、10 min 和 15 min 时的凝集标本情况,见表 2。

### 2.3 交叉配血实验

取正反定型无凝集反应的 20 例血清标本,发现有凝集反应者 4 例,配血不合。

### 2.4 ABO 正反定型不符和交叉配血不合的因素分析

行 ABO 正反定型、抗人球蛋白试验,结果显示导致 ABO 正反定型不符和交叉配血不合的因素包括血型不规则抗体、血型抗原性减弱、自身冷抗体、自身抗体阳性等,见表 3。

## 3 讨论

输血是危重外科手术尤其是失血性休克患者主要的治疗手段,而血型匹配是输血治疗有效性和安全性的基础<sup>[18-20]</sup>。研究

表 2 正定型为 A 型、B 型的血清标本反定型检测结果

Table 2 Anti-type test results of serum samples with positive type A and B

| Blood type            | Reagent red blood cell | Agglutination reaction specimen |          |          |
|-----------------------|------------------------|---------------------------------|----------|----------|
|                       |                        | 5 min                           | 10 min   | 15 min   |
| Positive stereotype A | Bc                     | 5(25.0)                         | 9(45.0)  | 12(60.0) |
| Positive stereotype B | Ac                     | 6(30.0)                         | 11(55.0) | 12(60.0) |

表 3 ABO 血型正反定型不符与交叉配血不合的因素分析(n=4)

Table 3 Analysis of the factors inconsistent with ABO blood group positive and negative stereotypes and crossmatching (n=4)

| Factor                        | Proportion |
|-------------------------------|------------|
| Self-cold antibody            | 3(75.0)    |
| Blood type irregular antibody | 1(25.0)    |

显示输血前有少数患者存在 ABO 血型正反定型不符、交叉配血不合的情况,可对输血治疗效果产生不利的影响<sup>[21,22]</sup>。因此,在外科手术患者输血治疗前了解 ABO 血型正反定型不符以及交叉配血不合的原因对患者手术治疗和预后意义重大<sup>[23,24]</sup>。

本研究选取 80 例行外科手术联合输血治疗患者,分别使用微柱凝胶法测定 ABO 血型正反定型,同时和供血者的血液行交叉配血实验,结果显示正反定型不符且交叉配血不合的病列为 4 例。其中,红细胞定型为 A 型 23 例患者中,正反定型不符且交叉配血不合者占比为 4.35%;而红细胞定型为 B 型 30 例患者中,正反定型不符且交叉配血不合者占比为 6.67%,红细胞定型为 O 型 27 例患者中,正反定型不符且交叉配血不合者占比为 3.70%。由此可见,80 例患者中 ABO 正反定型一致的占绝大多数,正定型为 A 型、B 型的血清标本随着反应时间的延长则凝集反应标本逐渐增加。选取反定型无凝集反应的 20 例血清标本,行为主凝胶法交叉配血实验,发现有凝集反应者 4 例,配血不合。原因包括两个方面:首先自身冷抗体。健康群体冷凝激素效价 $<1:16$ ,在 0~4℃活性最高,可以和红细胞结合后形成凝集反应<sup>[25,26]</sup>。在外科手术患者、传染性疾病等病理状态下的血清中存在大量的高效价冷凝激素,可能对结果产生影响<sup>[27,28]</sup>。因此,采取自身对照实验,再结合冷抗体效价检测或者抗人球蛋白试验等进行进一步鉴定。其次,血型不规则抗体。有研究<sup>[29,30]</sup>显示血型不规则抗体的检出率在 0.3%~2%,是导致交叉配血不合的主要原因。本次实验中 1 例患者为血型规则不合。

综上所述,外科手术患者正确的 ABO 血型正反定型和交叉配血,能够确保输血的有效性和安全性,导致血型正反定型不符和交叉配血不合的因素较为复杂,其原因主要与自身冷抗体、血型抗原性减弱、血型不规则抗体以及血型抗体效价减弱等因素相关。本研究受限于样本数量较少,仅验证了自身冷抗体和血型不规则抗体两种影响因素,未来的研究需扩大样本量,分析导致血型不符以及配血不合的其他影响因素,以提升临床输血的安全性。

#### 参考文献(References)

[1] Ding QL, Chen B, Qiu F. Blood Transfusion Selection in Patients with Autoimmune Hemolytic Anemia Producing Class Antibodies [J]. Zhongguo Shi Yan Xue Ye Xue Za Zhi, 2017, 25(4): 1208-1211

