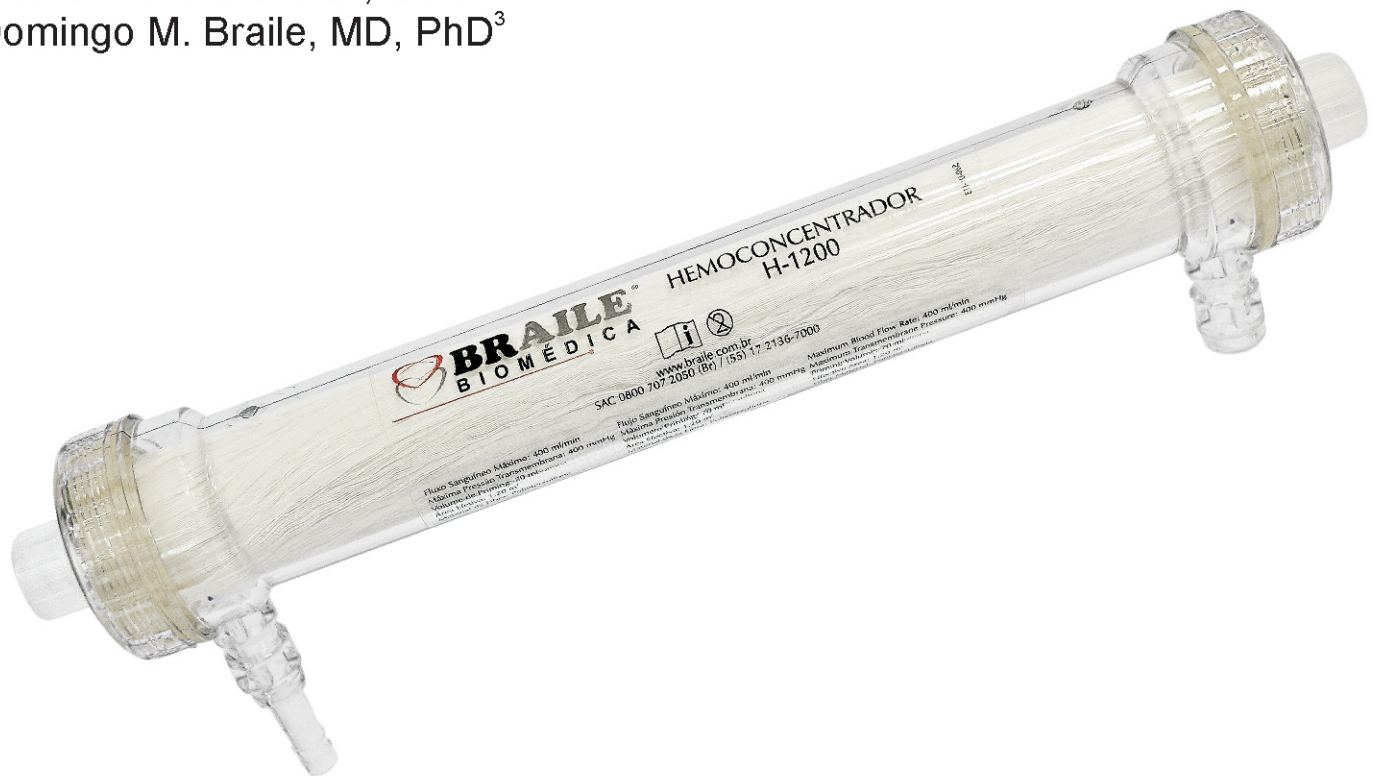


HEMOCONCENTRATOR

Glauca G. Basso Frazzato, MSc¹
Vinícius L. Semenzim, MSc²
Domingo M. Braile, MD, PhD³



¹ Physicist-Biologist
glauca.basso@braile.com.br
² Physicist-Biologist
vinicius.ladeia@braile.com.br
³ Cardiac Surgeon
domingo@braile.com.br

Braile Biomédica Ind. Com. Repres. Ltda
São José do Rio Preto, SP, Brazil

Hemoconcentration via ultrafiltration is a relatively simple, safe and effective process of controlling hemodilution during surgical procedures with extracorporeal circulation (ECC). The method helps to reduce blood loss and blood bank use.

