Original Article

Prospective evaluation of 2% (w/v) alcoholic chlorhexidine gluconate as an antiseptic agent for blood donor arm preparation

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Abstract:

Aim: A prospective study was undertaken to evaluate the use of 2% (w/v) alcoholic chlorhexidine gluconate (2% AlcCHG) in donor arm preparation, to monitor the contamination rate of blood products after the collection and to find incidence of transfusion associated bacteremia. **Settings and Design:** Optimal skin antisepsis of the phlebotomy site is essential to minimize the risk of contamination. Food and Drug Administration (FDA) in India has recommended antisepsis with three-step regimen of spirit-10% povidone iodine-spirit for donor arm antisepsis, but not with chlorhexidine, which is recommended by many other authors. **Material and Methods:** A total of 795 donors were studied from July 2011 to January 2012. Spirit-10% povidone iodine-spirit was used for 398 donors and 2% AlcCHG was used for 397 donors with the two-step method for arm antisepsis. Swabs were collected before and after use of antiseptic agents for all the donors. All the blood products collected from donors with growth in post-antisepsis swabs were cultured. A total of 123 various blood products were cultured irrespective of the method and result of antisepsis was observed. A total of seven patients had mild transfusion reaction. The transfused blood products, blood and urine specimen of the patients who had transfusion reaction were also cultured. **Results:** Seven donors out of 398 donors had growth in post-antisepsis swab with spirit-10% povidone iodine-spirit protocol and three donors out of 397 donors had growth in post-antisepsis swab with 2% AlcCHG protocol. All blood products collected from donors who had growth in post-antisepsis swabs when cultured had no growth. There was no contamination of blood products. **Conclusions:** Two percent (w/v) alcoholic chlorhexidine gluconate with two-step protocol can be used as an antiseptic agent for donor arm preparation without considerable cost difference. It is at par with spirit 10% povidone iodine spirit protocol as suggested by FDA in India. There was no reported transfusion associated bacteremia in the study period.

Key words:

Bacteremia, blood donor arm, chlorhexidine gluconate

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Introduction

Blood for transfusion is a potential source of infection by a variety of known and unknown transmissible agents. Over the last 20 years, reductions in the risk of viral infection have been achieved. However, approximately 57% of all transfusion transmitted infections have been associated with bacterial contamination.[1] Optimal skin antisepsis of the phlebotomy site is essential to minimize the risk of contamination. Food and Drug Administration (FDA)-India has recommended antisepsis with three-step regimen of spirit-10% povidone iodine-spirit for donor arm antisepsis.[2] US FDA- has approved use of alcoholic-chlorhexidine for donor arm preparation for donors with povidone iodine allergy.[3,4] However, it is not approved in India.

Materials and Methods

A prospective study was undertaken to evaluate the use of 2% (w/v) alcoholic chlorhexidine gluconate (2% AlcCHG) in donor arm preparation to find out the contamination rate of blood and blood products after the collection and to monitor the incidence of transfusion associated bacteremia. The study was conducted from July 2011 to January 2012 at our hospital. In Transfusion Medicine Department, the donors were screened for blood donation as per standard protocol. Informed consents were taken for blood donation.

From July' 11 to September' 11, protocol I was followed, i.e., antisepsis with spirit-10% alcoholic povidone iodine-spirit (three-step method) for donor arm preparation and from October' 11 to January' 12 for the first five donors of the day, protocol II was followed for donor arm antisepsis, i.e., antisepsis with 2% AlcCHG to be used twice. Spray bottle of 2% AlcCHG was used. In the first step, the area of venepuncture was cleaned with a cotton swab soaked in 2% of AlcCHG and allowing evaporation. In the second step, it was sprayed liberally over the area and allowed to dry. Pre-antisepsis and post-antisepsis swabs were collected for first five donors during the

entire study period. All who donated blood were included in the study. Thus, 400 donors were studied in each protocol.

The swabs were further processed in Microbiology Department. They were cultured on 5% sheep blood agar and incubated for 18-24 hours. If there was growth; the organisms were identified by their morphology and Gram's reaction. If there was growth in post-antisepsis swab, the blood products were not used for transfusion and were sent for culture.

A total of 4134 donors were bled in Transfusion Medicine Department during the study period and 12,256 components were prepared. Of these, 123 components (1% of the total components) were cultured in BacT Alert 3D, automated blood culture system (approved by USFDA for blood component culture) and were incubated for 14 days. The components included platelets, fresh frozen plasma, packed cells etc.