[2] Tiwari AK, Aggarwal G, Dara RC. First Indian study to establish safety of immediate-spin crossmatch for red blood cell transfusion in antibody screen-negative recipients[J]. Asian J Transfus Sci, 2017, 11(1): 40-44

[3] Golassa L, Tsegaye A, Erko B, et al. High rhesus (Rh (D)) negative frequency and ethnic-group based ABO blood group distribution in Ethiopia[J]. BMC Research Notes, 2017, 10(1): 330-337

[4] Li X, Feng H, Wang Y, et al. Capture of red blood cells onto optical sensor for rapid ABO blood group typing and erythrocyte counting[J]. Sensors & Actuators B Chemical, 2018, 262: 411-417

[5] Uno S, Tanaka T, Ashiba H, et al. Sensitive typing of reverse ABO blood groups with a waveguide-mode sensor[J]. Journal of Bioscience and Bioengineering, 2018, 126(1): 131-137

[6] Hee KB, Donghwan C, Jayun C, et al. Efficacy of Uncross-Matched Type O Packed Red Blood Cell Transfusion to Traumatic Shock Patients: a Propensity Score Match Study [J]. Journal of Korean Medical Science, 2017, 32(12): 2058-2063

[7] Liu J, Zhang S, Wang Q, et al. Frequencies and ethnic distribution of ABO and RhD blood groups in China: a population-based cross-sectional study[J]. BMJ Open, 2017, 7(12): e018476

[8] Blumberg N, Heal JM, Masel D, et al. The precautionary principle and use of Group A plasma in recipients of unknown ABO blood group [J]. Transfusion, 2018, 58(3): 829-831

[9] Özen, Mehmet, Yılmaz, et al. Incomplete Antibodies May Reduce ABO Cross-match Incompatibility. A Pilot Study [J]. Turkish Journal of Haematology Official Journal of Turkish Society of Haematology, 2018, 35(1): 54-60

[10] BCKman S, Ngerman-Haasmaa, Susanne, et al. ABO and D typing and alloantibody screening in marrow samples: relevance to intraosseous blood transfusion[J]. Transfusion, 2018, 58(6): 1372-1376

[11] Makroo RN, Kakkar B, Agrawal S, et al. Retrospective analysis of forward and reverse ABO typing discrepancies among patients and blood donors in a tertiary care hospital[J]. Transfus Med, 2019, 29(2): 103-109

[12] Wu G, Duan YH. Positive Distribution Rate of Coombs Test in Patients with Clinical Anemia and Blood Transfusion and Its Effect on Clinical Blood Transfusion[J]. Zhongguo Shi Yan Xue Ye Xue Za Zhi, 2018, 26(1): 223-227