Hemoconcentration may be recommended for routine use in cardiac surgeries with ECC, used since the 1980s.



Filtrating polyethersulfone fiber

In 1985, Osipov *et al.*⁽¹⁾ used blood ultrafiltration to control hemodilution in 84 patients subjected to surgical procedures with ECC. The ultrafiltrate quantity varied between 750 and 6250 cc (2588 ± 221 cc mean), a quantity similar to that of the cardioplegic solution given to patients.

In 2004, Souza & Braile⁽²⁾ evaluated the filtrating polyethersulfone fiber hemoconcentration technique and the requirement of hemoderivatives transfusion in patients subjected to cardiac surgery with ECC. A total of 140 adult patients were studied, divided into two groups according the use or not of the Braile Biomédica[®] hemoconcentrator.

Group A (no hemoconcentrator) included 70 patients, and B (with hemoconcentrator) also 70 patients. In this study, the hemoconcentration technique was shown to be feasible, with no additional intra and post-surgery complications for patients. In group B, less blood and plasma were used during and after ECC, and liquid balance as well, after ECC, was lower when compared to group A. The authors concluded that the hemoconcentration technique was effective in liquid removal, enabled greater use of residual blood in the ECC circuit, and reduced the need to use hemoderivatives during and after ECC.

Torina *et al.*⁽³⁾ in 2010 evaluated. in a blind, prospective study for the anesthetics and ICU teams - the effects of ultrafiltration on pulmonary function and the need of hemotransfusion in elective patients subjected to myocardium revascularization.

The patients were divided into two groups: A (subjected to ultrafiltration, with the use of the Braile Biomédica[®] hemoconcentrator, for 15 minutes after the leaving ECC) and B (with no ultrafiltration).

Group A had less post-surgical bleeding after 48 hours, less need for red blood cell transfusion, less resistance of respiratory tracts, and lower complacency, when compared to group B. With these results, the authors concluded that ultrafiltration use reduced post-operational bleeding and need for transfusion, with no differences in the final clinical result and without association with hemodynamic instability.

