CORRESPONDENCE

Novel use of photoplethysmographic technology (Nexfin™) for real-time assessment of cardiac output during endovascular stenting in a patient with chronic inferior vena cava occlusion

Rosie Earle, BSc · Himat Vaghadia, MBBS · York Hsiang, MD ·
Joel Gagnon, MD

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To the Editor,

Endovascular stenting has been used to treat chronic inferior vena cava (IVC) occlusion. Successful deployment of this procedure has resulted in restoration of flow through the newly created lumen and disappearance of the collateral venous circulation.^{1,2} It is well documented that IVC occlusion is associated with a decrease in cardiac output (CO) due to an impairment in venous return.^{2,3} Continuous monitoring of improvements in intraoperative CO measurements could reflect real-time increases in venous flow and provide another measurement of successful stent deployment. Intraoperative measurement of CO has traditionally required placement of various intra-arterial catheters, including a Swan-Ganz catheter. These invasive techniques are associated with the potential for significant complications, including arrhythmias, infections, mural thrombi, and arterial rupture.⁴ Currently, there is little information in the literature on continuous noninvasive CO monitoring in patients undergoing endovascular stenting for IVC occlusion.

We present the novel use of photoplethysmographic technology with the Nexfin™ HD monitor (BMEYE, Amsterdam, The Netherlands) for hemodynamic management and assessment of CO during endovascular stenting in a 65-yr-old patient with chronic IVC occlusion due to a large retroperitoneal seminoma encasing the IVC.

The patient gave his consent for publication of this report. A previous attempt at removing his retroperitoneal tumour was unsuccessful and led to IVC occlusion and bilateral iliac vein occlusions secondary to deep vein thrombosis. The tumour was subsequently treated successfully with chemotherapy, but the patient experienced symptoms of bilateral lower leg edema, ulceration, and pigmentation due to the chronic venous insufficiency. We elected to address the condition with endovascular stenting under general anesthesia.

The patient was placed in the supine position, and in addition to the standard noninvasive monitors, a Nexfin sensor was placed on the index finger of his left hand. The Nexfin uses finger cuff-based photoplethysmography⁵ to provide reliable noninvasive continuous monitoring of blood pressure (BP), CO, stroke volume, and heart rate. After induction of anesthesia, endovascular stenting of the iliac veins and IVC was performed using Zilver® Vena™ stents (Cook Medical, Bloomington, IN, USA). The patient required stenting of both iliac veins and IVC with two overlapping stents placed in the IVC. Baseline CO was 5.4 L·min⁻¹, which progressively increased throughout the procedure to 6 L·min⁻¹ once stenting was completed (Figure). During the procedure, systemic vascular resistance decreased from 1,023 to 895 dynes·sec⁻¹·cm⁵, and there were no changes in arterial BP as monitored by a BP cuff and Nexfin. The patient was hemodynamically stable throughout the procedure and postoperatively within the hospital. He was discharged on the third postoperative day.

Currently, there are no monitoring guidelines for clinical management of patients undergoing endovascular stenting for IVC occlusion. The progressive increase in CO during IVC stenting likely reflects an improvement of IVC blood flow after stent deployment. Monitoring CO during IVC

R. Earle, BSc (✉) · H. Vaghadia, MBBS
Department of Anaesthesia, Vancouver Coastal Health,
Vancouver, BC, Canada
e-mail: earle.rk@gmail.com

Y. Hsiang, MD · J. Gagnon, MD
Department of Vascular Surgery, Vancouver General Hospital,
University of British Columbia, Vancouver, BC, Canada

Figure Cardiac output (CO) trends from a Nexfin™ monitor during an endovascular stenting procedure. Baseline CO was $4.5 \text{ L}\cdot\text{min}^{-1}$ preoperatively (A) and trended upward to $6.0 \text{ L}\cdot\text{min}^{-1}$ post stent

insertion (B). Systematic vascular resistance was observed to trend downwards from 1,023 to 895 $\text{dynes}\cdot\text{sec}^{-1}\cdot\text{cm}^5$ during the procedure

stenting may prove to be a valuable real-time guide to therapeutic effectiveness of this procedure. Further research with Nexfin in this population will help determine the safety, efficacy, and value of using this approach.

Conflicts of interest None declared.

References

1. Robbins MR, Assi J, Comerota AJ. Endovascular stenting to treat chronic long-segment inferior vena cava occlusion. *J Vasc Surg* 2005; 41: 136-40.
2. Razavi MK, Hansch EC, Kee ST, Sze DY, Semba CP, Dake MD. Chronically occluded inferior vena cavae: endovascular treatment. *Radiology* 2000; 214: 133-8.
3. Peters RM, Carter RA. Alterations in cardiac output with portal vein and inferior vena caval occlusion. *Ann Surg* 1966; 164: 197-202.
4. Hadian M, Pinsky MR. Evidence-based review of the use of the pulmonary artery catheter: impact data and complications. *Crit Care* 2006; 10(Suppl 3): S8.
5. Thiele RH, Bartels K, Gan TJ. Inter-device differences in monitoring for goal-directed fluid therapy. *Can J Anesth* 2015; 62: 169-81.