- [13] Akin S, Altundag K. Clinical Associations with ABO Blood Group and Rhesus Blood Group Status in Patients with Breast Cancer: A Nationwide Retrospective Study of 3,944 Breast Cancer Patients in Turkey[J]. Medical Science Monitor International Medical Journal of Experimental & Clinical Research, 2018, 24(7): 4698-4703
- [14] Wang Z, Dou M, Du X, et al. Influences of ABO blood group, age and gender on plasma coagulation factor VIII, fibrinogen, von Willebrand factor and ADAMTS13 levels in a Chinese population[J]. PeerJ, 2017, 5(3): e3156
- [15] He Y, Deng G, Xu D, et al. Identification of novel variant B alleles within the ABO gene[J]. Transfusion, 2018, 58(2): 539-540
- [16] Qiang F, Jian-Yu X, Min-Hui WU, et al. Identification of a Rare Ael05/B101 Subtype and Selection of Blood Transfusion Strategy[J]. Journal of Experimental Hematology, 2017, 25(5): 1528-1531
- [17] Ting X, Qiang Z, Ya-Han F, et al. Quantitative and multiplexed detection for blood typing based on quantum dot-magnetic bead assay [J]. International Journal of Nanomedicine, 2017, 12(26): 3347-3356
- [18] Jo SY, Lee JM, Kim HL, et al. Comparative Analysis of Clinical Samples Showing Weak Serum Reaction on AutoVue System Causing ABO Blood Typing Discrepancies [J]. Annals of Laboratory Medicine, 2017, 37(2): 117-123
- [19] Namikawa A, Shibuya Y, Ouchi H, et al. A case of ABO-incompatible blood transfusion treated by plasma exchange therapy and continuous hemodiafiltration[J]. Cen Case Reports, 2018, 7(1): 1-7
- [20] Zu B, You G, Fu Q, et al. Association between ABO Blood Group and Risk of Congenital Heart Disease: A 6-year large cohort study [J]. Scientific Reports, 2017, 7(12): 42804-42810
- [21] Dubinski D, Won SY, Jü rgen K, et al. The Role of ABO Blood Group in Cerebral Vasospasm, Associated Intracranial Hemorrhage, and Delayed Cerebral Ischemia in 470 Patients with Subarachnoid Hemorrhage[J]. World Neurosurgery, 2017, 97(24): 532-537
- [22] Khorshidfar M, Chegini A, Pourfathollah AA, et al. Establishing Blood Group Genotyping to Resolve ABO Discrepancies in Iran[J]. Indian Journal of Hematology and Blood Transfusion, 2018: 1-6
- [23] Makroo RN, Agrawal S, Chowdhry M. Rh and Kell Phenotype Matched Blood Versus Randomly Selected and Conventionally Cross Matched Blood on Incidence of Alloimmunization [J]. Indian Journal of Hematology & Blood Transfusion, 2017, 33(2): 1-7
- [24] Fatic N, Nikolic A, Vukmircovic M, et al. Blood groups and acute aortic dissection type III [J]. Archives of Medical Science, 2017, 3 (12): 597-600
- [25] Liu J, Zhang S, Liu M, et al. Distribution of ABO/Rh blood groups and their association with hepatitis B virus infection in 3.8 million Chinese adults: A population-based cross-sectional study [J]. Journal of Viral Hepatitis, 2017, 25(4): 12-16
- [26] Bhargale A, Pathak A, Pawar S, et al. Comparison of antibody titers using conventional tube technique versus column agglutination technique in ABO blood group incompatible renal transplant [J]. Asian Journal of Transfusion Science, 2017, 11(2): 131-134
- [27] Pan T, Sethi J, Nelsen C, et al. Detection of misfolded prion protein in blood with conformationally sensitive peptides[J]. Transfusion, 2010, 47(8): 1418-1425
- [28] Cai Y, Zhou Y, Zhenyang L I, et al. Surgical outcome of laparoscopic colectomy for colorectal cancer in obese patients: A comparative study with open colectomy[J]. Oncology Letters, 2013, 6(4): 1057-1062
- [29] Xavier FP, Silva L G DA, Regis C DM. ABO/Rh Blood Typing Method for Samples in Microscope Slides by Using Image Processing [J]. IEEE Latin America Transactions, 2018, 16(3): 885-890
- [30] Wieckhusen C, Rink G, Scharberg EA, et al. A new genetic background for the Jr (a-) blood group phenotype caused by the ABCG2\*439T allele encoding a p.Arg147Trp change[J]. Transfusion, 2017, 57(12): 3063-3064

(上接第 276 页)

- [24] Fai D, Cassano N, Vena GA. Narrow-band UVB phototherapy combined with tacrolimus ointment in vitiligo: a review of 110 patients[J]. J Eur Acad Dermatol Venereol, 2007, 21(7): 916-920
- [25] Liu CW, Huang YC. Vitiligo and autoantibodies: a systematic review and meta-analysis[J]. J Dtsch Dermatol Ges, 2018, 16(7): 845-851
- [26] Taieb A, Alomar A, Bohm M, et al. Guidelines for the management of vitiligo: the European Dermatology Forum consensus [J]. Br J Dermatol, 2013, 168(1): 5-19
- [27] Kathuria S, Khaitan BK, Ramam M, et al. Segmental vitiligo: a randomized controlled trial to evaluate efficacy and safety of 0.1% tacrolimus ointment vs 0.05% fluticasone propionate cream[J]. Indian J Dermatol Venereol Leprol, 2012, 78(1): 68-73
- [28] Bastonini E, Bellei B, Filoni A, et al. Involvement of non-melanocytic skin cells in vitiligo[J]. Exp Dermatol, 2018: Epub ahead of print
- [29] Gou D, Currimbhoy S, Pandya AG. Suction blister grafting for vitiligo: efficacy and clinical predictive factors [J]. Dermatol Surg, 2015, 41(5): 633-639
- [30] Majid I, Imran S. Ultrathin Skin Grafting in Resistant Stable Vitiligo: A Follow-up Study of 8 Years in 370 Patients [J]. Dermatol Surg, 2017, 43(2): 218-225