Blood ultrafiltration with max efficiency

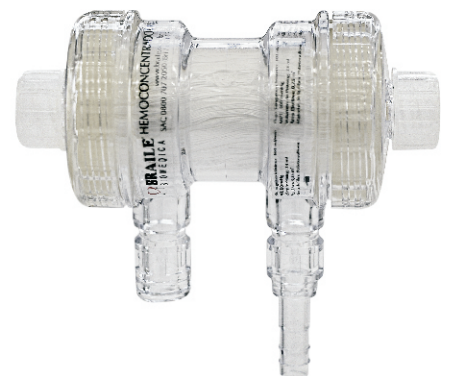
H-1200



H-250



H-250

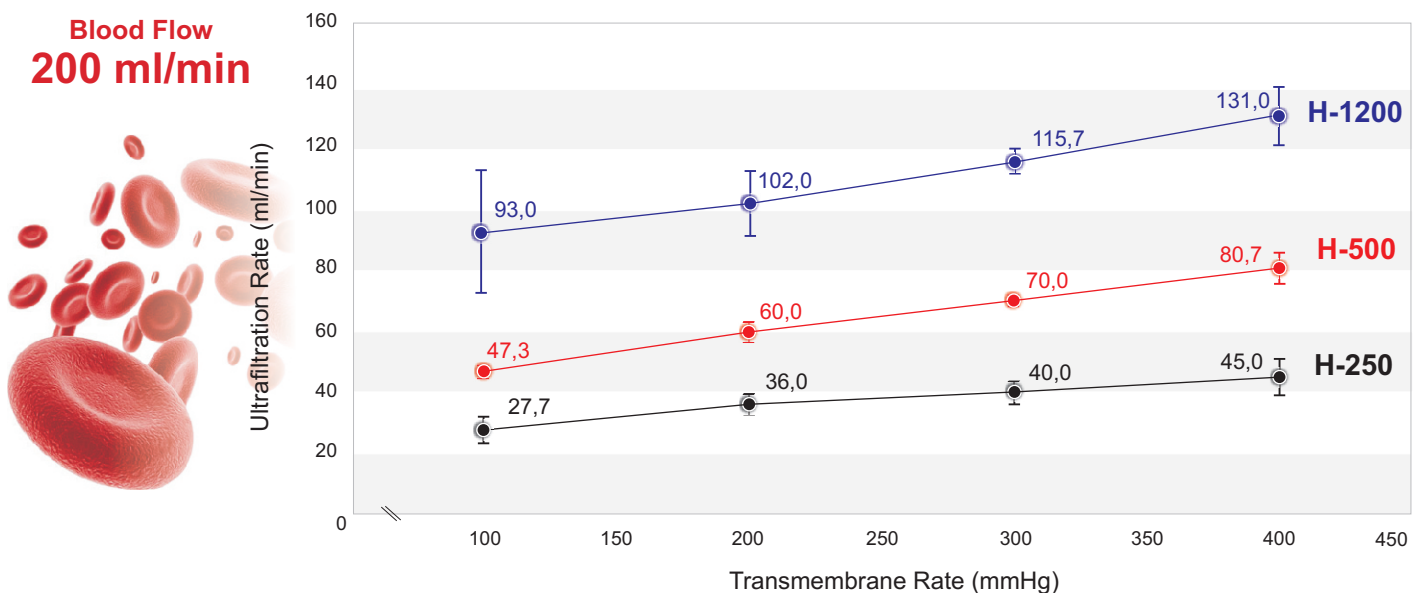
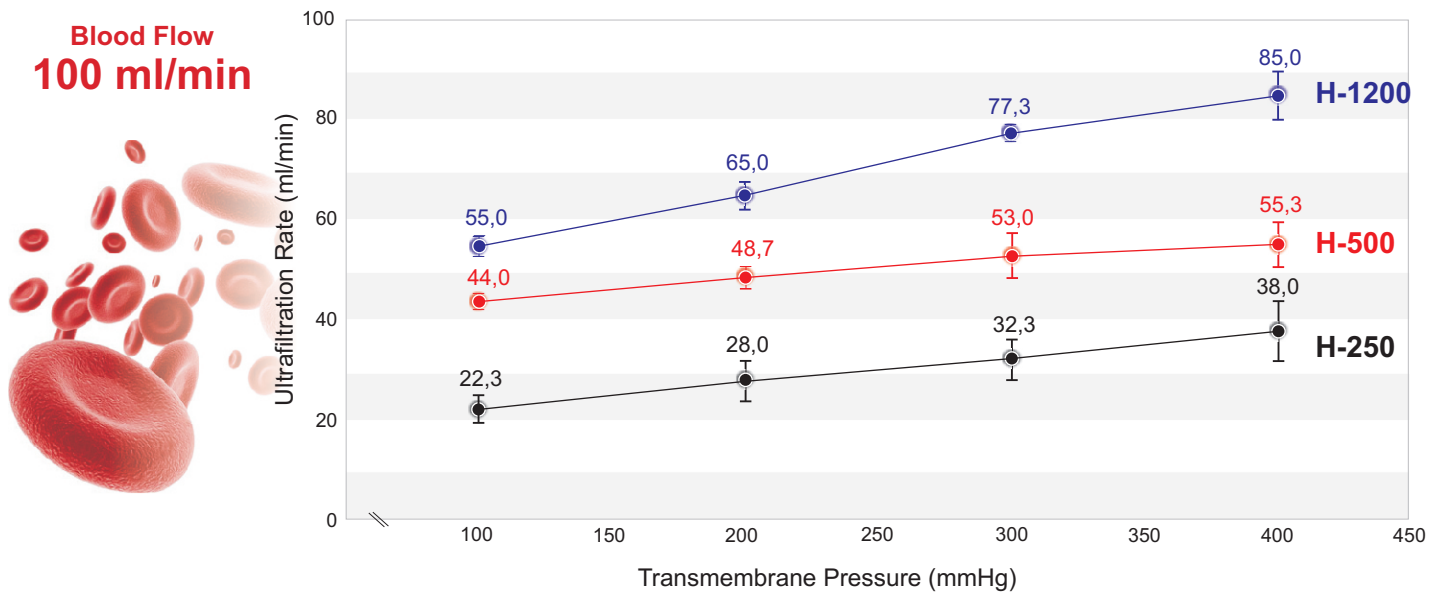