All the patients who received transfusion were followed-up for transfusion reaction. If any patient had a rise in temperature by one degree centigrade, the transfusion was stopped and Transfusion Medicine Department was informed along with the treating physician of the patient. For a total of seven patients who were suspected to have transfusion associated reaction, blood and urine culture were ordered. Transfused blood product/s was/were cultured as per protocol.

Cost/donor for each protocol was evaluated.

The technical officers were interviewed on the use of the antiseptic solutions.

Any allergic reactions to patients or technical staff were to be noted and treated.

Technical Information

- 10% alcoholic povidone iodine: Walkadine, Walkhardt Pvt. Ltd.
- 2% (w/v) or 10% (v/v) AlcCHG: Saniscrub E 10; Siromax India Pvt. Ltd.
- Blood collection bags: Quadruple and Triple Adsol bags; Fenwall bags.
- BacT Alert 3D: Automated Blood culture system, Biomerieux Pvt Ltd, France.

Results

A total of 795 donor's samples were incorporated in the study. A total of five donor's samples were not processed as there was a discrepancy in labeling/transportation or processing in the laboratory. A total of 398 donor's samples (pre-antisepsis and post-antisepsis swabs per donor) were studied with protocol I and 397 donor's samples were studied with protocol II. The details of growth are mentioned in Table 1. Some donors had more than one bacterial isolates. The antisepsis was achieved satisfactorily in both the protocols. There was no statistically significant difference in inhibition of growth in both the protocols ($P > 0.5$).

The blood products of all the ten donors (irrespective of protocol) who had growth in post-antisepsis swabs were cultured in BacT Alert 3D. All showed no growth indicating that blood products were sterile. However, they were discarded.

A total of 123 components (1% of total products) were randomly cultured. There was no growth in any of the components indicating no contamination of prepared blood components during the study period.

A total of seven patients had transfusion reaction during the study period. All the products used for transfusion and blood and urine culture of patients (who had transfusion reaction) showed "No Growth." All the transfusion reactions were mild. Patients were treated with anti-allergic medication and additional antibiotics were not added to the treatment. As confirmed with the treating physicians; outcome of the donor did not change significantly due to the transfusion associated reaction. Thus, there was no incidence of transfusion associated bacteremia during the study period.

The costs/donor in INR was not significantly different. Cost for protocol I (spirit-10% povidone iodine-spirit: Three-step method) was two rupees/donor and cost for protocol II was (two-step method with 2% AlcCHG) was three rupees/donor.

The opinion of nurse and technicians regarding "comfort to use" 2% alcoholic chlorhexidine two-step method was that spray bottles were easy to use, 2% AlcCHG evaporated well, did not leave any stains, it was only one solution to use and saved approximately 2 min/patient.

There was no hypersensitivity reported to chlorhexidine among donors or hospital staff.

Discussion

Contamination of blood at the time of blood collection is the major cause of bacterial contamination of blood products. A variety of strategies have evolved in recent years to decrease the transfusion associated bacteremia such as optimizing blood collection devices, use of diversion pouch, reducing recipient's exposure, improved donor screening, better skin antisepsis etc. As the majority of organisms causing bacteremia belong to normal skin flora, optimal antisepsis of donor arm may significantly reduce contamination of blood products. Recent studies exploring blood culture contamination rates of blood products have demonstrated that both the quality and mode of application of antiseptic agent can influence the efficacy of skin antisepsis.[1,4,5] Chlorhexidine is a broad spectrum antiseptic agent with persistent and cumulative actions. It is less irritant compared to other agents. "World Health Organization Guidelines on drawing blood" recommends the use of chlorhexidine as an antiseptic agent.[6] It is also recommended for pre-operative skin preparation, vascular catheter insertion and maintenance by Centers For Disease Control and Prevention (CDC) and Health Care Infection Control Practices Advisory Committee (HICPAC).[7] It has been also evaluated for umbilical stump among neonates.[8] It is also recommended by American Association of Blood Banks for donors sensitive to Iodine.[4] There are other studies mentioning superiority of alcoholic chlorhexidine for donor arm preparation.[9,10,] However, the cochrane collaboration on skin preparation for prevention of bacteremia concludes that it has remained unclear which antiseptic solution or process may reduce bacteremia due to paucity of available data.[11] Thus, in view

