VoxSanguinis
The International Journal of Transfusion Medicine

International Society of Blood Transfusion

Vox Sanguinis (2016)

ORIGINAL PAPER

DOI: 10.1111/vox.12379

Predonation finger lancet punctures: a potential risk factor for interdonor pathogen transmission in the blood donor clinic

A. Greinacher & N. Lubenow*

Institut für Immunologie und Transfusionsmedizin, Universitätsmedizin, Greifswald, Germany

**Present address: Department of Immunology, Genetics and Pathology, Uppsala University, Uppsala, Sweden*

Vox Sanguinis

Background and Objectives Point-of-care testing using capillary blood from a finger prick is widely used for predonation haemoglobin testing of blood donors. It is common practice to cover the finger prick with a cotton swab and to instruct the donor to press for few minutes. The finger prick can cause blood contamination of surfaces in contact with the lanced finger, especially door handles, risking infectious disease transmission, particularly if another person touching the contaminated door handle also has a punctured fingertip.

Materials and Methods First, we investigated contamination by blood (benzidine assay) of the door handles of our blood donor clinic, taking 175 samples 3 h after opening of the donation centre (baseline). We then introduced band-aids to cover the finger prick and started an information campaign using educational flyers to sensitize blood donors and staff to this problem (period-1). Thereafter, the staff was instructed to use the non-dominant hand for blood sampling and mandated to replace any discarded band-aids immediately (period-2).

Results At baseline, 82% of the nurse room door handles showed contamination with blood. This decreased somewhat (10–40%) after period-1, but only after immediate mandatory band-aid replacement on any donor finger without a band-aid (period-2), no further blood contaminations were detected.

Conclusion Blood contamination of shared surfaces can occur after finger prick for capillary blood sampling. Application of a band-aid and use of the non-dominant hand for fingertip incision are easy to apply and effective in reducing this iatrogenic health hazard.

Received: 13 November 2015, revised 22 December 2015, accepted 22 December 2015

Key words: blood collection, blood safety, donors, donor health, predonation Hb-determination, quality management, transfusion - transmissible infections.

Introduction

Haemoglobin (Hb) determination before blood donation is implemented in most jurisdictions to exclude blood donors with a low Hb and to ensure that red blood cell concentrates (RBCs) have a sufficient Hb content [1, 2]. The gold standard for predonation Hb screening is measurement of venous whole blood obtained via venipuncture in a cell counter. This method has a high sensitivity and specificity; however, it is time-consuming and requires an additional venipuncture. Point-of-care methods are the most widely applied approach for rapid predonation Hb screening. In these methods, capillary blood is obtained after lancing a fingertip ('finger prick') for subsequent Hb determination in a measurement device [3]. Ear lobe punctures are less appropriate, as they may lead to prolonged bleeding and false high Hb values [4]. Non-invasive methods are currently entering clinical practice in donor clinics, but these methods still require retesting by invasive procedures in about 30% of donors [5].

Correspondence: Andreas Greinacher, Institut für Immunologie und Transfusionsmedizin, Sauerbruchstrasse, 17487 Greifswald, Germany
E-mail: greinach@uni-greifswald.de

The finger prick induces a wound which can cause contamination by blood, especially door handles in contact with the injured finger. Contamination of surfaces with fresh blood bears the risk of infectious disease transmission (e.g. hepatitis B), particularly if another person touching the contaminated door handle also has a fingertip puncture. In a busy clinic, short intervals between contacts of door handles and other surfaces may even facilitate transmission of less stable pathogens. Although blood donors are a preselected and generally healthy population, some of them still test positive for infectious disease markers, especially first time donors.

The blood donation service is obliged to keep the risk of adverse effects of blood donation as low as possible. Generally, the process of blood donation is considered to be safe and the risk for acquiring a blood transmissible disease during the blood donation process is considered negligible to non-existent. However, contact with fresh blood of other donors might bear the risk for pathogen transmission.

In this study, we systematically investigated blood contamination of the door handles of our blood donor clinic and found frequent contamination, which was substantially reduced by making it mandatory for blood donors to cover the finger prick wound with a band-aid.