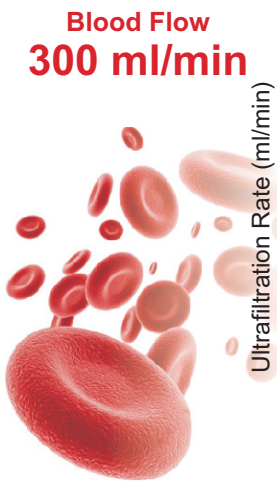
With the objective of evaluating the performance of Braile Biomédica® Hemoconcentrators, tests were carried out in Braile Biomédica's Test and Trial Lab, following the recommendations of the methodology indicated on the standard ANSI/AAMI/ISO 8637:2010 & A1:2013 "Cardiovascular implants and extracorporeal systems - Hemodialyzers, hemodiafilters, hemofilters and hemoconcentrators". The ultrafiltration rate was determined with fresh bovine blood heparanized at 37°C and hematocrit in 25%. The final system pressure is called Transmembrane Pressure - TMP, and corresponds to the variable controlled in the test circuit (100, 200, 300 and 400 mmHg). TMP was determined by the equation:

$$TMP = \frac{(P_{es} + P_{ss})}{2} + P_{vacuum}$$

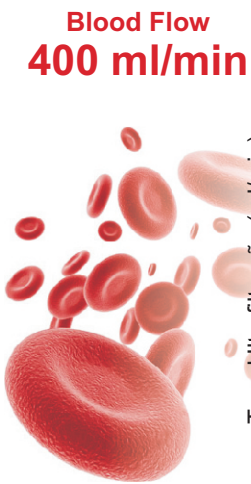
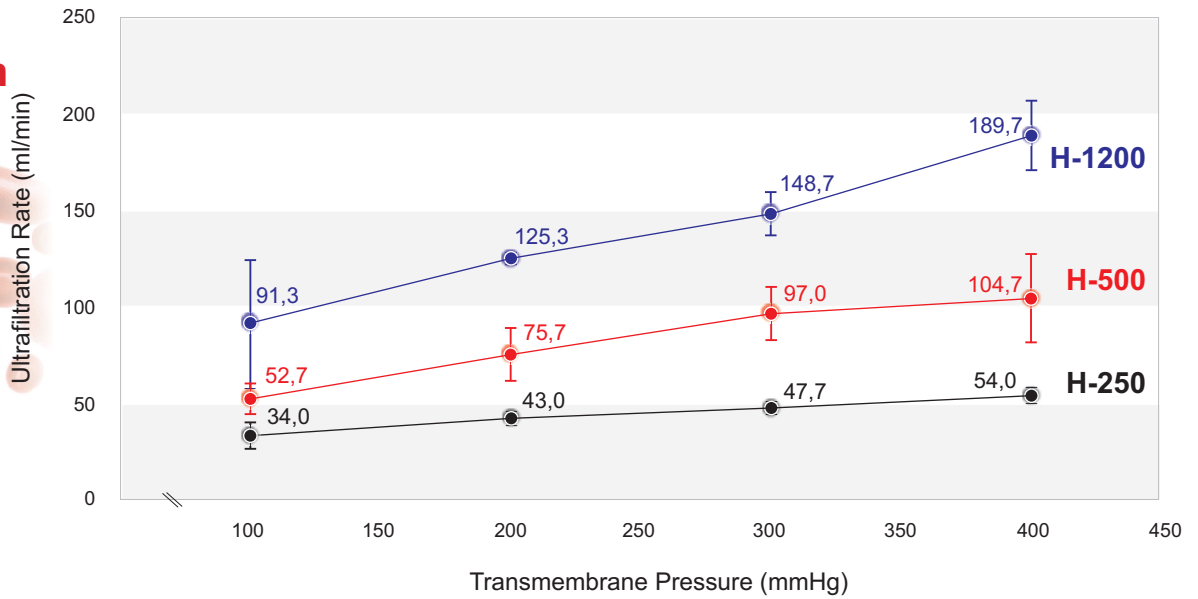
where: P_{es} = blood input pressure; P_{ss} = blood output pressure; P_{vacuum} = vacuum pressure in the filtered solution line.

