Stored Blood Microfiltration

Evaluation of Micro-Aggregate Filter Composed of Polyurethane Foam and Nylon Wool

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Summary. Aggregates of amorphous material which develop during storage of banked blood have been implicated as a cause of pulmonary micro-embolism in man following massive transfusion. Such pulmonary micro-embolism may be a causal factor in the development of post traumatic pulmonary insufficiency. At present several microaggregate filters for use in massive transfusion are commercially available, and one of these is the Fenwal filter. It is composed of a screen filter which removes microclots of 250 microns and higher, a layer of polyurethane foam and a layer of nylon wool. The resistance of this device is very acceptable and the filter may be used for several blood units, but its efficiency seems less than that of the Dacron wool filter.

Key words: Transfusion – Blood – Filter – SEM.

We previously reported [2, 3] the need for adequate filtration for stored whole blood transfusions. It is well established that large amounts of micro aggregates develop during storage, and when blood is administered to patients, these micro aggregates are trapped in the capillaries of the lungs, brain, retina or kidneys. Death attributed to pulmonary insufficiency after massive blood transfusion have been well documented by Moseley and Doty [5]. Reul examined the problem of pulmonary insufficiency after blood transfusion and its prevention by fine screen filtration [7—9]. Several types of devices are now commercially available: either screen or depth filters. We have previously presented reports on two types of micro filters: the first made of five layers of polyurethane foam with graded pore size [2], the second made of compressed Dacron wool [3]. We now report a third type composed of two layers of different materials: the upper layer is similar to a polyurethane foam filter and the lower layer to a wool filter. A similar experimental protocol as for the Dacron wool filter evaluation was followed.

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Material and Method

1. The Filter

We were provided with filters by Fenwal (Travenol) which markets the filter in Canada. The Fenwal microaggregate filter is inserted into a case made of rigid plastic. It has a conventional screen filter with 250 micron pore size for removing clots. In the top part of the filter there is a polyurethane foam layer (0.86 g) to trap clots of 150 micron and above while in the lower part there is a square of rolled wool (1.92 g) placed in the blue cylinder just above a nylon screen filter which should prevent the fibres being flushed away through the outlet. The inlet part of the filter is identified by the long spike and the outlet part by the shorter female adapter. Both are provided with protective caps in sterilized packages.

2. Method

As in earlier experiments, we were supplied with stored whole blood by the Canadian Red Cross at Quebec City. We used banked blood which was between 15 and 25 days old. Only group A Rh positive (87.5%) and group 0 Rh positive (12.5%) were used since these are the commonest groups. The blood had been collected into citrate phosphate dextrose (CPD) and subsequently stored at 4°C. Prior to filtration the blood units were left at room temperature for between thirty minutes and one hour, in order to reverse platelet aggregation which occurs at 4°C. We mixed the blood inside the packs by gently shaking each pack by hand for approximately 5 to 10 min. A total of 4 blood units were needed for each experiment, all of the same group, in order to avoid red cell agglutination and immune haemolysis. These units were numbered as follows: A for the first, B for the second, C for the third, D for the fourth. We removed control blood