Materials and methods

Procedure of predonation donor assessment in this study

Donors are first seen in a nurse-staffed clinic room for capillary Hb measurement. Capillary measurements are performed with a HemoCue 301 device with disposable cuvettes. The fingertip of the middle or ring finger is cleansed with an alcohol wipe and pricked with a safety lancet. The first three drops of blood are removed with a cotton wool swab and the subsequent drop used to fill a cuvette, which is then inserted into the HemoCue device.

Before the study and during the baseline period, the lanced finger tip was then covered with a cotton swab and the donor asked to press it for a few minutes on the finger to stop bleeding.

During study period 1 and study period 2, band-aids were used instead of cotton swabs to cover the finger wound.

After predonation Hb determination, the donor is assessed in a separate room by a physician, before finally entering the donation room (Fig. 1).

Determination of blood contamination

During the entire study, blood contamination of the door handles of the donor clinic rooms was determined by the benzidine assay [6]. In brief, cotton swabs moistened with saline were used to wipe the handle surface. For each door handle, a new cotton swab was used. Samples were taken 3 h after opening of the blood donation clinic, and also at the end of the day after final cleaning to obtain the baseline value for the next day. The cotton swabs were incubated (90s, room temperature) with 20 µl benzidine solution (0·05 g benzidine, 0·05 g hydrogen peroxide, 0·5 ml 80% glacial acetic acid, in saline). Cotton swabs turned blue depending on the amount of haemoglobin. Colour development was compared to a freshly prepared standard curve of diluted whole blood.

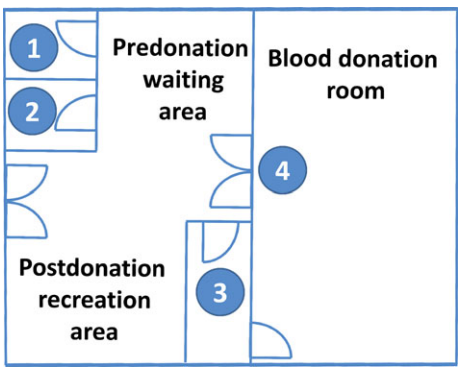

Fig. 1 Floor plan of the Greifswald donor clinic. The numbers indicate the sites tested for blood contamination in this study. 1 and 2 are the predonation rooms in which a nurse measured haemoglobin, temperature and blood pressure; 3 is the room in which each donor is seen in privacy by a physician before donation, 4 is the blood donation room.

Study design

In this prospective single centre study, we determined contamination by blood of the door handles in the donation clinic on a daily basis taking as baseline a total of 175 samples. This was done by a researcher who did not belong to the team of the donor clinic. We then started an education and intervention campaign (study period 1) to sensitize blood donors and staff for the problem of blood contamination and the risk of transmitting infectious diseases. For the blood donors, we created a poster which was posted in the waiting area, and a flyer (Fig. 2), which was attached to each questionnaire donors had to complete before donating blood. The staff was instructed to cover each finger prick with a band-aid. After the campaign started, 35 samples from door handles were taken. When still a considerable proportion of samples tested positive for blood contamination, the staff was instructed again to watch for donors who had removed their band-aid, with mandatory replacement for any blood donor not wearing a band-aid. Thereafter, blood contamination of door handles was reassessed taking 32

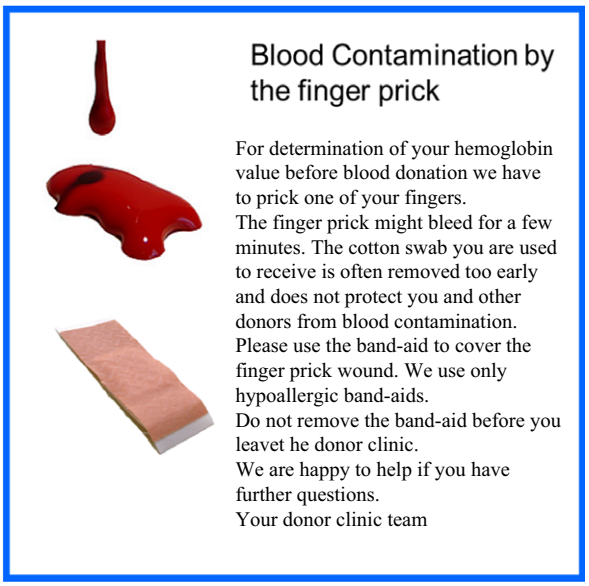

Fig. 2 Information flyer for blood donors about the risk of blood contamination and the necessity to wear a band-aid

samples (study period 2). Contamination prevalence was compared between pooled data (data from all doors combined) between pre-intervention, period 1 and period 2 by chi-square test. In a subsequent qualitative analysis, the contamination rates of the separated door handles are given descriptively.