With the results analysis, Braile Biomédica® Hemoconcentrators H-250, H-500 and H-1200 have performance corresponding to those required by standard ANSI/AAMI/ISO 8637.

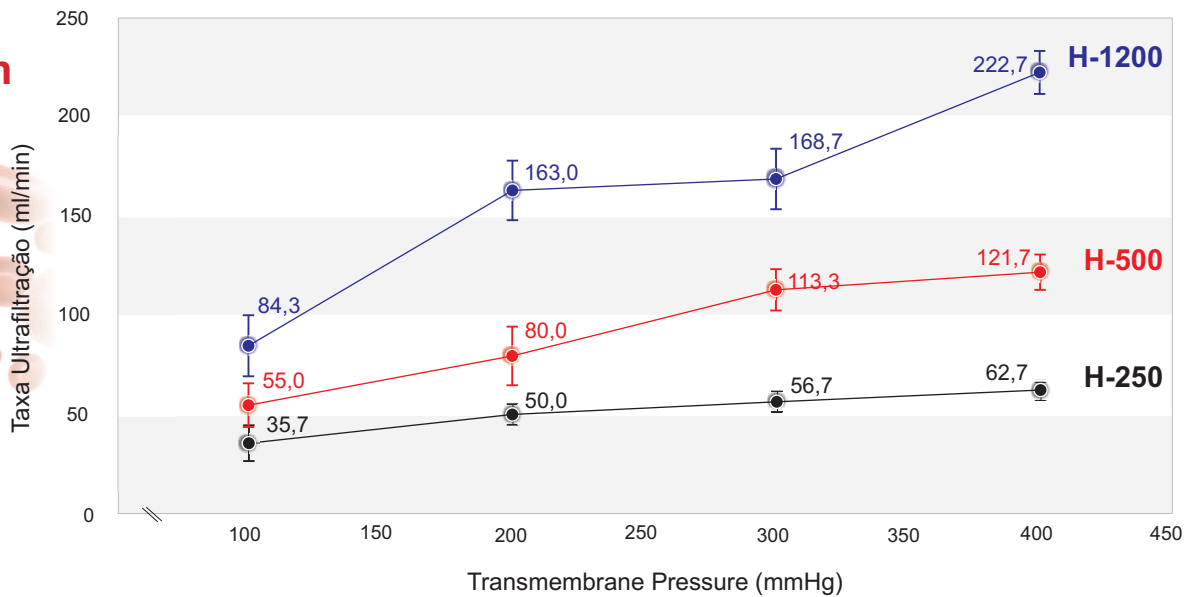




**Blood Flow
300 ml/min**



**Blood Flow
400 ml/min**



References

1. Osipov VP, Lurie GO, Khodas MYa, Mikhailov Y, Fadejeva NV. Hemoconcentration during open heart operations. *Thorac Cardiovasc Surg.* 1985; 33(2):81-5.
2. Souza DD, Braile DM. Avaliação de nova técnica de hemoconcentração e da necessidade de transfusão de hemoderivados em pacientes submetidos à cirurgia cardíaca com circulação extracorpórea. *Braz J Cardiovasc Surg.* 2004;19(3): 287-94.
3. Torina AG, Petrucci Jr O, Oliveira PPM, Severino ESBO, Vilarinho KAS, Lavagnoli CFR, Blotta MH, Vieira RW. Efeitos da ultrafiltração modificada na função pulmonar e necessidade de hemotransfusão em pacientes submetidos à revascularização do miocárdio. *Braz J Cardiovasc Surg.* 2010; 25(1): 59-65.