EVALUATION OF A TEMPERATURE INDICATOR FOR THE MONITORING OF RBC

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INTRODUCTION

Red cells in additive solution , buffy coat removed, may be stored for 42 days, if adequate storage and shipping conditions are met. According to the "Austrian guidelines for blood group serology and transfusion medicine" and th "Guide to the preparation, use and quality assurance of blood components" red blood cells (RBC's) should be stored at 2° to 6°Celsius, shipping temperatures should not exceed 10°C. Whereas it is easy to obtain data about the temperature of the storage areas like refrigerator using calibrated thermometers with or without data loggers, information about the core temperature conditions of the RBC can only be acquired by opening the blood bag or by fixing a temperature indicator on the surface of the blood bag.

The use of data loggers is especially problematic with respect of the surveillance of transport conditions. These thermometers supply information about the environmental temperature within the transport box but not about the RBC's temperature.

Previous experiments which could also be confirmed in own studies showed that RBC's core temperature reaches 10°C not earlier than 30 min when exposed to temperature of 25°C.

In this recent work we evaluated the applicability of a temperature indicator (CHECK-SPOTTM) for the detection of aberrant storage and transport temperatures of red blood cells (RBCs) with respect to the core temperature.

The indicator should provide reliable and definite information whether a single blood unit was adequately stored and transported, it's handling should be simple, and the system should only cause low additional costs for the transfusion service.

METHODS

>22.9°C

20.0-

15.0-

10.0 -

5.0-

<3.0°C

thermometer

indicator.

In a first step we evaluated the temperature of the RBC when exposed to room temperature. The surface temperature of the blood bag was determined using a thermography camera.



Horizontal (<3°C)

Core temperature was determined within

surface temperature were analysed for the

the RBC using a calibrated, electronic

The results of core temperature and

ideal positioning of the temperature

The temperature indicator is integrated in an adhesive label. The system can be activated and fixed on the surface of the blood bag using a mechanical device (SPOT-GUN™).



The second step was to determine core and surface temperature of standard RBCs using calibrated thermometers and a thermography camera. Results were compared to the reaction of the indicator.



RESULTS

The activation device was easy to handle and no electric supply was necessary. The activation had to be performed at a temperature less than 6° Celsius. If activation was successful it could be controlled visually by a second integrated indicator. The main indicator showed no reactions at blood temperatures less than 10° Celsius as it is mandatory for the storage and shipping of RBCs. When the RBC reached a 10°Celsius core temperature (according to 13° Celsius surface temperature, ambient temperature of 25° Celsius) the colour of the indicator changed irreversebly from white to red, e.g. when a RBC unit was exposed to 25° Celsius ambient temperature for appr. 30 minutes.

The time for colour change was almost linear when ambient temperature rose. 30° C ambient temperature caused irreversible colour change of the label within 9 min.



CONCLUSIONS

The temperature indicator (CHECK-SPOTTM) combined with the activator (SPOT-GUNTM) is an easy to handle, reliable and cheap (costs per label appr. $0.5 \in$) surveillance system which can be well used to monitore storage and shipping conditions of RBCs. On the other hand it is possible to use this system for evaluation of different RBC transport systems.

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