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**AIR DROP OF ACD
WHOLE BLOOD**

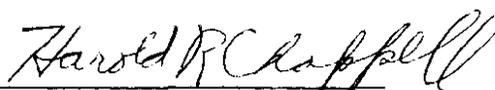
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ABSTRACT

To evaluate the effects of air drop on ACD whole blood as a relation to the plasma hemoglobin levels before and after drop. Nineteen percent of the units of blood dropped were fractured and unusable due to impact shock. Those units remaining intact showed no significant elevation in plasma hemoglobin. Present methods of packaging blood for aerial drop are inadequate. Erythrocyte breakdown due to impact forces is not significant.

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I. INTRODUCTION

The air drop of whole blood by parachute is an obvious method of rapid supply of essential items to aid stations. With the advent of the helicopter as a medical transportation tool, much of the necessity of parachute supply has been deleted. However, there are still situations in which terrain and the enemy may prevent the landing of a helicopter and the deliverance of supplies by usual routes.

Whole blood is of utmost importance in the care of wounded personnel. Because of this, it is felt that the effects of air drop on ACD whole blood should be investigated from the view of the effect of the shock of drop on the survivability of the erythrocyte. The parameter of the plasma hemoglobin prior to and after drop was considered to be able to give an adequate, direct indication of the breakdown of erythrocytes due to the impact shock.

This study was performed since there was no previous report available concerning the survivability of the blood.

II. METHODS AND MATERIALS

54 units of outdated ACD whole blood was used as the test material. This was supplied by the U. S. Naval Medical Center, Bethesda, Maryland, and Walter Reed Army Medical Center, Washington, D. C. The blood was packaged in the plastic bag manufactured by Fenwall Laboratories, Inc., Framingham, Mass. (Federal Stock No. 6515-664-2734).

The blood containers were packaged for air drop in the standard cardboard blood container, using the parachute rigging procedure set forth in TM 10-500-62 (this rigging was developed specifically for the air drop of blood). Three separate packages were made.

Previous study with the use of a simulated blood package revealed velocities at impact in the range of 30-40 ft/sec vertical and 21-33 ft/sec horizontal. This was calculated by use of photography with a fixed size object as the reference point. From this data and an estimation of the possible tactical situations, the blood packages were dropped at an altitude of 250 ft above terrain and an estimated

ground speed of 40 kts (indicated 60 kts). The carrier aircraft was a CH-34 helicopter equipped for medical rescue work.*

Plasma samples for hemoglobin determination were obtained prior to the packaging of the blood containers and immediately after the drop. The samples were allowed to sediment for 24 hrs and the free plasma then withdrawn. These samples were then centrifuged at 4000 rpm for 20 minutes to remove any remaining RBC. Sedimentation was allowed prior to centrifugation since previous work had shown that the plasma hemoglobin could be increased by high-speed centrifugation alone.

Plasma hemoglobin was determined by using o-tolidine diHCl⁽¹⁾. Other methods^(2,3,4) were investigated, however, the Beau method was found to be more applicable as to accuracy and large sample numbers. A problem did exist due to the rapid fading of the colored end product.

III RESULTS

There were 54 units of outdated ACD whole blood in the total air drop. Of this number, 19% (10 units) were found to be fractured due to impact. The two (2) packages dropped in an open field contained all the broken blood bags. That package dropped into a moderately thick wooded area showed no breakage.

The results of plasma hemoglobin determination on the surviving samples prior to and after air drops are shown in Table I.

Of the units assayed for plasma hemoglobin, 46% showed an increase in plasma hemoglobin. Of these samples, only 19% showed an increase greater than 50 mgm %. The average increase was 28.6 ± 41.1 mgm % hemoglobin.

IV DISCUSSION

The deleterious effect of hemoglobin on renal function has been well documented^(5,6). It is obvious that one would not wish to further stress a wounded individual with the transfusion of large amounts of free hemoglobin. The results obtained here indicate that the packaging of blood in plastic containers without an air-liquid interface will allow the RBC to withstand large impact forces without significant breakdown.

*Aircraft supplied by USAH(3185) Ft Rucker, Alabama

The large increases in plasma hemoglobin in certain samples is explainable due to the fact that the samples obtained after the drop in three (3) of the cases did not sediment and had to be centrifuged. Those instances in which the plasma hemoglobin is higher prior to the drop are explained by inherent error in the technique and due to local uncontrollable factors during sedimentation and centrifugation.

The packaging for air drop is inadequate. The loss of almost 20% of a delivery of whole blood is not tolerable. The altitude and airspeed used for the drop were chosen since it was felt this constituted a good approximation of a tactical situation. All parachutes deployed well. The only conclusion which can be reached is that the packaging brought forth in TM 10-500-62 for the air drop of whole blood is inadequate. There are two possible solutions: 1) the standard blood boxes are inadequate and should be changed or, 2) the rigging for air drop is inadequate and deserves revision.

V. SUMMARY AND CONCLUSIONS

1. Outdated ACD whole blood (54 units) was air dropped using the rigging described in TM 10-500-62
2. Plasma hemoglobins were determined prior to and following the air drop.
3. Of the number of units of blood dropped, 19% were fractured due to impact.
4. Plasma hemoglobin did not increase to a significant extent.
5. The rigging of whole blood for air drop is inadequate and deserves revision.

ADDENDUM: This study was performed with the USN Medical Center as a preliminary to comparison of the effect of aerial delivery of ACD whole blood and frozen, reconstituted whole blood.

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