Table 1: Comparison of growth Characteristic among pre-antisepsis and post-antisepsis swabs in both the protocol

Samples	Protocol I (spirit-10% betadine-spirit)			Protocol II (2% W/V alcoholic chlorhexidine)		
	Total no. of patients enrolled	Pre-antisepsis swabs (%)	Post-antisepsis swabs (%)	Total no. of patients enrolled	Pre-antisepsis swabs (%)	Post-antisepsis swabs (%)
Total samples	398			397		
Samples with growth		325 (82)	7 (2)		332 (84)	3 (1)
Samples without growth		73 (18)	391 (98)		65 (16)	394 (99)
Total samples with growth		325	7		332	3
Total bacterial isolates		343	9		324	3
Microorganisms						
Gram-positive cocci		276 (80)	5 (76)		268 (83)	1 (33)
Gram-positive bacilli		64 (19)	1 (11)		53 (16)	1 (33)
Gram-negative bacilli		3 (1)	3 (33)		3 (1)	1 (33)

of this literature we had designed the study to evaluate the use 2% AlcCHG as an antiseptic agent for donor arm preparation with criteria that it should be as good as 10% povidone iodine, which is approved by FDA India. Our blood product contamination rate for year 2010 was 0.04% (unpublished data) and thus it would have required a very large study to evaluate superiority of any one product which was not feasible for practical reasons.

In our study, the antisepsis achieved in both the protocols was almost similar. Chlorhexidine gluconate has an affinity for skin and remains active for hours after application. It disrupts the bacterial cell wall and it is known to be more effective against gram positive than gram-negative organisms with the exception of sporulated bacteria.[10,12] In our results also, the inhibition of gram positive organisms appear to be better but due to small numbers the data cannot be analyzed and compared.

It was expected that if antisepsis was not achieved, the blood collected from donor could be contaminated. The products were cultured using automated blood culture system, which is a very sensitive method. However, there was no growth in any of the blood products collected from donors who had growth in post-antisepsis swabs (which may be due to contamination while collecting or transporting post-antisepsis swabs). However, it was ensured not to use these blood product for patients to avoid risk of bacteremia.

A total of 123 products were cultured and showed "No Growth". Thus, there was no bacterial contamination of blood products (rate 0%) during the study period. This may or may not have included the blood culture products from donors who had undergone antisepsis with chlorhexidine. The bacterial contamination rates are reported from 0.2% in USA, 0.1% in France, 0.15% in UK to 10-17% in Ghana.[13] As per our data (unpublished data) of year 2010, blood contamination rate was 0.04% which matched the international standard. As our blood product contamination of the study period was 0%, we conclude that there is a decrease in contamination rate of blood products.

Approximately, 16% of transfusion related deaths have been associated with bacterial contamination.[1] It has been reported that bacteria grown in the products are usually multi drug resistant bacteria and thus risk serious morbidity and mortality among transfused patients.[1,13] Thus, it is very important to identify transfusion associated bacteremia, analyze the gaps in the process and implement corrective action to prevent them. As there was no growth in any of the culture from patient and/or transfusion product, we do not report any transfusion associated bacteremia during the study period.

Since the staff found using 2% AlcCHG convenient as mentioned earlier, we expect improved compliance of staff in performing donor arm antisepsis which may help in improving outcome.

Although chlorhexidine is well tolerated, it is reported to have delayed hypersensitivity reaction when used on the skin and also anaphylaxis is reported when in contact with mucous membrane.[12] However, we did not report any skin irritation or allergy among all 400 blood donors included in the study and among technical officers and nurses.

The difference in cost of both the protocols is not significant and is affordable in a developing nation like India.

Conclusion

Two-step 2% AlcCHG protocol could reduce the bacterial load from skin as effectively and is at par with three-step method of spirit-10% povidone iodine-spirit method as recommended by India FDA for donor arm antisepsis. Two percent(w/v) alcoholic chlorhexidine can be used for donor arm antisepsis. There was no bacterial contamination of blood and body products and there was no transfusion associated bacteremia during the study period.

As the target of any Transfusion Medicine Department should be "Zero Tolerance" to transfusion associated infections, all measures to prevent bacterial contamination should be implemented, every transfusion reaction should be evaluated for transmission of bacterial infection and if so should be documented. This can help in further reducing contamination rate. Monitoring transfusion associated infections is a continuous process since a constant vigilance is a paramount to maintain a safe blood transfusion practices.

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