

OPTIFLOW™ Arterial Cannula

Improved hydrodynamics of a new aortic cannula with a novel tip design

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INTRODUCTION

- *"Atheroembolic events occurring during cardiopulmonary bypass are recognized to be the major cause of neurologic deficits after cardiac surgery."*
- *"Atheroembolism is caused by the dislodgement of atherosclerotic plaques from the ascending aorta due to external manipulation of the aorta, such as crossclamping and cannulation, as well as internal disruption produced by the blood flow from the cannula."*
- *"In this case, flow characteristics of the aortic cannula play an important role and are mainly influenced by the design of the cannula tip."*
- *"Commonly used aortic cannulae with a single end-hole stream have a high risk of plaque dislodgement related to the high flow velocity of blood impacting the atherosclerotic intima (sandblasting effect)."*
- *"In this study, we introduce a new cannula tip design [Sorin Optiflow arterial cannula] which is based on the arrangement of circular lamellae into the cannula tip, with increasing angles in flow direction and decreasing diameter in order to disperse the central stream circumferentially."*
- *"The formation of a divergent diffuse flow pattern is likely to reduce the sandblasting effect and its resulting complications."*

METHODS

- Hydrodynamic comparison of four different cannulae was performed (Figure 1).
- *"All cannulae were straight and had an outer diameter of 8 mm (24F)."*
- *"A closed-loop circuit was used for determination of pressure gradients."*
- *"Back pressures of the cannulae were measured in an open fluid reservoir."*
- *"Visualization of the outflow characteristics of the new cannula was performed by injection of ink into the arterial line with the cannula placed in an open fluid reservoir."*

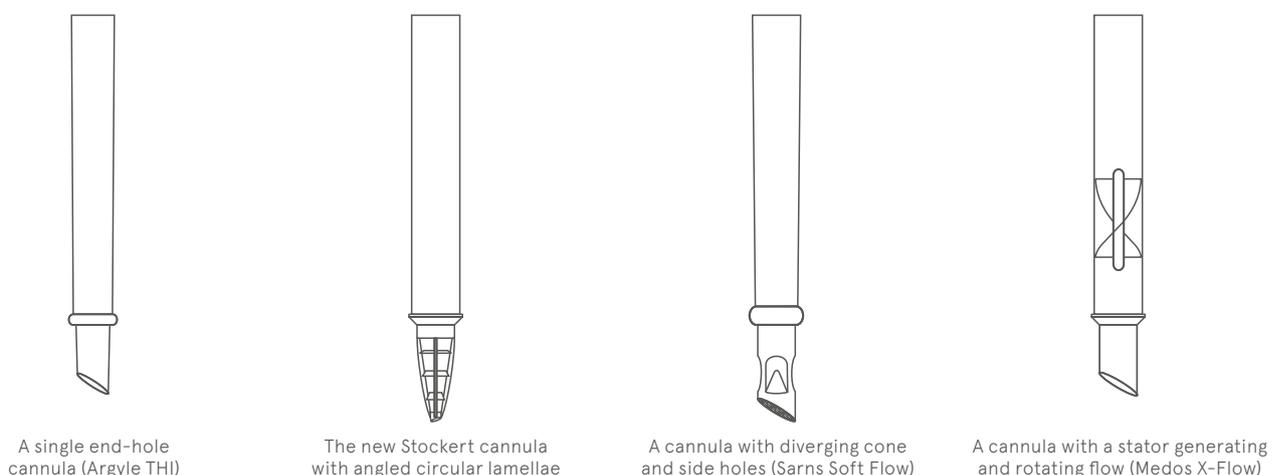


Figure 1. Schematic drawings of the tested cannulae lamellae [Sorin Optiflow arterial cannula]

RESULTS

- "At a pump flow of 5 L/min, the pressure drop was 19 mmHg for the [Sorin Optiflow arterial cannula], 20 mmHg for the Medos cannula, 26 mmHg for the Sarns cannula and 47 mmHg for the Argyle cannula (Figure 2)."
- "At a distance of 10 mm, back pressures of the new cannula [Sorin Optiflow arterial cannula] were 80.5-84.0% lower than the values of the single end-hole Argyle cannula. For the Medos cannula and the Sarns cannula, back pressures were 65.6-78.3% lower and 64.0-72.3% lower, respectively, compared with the Argyle cannula (Figure 3)."
- "Flow visualization of the new cannula [Sorin Optiflow arterial cannula] showed a diverging flow with an opening angle of approximately 28° [Figure 4]. The expansion of the stream was uniform over the whole circumference and length, [...]."



Figure 4. Flow visualization of the new cannula tip [Sorin Optiflow arterial cannula] at a flow rate of 5 L/min.

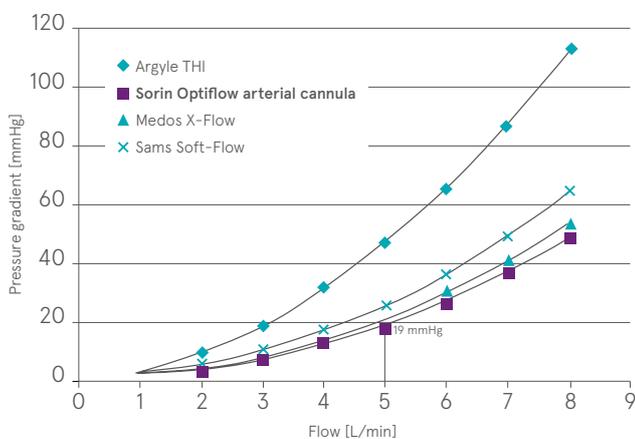


Figure 2. Comparison of pressure gradients across different arterial cannulae.

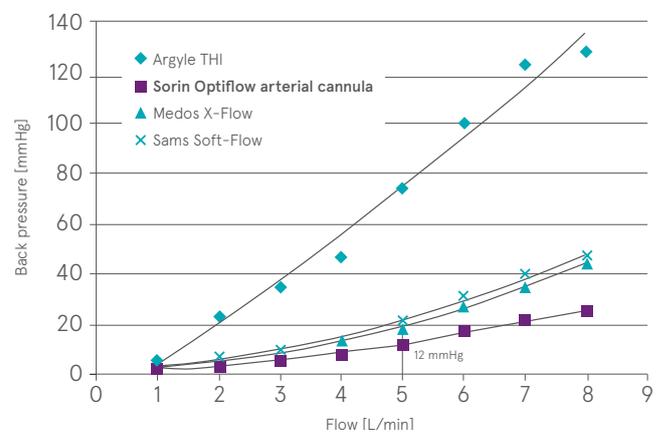


Figure 3. Comparison of back pressures at a distance of 10mm for different arterial cannulae.

CONCLUSIONS

- "Flow visualization of the new cannula [Sorin Optiflow arterial cannula] depicted a homogenous diverging flow profile (Figure 4) with expected low velocities which could be confirmed by the in vitro hydrodynamic investigations."
- "Back pressures of the new cannula [Sorin Optiflow arterial cannula] were up to 84% lower than those of the common Argyle THI cannula, attaining values even less than the Medos X-Flow cannula."
- "By avoidance of high back pressure, the novel cannula concept [Sorin Optiflow arterial cannula] presented in this study has the potential to decrease atheroembolic risk in cardiopulmonary bypass operations."

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