Development of Cardiopulmonary Bypass System With Ultra-Low Priming Volume For Pediatric Open Heart Surgery

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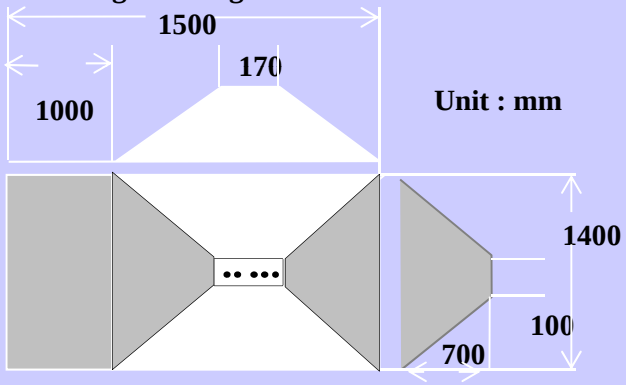
Introduction

To broaden the application of pediatric cardiopulmonary bypass without homologous blood transfusion and to reduce the initial priming volume of the system, we have developed a special barrier sheet. When used in conjunction with a Heart-Lung Machine with a separable controller and pump head, the priming volume was reduced significantly. *(Presented as a poster at the American Society of Extra-Corporeal Technology 39th Int'l Conference, Mar. 22-25, 2001, Miami Beach, FL, U.S.A.)*

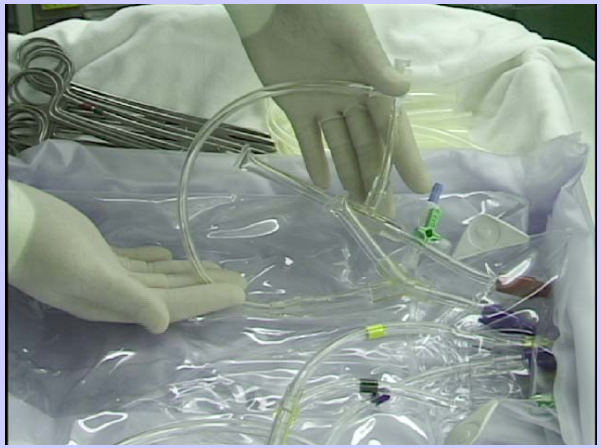
MATERIAL and METHODS

Barrier Sheet

Fig . 1 Diagram of the Barrier Sheet

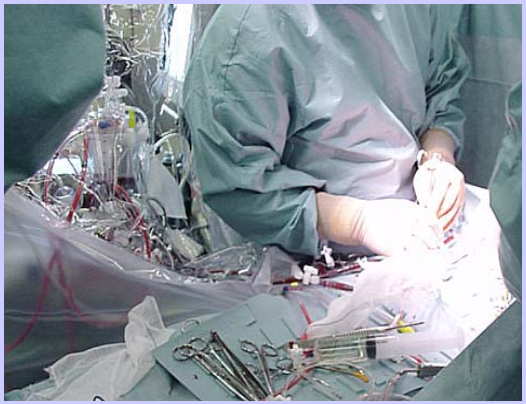


The center portion of the Barrier sheet is shaped like a pyramid to cover the heart-lung machine without compromising the sterility of the field.

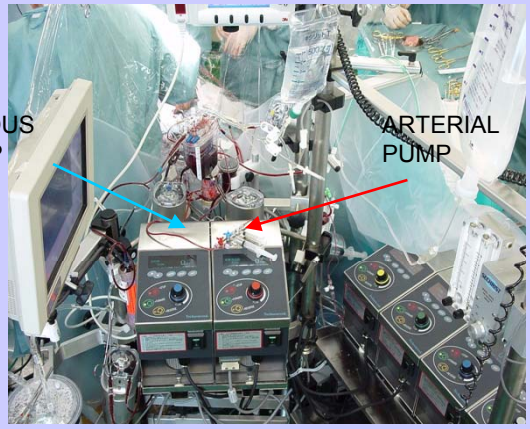


Venous, arterial, vent, and 2 suction lines are pierced through and welded at the tip of the pyramid. The arterial-venous line at the surgical field is very short (360mm).

Fig .3 View of the Surgical Field



The Barrier sheet maintains sterility even if non-sterile section gets on the patient.



The height of the system is about the same as the patient. The arterial, venous pumps and the controllers are set in front of the reservoir for easy operation. Each pump heads are separable for various layouts.

CPB system composition

Table 1 System and priming volume by body weight
(with heat exchanger system)

BW(kg)	~6.5	6.5~9	9~17
Oxygenater	Safe Micro	Menox AL2000α	
Reservoir	Safe Micro	Minimax 1316	
Arterial filter	Pall LPE-1440		
Pump head	75ΦΩ	120ΦΩ	
Circuit tube(inch)	5/32	3/16	
Pump tube(inch)	1/4	3/16	1/4
Priming volume(ml)	136*/168	190	223

*without arterial filter

Subject

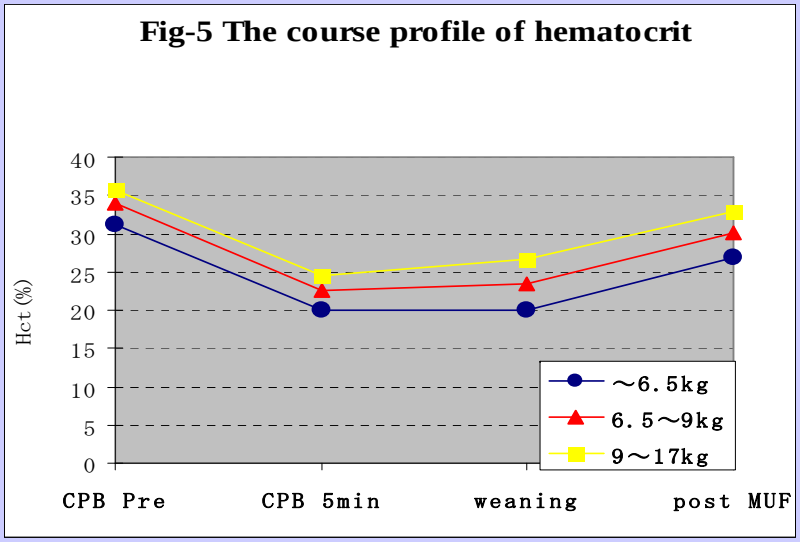
Table 2 Study patients
(with heat exchanger system)

BW(kg)	~6.5	6.5~9	9~17
N＝25	11	5	9
Mean BW (kg)	5.8±0.4	8.1±1.0	13.6±2.8
Age (months)	7.1±1.7	12.4±7.1	35.6±15.5
CPB time (min)	105±47.8	110±58.8	70±24.3

※From Dec.,1999 to Feb.,2001, we have applied CPB wihtout adding Homologous blood for 25 cases with different weights.

Results

Fig-5 The course profile of hematocrit



Conclusion

The Barrier sheet made us possible to move the Heart-Lung Machine close to the surgery field without compromising its sterility. As a result, the lengths of the tubings were shortened and the priming volume was reduced significantly. Excluding the heat exchanger for light cases was clinically useful and the priming volume was reduced even more.

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