Results

Contamination of door handles was 102 of 175 (58·3%) samples taken in the pre-intervention period; 6 of 35 (17·1%) samples taken during study period 1; and 1 of 32 (3·1%) samples taken during study period 2. The reduction in contamination rates was highly significant ($P < 0·001$). The results of contamination of the individual room door handles are summarized in Table 1. At baseline, of the two nurse-staffed clinic room door handles, one showed blood contamination in 78% of samples and the other 82% of samples taken. These frequencies decreased substantially (to 10%) after the first intervention during study period 1. Unexpectedly, during the same time period, there was no decline in contamination of the door handle of the physician room, suggesting removal of band-aids by the blood donors soon after leaving the nurse-staffed rooms. After the staff were instructed to replace band-aids immediately in any donor without a finger band-aid, and to use the donor's non-dominant hand for performing the finger prick, contamination rates decreased to non-detectable levels (study period 2).

Poststudy assessment of using urine sticks for blood contamination control

The benzidine assay is very sensitive, but benzidine is a known human carcinogen, which makes the assay unsuitable for routine monitoring. An easy to apply method is the use of urine sticks (Combur 3™, Roche, Mannheim, Germany) designed to detect small amounts of red cells in urine (Fig. 3). A cotton swab was first dipped into saline and then used to wipe the door handle surface before it was pressed on the respective field for red cell detection on the urine stick, and the colour change was observed (Fig. 3). By diluting whole blood with saline, we determined the sensitivity of the Combur 3 urine sticks to detect 0·003 µl of whole blood, at a triple plus reaction or greater (max 4 plus; Fig. 3). According to the manufacturer, the test becomes positive at a concentration of 10 red blood cells/µl. These urine sticks can be easily applied for daily monitoring of blood contamination of sensitive areas of the donor clinic.

Discussion

This study shows that blood contamination of shared surfaces can readily occur after finger prick performed for capillary blood sampling. This is especially relevant in donor clinics not using band-aids to cover the fingertip wound, as it is standard practice in many blood donor centres (personal communication of AG with blood service managers from different countries and continents)

Table 1 Swabs of door handles taken 3 h after opening of the donor clinic detecting contamination with blood

	Nurse room 1 [1] *(Hb determination)			Nurse room 2 [2]* (Hb determination)			Physician room [3]*			Blood donation room [4]* (blood donation)		
After study period	Baseline	Study period 1	Study period 2	Baseline	Study period 1	Study period 2	Baseline	Study period 1	Study period 2	Baseline	Study period 1	Study period 2
3 h after start of donor clinic	39/50 (78%)	1/10 (10%)	0/10 (0%)	41/50 (82%)	1/10 (10%)	0/10 (0%)	18/50 (36%)	4/10 (40%)	1/8 (13%)	4/25 (16%)	0/5 (0%)	0/4 (0%)

*[*numbers*] refer to the sample points for measuring blood contamination as shown in Fig. 1.

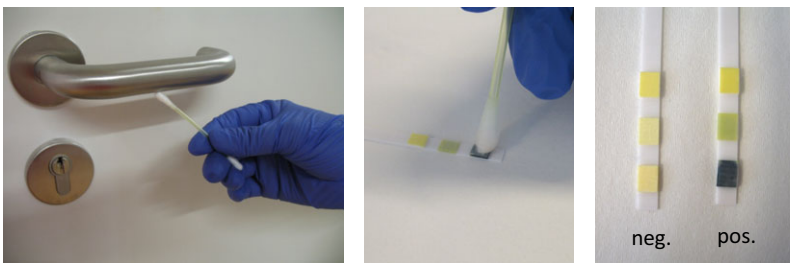

Fig. 3 Example of the use of a cotton stick and the Combur 3 urine test stick to control for potential blood contamination of shared surfaces. The surface is probed with a saline-moistened cotton stick, which is then pressed on the respective field of the urine stick and the colour change compared with a standard scale.

