A novel approach for fat removal while maintaining blood quality in a discontinuous autotransfusion device - concept and evaluation

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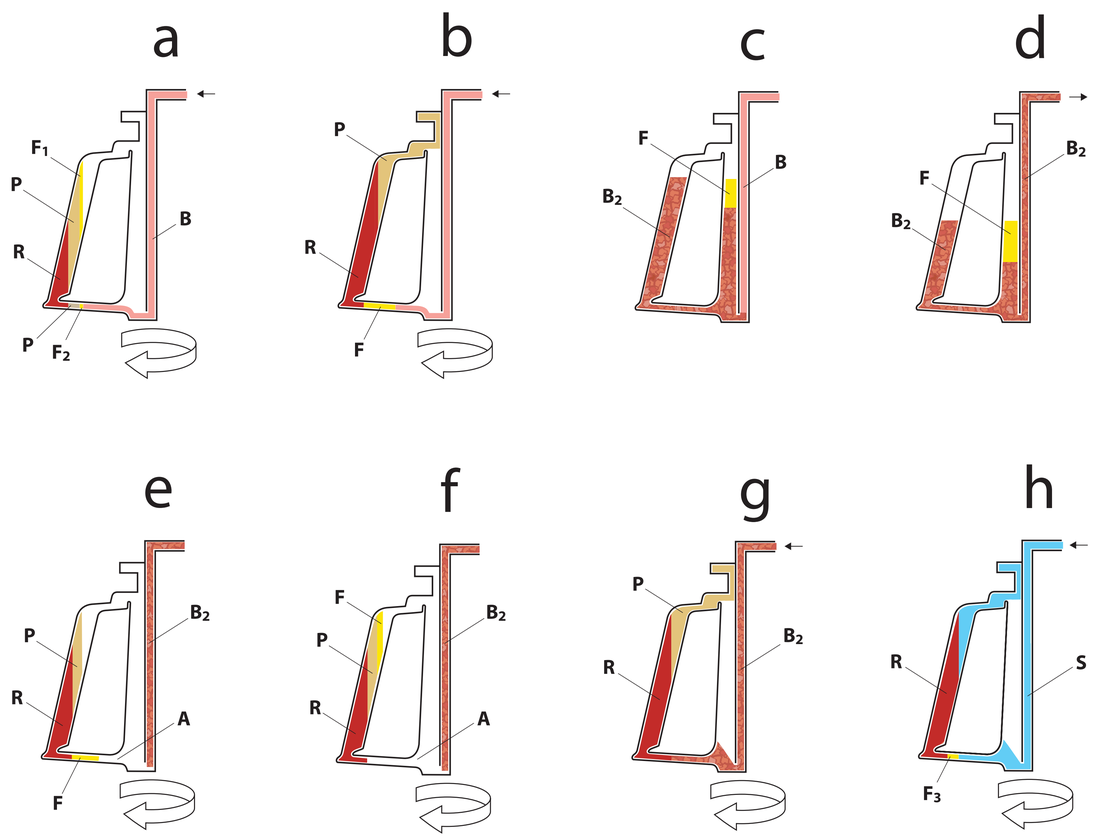
INTRODUCTION: Fat observed during blood salvage in orthopedic or cardiac surgery can pose a risk of fat embolism and brain vessel microembolism, and should be eliminated before transfusion. Due to its light density, fat is trapped in the separation chamber of both discontinuous and continuous autotransfusion systems. Latham bowl based systems have been reported to achieve significantly lower fat removal than that seen in continuous systems. Therefore, a special fat reduction program was developed and evaluated for the new generation Cell Saver Elite.

STUDY DESIGN AND METHODS: In an experimental study ABO-matched blood from fresh donations was adjusted to a hematocrit (Hct) of 10% and 1.25% fat from human fat tissue added. This blood was processed with the cell salvage device CS Elite in a newly developed fat removal program in bowls of three sizes. Volumetric quantification of fat was performed after centrifugation of blood samples in Pasteur pipettes. The program was also evaluated for Hct, RBC recovery, and constituent washouts.

