Blood Bank on Wheels : A Novel Concept

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Abstract

The concept of supplying safe and screened blood to casualties in war has been a problem over the years. Using the equipments available in a Corp Blood Supply Unit, we describe a simple modification of a vehicle for blood supply and its potential use as a mobile blood bank.

MJAFI 2008; 64 : 165-166

Key Words : Blood transfusion; Mobile Blood Bank

Introduction

Blood transfusion in war was first used in Europe in World War I [1]. The Spanish Civil War (1936-1939) proved conclusively the practicability of supplying stored blood in war for the first time [2].

In the Indian scenario, the peculiarities of terrain and weather make the supply of blood difficult. In mobile military operations, safe and tested blood should move along with the forward surgical teams. With this considerations in mind, we have modified a vehicle using the available resources. We have also proposed a novel concept for the supply of blood during mobile warfare based upon the modified vehicle.

Modification of the Vehicle

The vehicle modified is a DCM Toyota RefCon (Refrigerated Container). It has a large insulated container over the chassis with refrigeration unit at one end (Fig.1). A compression unit powers the refrigeration system, which uses diesel as the fuel and it is completely independent of the main engine. The unit can be put on and off manually using an electric switch from the driver's cabin. On the dashboard is a thermometer, which measures the temperature of the interior of the insulated box.

The interior of the vehicle resembles an empty box. To this basic structure, plywood sheets on the walls and floor of the vehicle were added. Over the plywood scaffolding were fitted steel racks, which were designed to hold the thermostabiliser boxes. The thermostabiliser boxes are mini refrigeration units which are capable of holding up to 30 units of blood (Fig.2). The boxes maintain the interior temperature based on the Peltier effect. The boxes are powered by batteries, which can

be charged using either an 220 volts AC or DC supply. When fully charged, the batteries are capable of maintaining the temperature of the interior of the box at 4°C for a period of up to 6-8 hours. However, if the external temperature is low, these boxes can maintain an interior temperature of 4°C for a longer period.

The steel racks on the interior of the vehicles can hold 12 thermostabiliser boxes (Fig.3), giving a carrying capacity of 360 units of blood. The vehicle is also fitted with plug points for each of the boxes which are centrally connected to an external 15 amp plug for connection to 220V main AC supply or a generator. Hence, when stationary, the batteries of the thermostabiliser boxes can be charged by simply connecting the external plug point to a 220 AC main supply or a generator set.

The blood is maintained at a constant temperature of 4°C within the thermostabiliser boxes. The temperature of the vehicle interior can also be maintained at 4-8 °C by judicious use of the vehicle refrigeration unit. Hence, the blood can be stored for much longer periods.

Fig. 1 : A view of the DCM Toyota RefCon vehicle.

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Received : 18.11.2005; Accepted : 11.10.2007

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Fig. 2 : A view of the Thermostabiliser box.

Fig. 3 : The scaffolding of the steel racks along one wall of the vehicle. The boxes are not fitted. Note the plug points over each rack.

In addition, the vehicle also carries a bleeding couch and a workbench to hold an ELISA reader, a centrifuge and a microscope (Fig. 4).

Proposed Concept for Blood Supply

It is proposed that when the vehicle is static, the 15 amp plug point on the exterior of the vehicle can be connected to a static 220 V AC main supply. Alternatively, if an AC supply point is not available in the vicinity, the on board generator set can be used to charge the boxes. This will ensure that the boxes are fully charged and can maintain their temperature at 4°C.

Fig. 4 : The bleeding couch of the vehicle.

When the vehicle is in motion, it is proposed that the refrigeration unit be operated to maintain the interior of the vehicle between 6-8°C using the dashboard thermometer. The maintenance of the interior of the vehicle at a low temperature will ensure that the time period of optimum storage is increased. If the on board generator and refrigeration unit cannot be operated, the batteries of the thermostabiliser boxes will themselves ensure that the blood is maintained at a constant temperature of 4°C for up to eight hours.

It is envisaged that the vehicle will move along with the Corps Field Ambulance during war. Blood can be collected from the rear areas and stored for a period of 35 days. Blood from the vehicle can be supplied to the Corps Field Ambulance and the forward surgical centres using refrigerated containers. The blood requirement can be calculated as per existing protocols.

Conclusion

The vehicle has carried blood from Mathura to Delhi (145 km) on three occasions without haemolysis. However, trials over rough terrain were not carried out. The modification costing Rs 25,000 (Rupees Twenty Five Thousand), can be potentially used for supply of safe and screened blood in war.

Conflicts of Interest

None identified

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