and had been standard practice in our blood centre before the study. Blood donors with a fresh fingertip wound might cause blood contamination, putting other donors at risk for infection and also putting the individual donor at risk, as the wounds also represent a potential invasion site for blood-borne pathogens. Door handles are critical, as the injury site on the fingertips is often in contact with the door handles (which are designed for contact with the surfaces of the fingers); moreover, contamination by blood of the lower handle surface is often difficult to see.

We are not aware of a documented case of pathogen transmission in donor clinics via blood contamination, but we are neither aware that blood contamination in donor clinics has been addressed systematically so far. As with any preventive intervention aiming at rare events, it is difficult to show efficacy using the hard end-point infection. As transmission of pathogens with blood requires blood contamination, we still consider the surrogate end-point of blood contamination of door handles used in the present study a valid marker.

We introduced several interventions: i) monitoring of blood contamination; ii) education of donors and staff using posters and flyers; iii) application of a band-aid; and iv) preferential use of the non-dominant hand for fingertip incision. All these measures are easy to apply, low-cost interventions. They were highly effective in reducing the iatrogenic health hazard of blood contamination in our donor clinic.

As with any hygienic measure, regular surveillance helps to encourage adherence. However, the benzidine method is not practicable under routine conditions as the reagents are carcinogenic. We therefore tested urine sticks, which are not toxic, cheap and widely available. The use of urine sticks as a point-of-care monitoring tool of blood contamination is an easy to apply routine quality measure, which, together with training of the staff and education of donors about the relevance of wearing a band-aid, can reduce blood contamination in the donor clinic.

Beyond transfusion medicine, point-of-care testing using lancet skin puncture of the fingertip for capillary blood sampling is increasingly used for determination of glucose, haemoglobin, INR [7], lipid status or infection monitoring, especially in outpatient settings and resource limited environments [8]. Transfusion committees of hospitals and health organizations are often in charge of reducing the risk of blood transmissible disease in hospitals. The measures suggested based on the findings of our study can reduce the risk of iatrogenic transmission of infectious diseases and may also be introduced to other outpatient clinics, in which point-of-care testing is frequently used.

Conflict of interest

None of the authors has to declare a conflict of interest.

References

1 Commission Directive 2004/33/EC of 22 March 2004 implementing Directive 2002/98/EC of the European Parliament and of the Council as regards certain technical requirements for blood and blood components. Official Journal of the European Union 2004.

2 Cable RG: Hemoglobin determination in blood donors. *Transfus Med Rev* 1995; **9**:131–144

3 Patel AJ, Wesley R, Leitman SF, *et al.*: Capillary versus venous haemoglobin determination in the assessment of healthy blood donors. *Vox Sang* 2013; **104**:317–323

4 Wood EM, Kim DM, Miller JP: Accuracy of predonation Hct sampling affects donor safety, eligibility, and deferral rates. *Transfusion* 2001; **41**:353–359

5 Sumnig A, Hron G, Westphal A, *et al.*: The impact of noninvasive, capillary, and venous hemoglobin screening on donor deferrals and the hemoglobin content of red blood cells concentrates: a prospective study. *Transfusion* 2015; doi: 10.1111/trf.13241. [Epub ahead of print]

6 Garner DC, Peimer KM, Yeshion RS, *et al.*: An evaluation of tetramethyl-

benzidine as a presumptive test for blood. *J Forensic Sci* 1976; **21**:816–821

7 Kitchen DP, Jennings I, Kitchen S, *et al.*: Bridging the gap between point-of-care testing and laboratory testing in hemostasis. *Semin Thromb Hemost* 2015; **41**:272–278

8 Williams DA, Kiiza T, Kwizera R, *et al.*: Evaluation of fingerstick cryptococcal antigen lateral flow assay in HIV-infected persons: a diagnostic accuracy study. *Clin Infect Dis* 2015; **61**:464–647