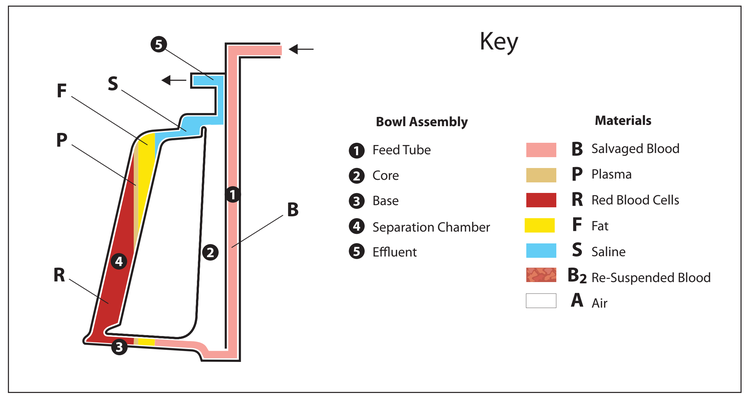
RESULTS: The tested fat reduction program is based on volume displacement, where a portion of blood is temporarily removed from the separation chamber. This displacement allows fat trapped in the core of the bowl to be displaced to the outer chamber of the bowl where it can easily be removed to the waste bag. Reducing the fluid volume in the bowl increases the air volume in the bowl which pushes fat past the packed RBC layer as bowl is re-spun. As blood is returned to the bowl and wash solution is introduced, the fat is simply pushed out to waste. Using this new program, high fat reduction rates were achieved (See Table) with all three bowls. Fat removal increased from 77.4 ±5.1% (default mode) to an average of 96.6 ±1.7%. At the same time, high RBC recovery, Hct and washouts were maintained, not significantly different than the CS Elite default program mode.

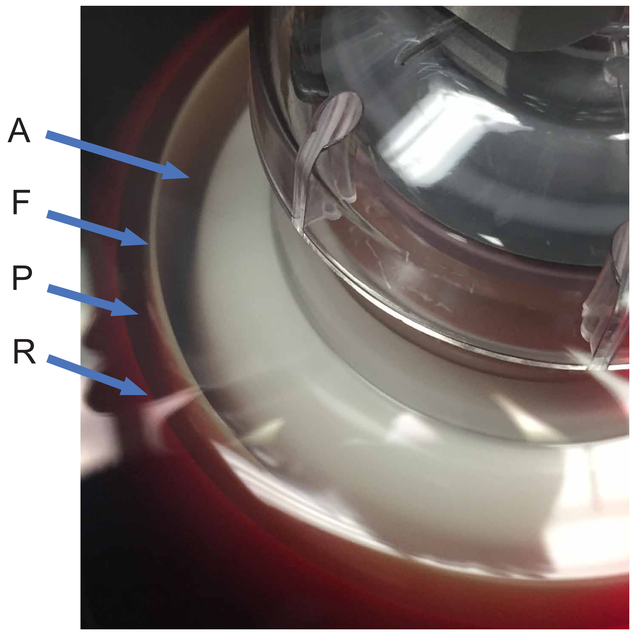
CONCLUSIONS: Based on observations using a transparent centrifugation system, a hypothesis is presented to explain the accumulation of fat in the centrifuge bowl, both in spinning and stopped configurations. Modifications in process parameters and sequence resulted in the development of a dedicated fat removal program. This novel program significantly improves fat removal by the Latham bowl based autotransfusion device CS Elite, thus yielding results equivalent to the continuous autotransfusion system (CATS).

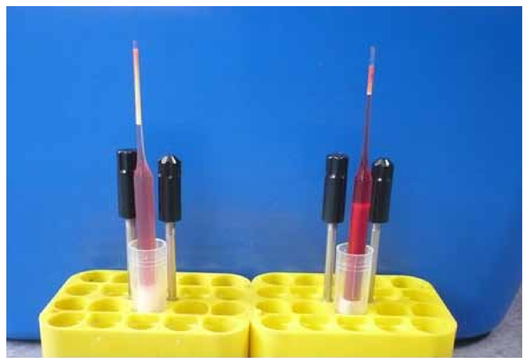
Quality parameter	Bowl size		
	225mL	125mL	70mL
Hematocrit (%)	57.0 ±2.1	51.4 ±2.6	50.5 ±0.5
RBC recovery rate (%)	94.5 ±0.8	92.1 ±1.8	90.8 ±1.3
Fat elimination rate (%)	99.6 ±0.3	97.0 ±2.1	93.2 ±2.8



Scheme of fat reduction by volume displacement







Quantification of fat in blood by centrifugation in Pasteur pipettes, reading of the fat band and calculation from nomograms