



# Modified Inside-Out Technique for Continued Use of Chronically Occluded Upper Central Veins

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## ABSTRACT

This report describes a 2-step, inside-out procedure for upper body central venous access in patients with chronic central venous occlusions. Blunt cephalad dissection through the mediastinum was achieved with a curved metal cannula and guide wire followed by percutaneous puncture of an open snare from a right supraclavicular approach and dilation of the tract for a tunneled central venous catheter insertion. Of 9 patients, all had a successful placement of a tunneled central venous catheter using this method. Although this 2-step, inside-out technique is effective for creating access in the presence of central venous occlusion, further clinical evaluation is warranted.

## ABBREVIATIONS

SVC = superior vena cava, TPN = total parenteral nutrition

Chronic central venous occlusion (subclavian vein, brachiocephalic vein, or superior vena cava [SVC]) can represent a challenge in acquiring upper body central venous access, with current management options including both surgical and endovascular interventions. Traditional endovascular options are possible only if the occlusion can be successfully crossed with a guide wire. Sharp recanalization was initially described in 1999 for management of cases of symptomatic chronic central venous occlusion in which a guide wire could not be used to cross the occlusion (1). Since then, further techniques using sharp recanalization (2,3), radiofrequency guide wires (4), and inside-out central venous access (5) have been described in small case series. This report describes a modified 2-step, inside-out technique to obtain central venous access in the context of chronic central venous

occlusions with the use of a blunt metal stiffening cannula and the stiff end of a guide wire. The technical success and complication rates associated with this technique are reported.

## MATERIALS AND METHODS

### Study Population

Institutional ethics review board approval was obtained for this retrospective review, and patient consent was waived. Between July 2005 and January 2016, 9 procedures were performed in 9 patients (7 men and 2 women; average age, 54 y; range, 32–78 y). All patients had upper body central venous occlusion, documented by catheter venography, and had failed a prior attempt at placement of upper central venous catheter by the interventional radiology service. Venous access was required for hemodialysis in 5 patients and for total parenteral nutrition (TPN) administration in 4 patients (Table 1). None of the patients had symptomatic SVC occlusion. Electronic medical records were reviewed for demographic information and clinical presentation (Table 1).

### Procedure

Angiographic images and available computed tomography studies for each patient were reviewed (Figs 1a, b and 2). All procedures were performed by a single operator (A.H.) in a single-plane angiography suite

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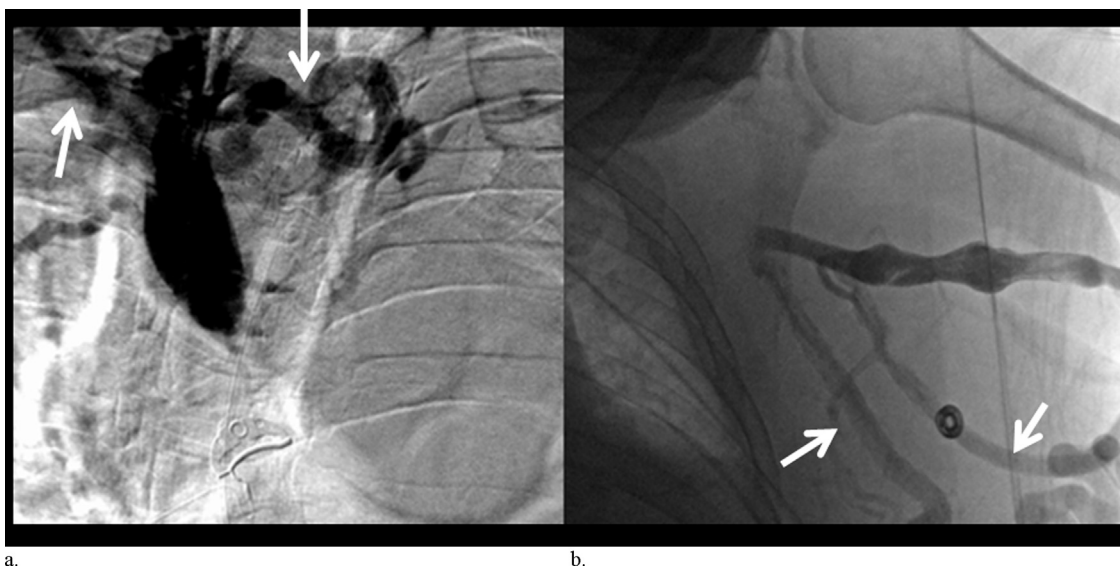
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**Table 1.** Demographic and Clinical Characteristics of Study Subjects

Characteristic	Value
Age, y, mean $\pm$ SD	53.9 $\pm$ 17.1
Male sex, n (%)	7 (77.7%)
Duration of central venous access before presentation, d, mean $\pm$ SD	3,067 $\pm$ 1,741
Location of central venous occlusion, n (%)	
SVC and right brachiocephalic vein	6 (66%)
SVC only	1 (11%)
Right and left brachiocephalic veins	2 (22%)
Indication for ventral venous access, n (%)	
Hemodialysis	5 (55.5%)
TPN	4 (45.5%)

SVC = superior vena cava; TPN = total parenteral nutrition.



**Figure 1.** Venogram images acquired during attempts at obtaining central venous access in a 57-year-old man demonstrate occlusion of the (a) right brachiocephalic and (b) left axillary veins with the presence of multiple collateral vessels (arrows).



**Figure 2.** Coronal reformat of a contrast-enhanced computed tomography image in pulmonary arterial phase with contrast medium administered via right upper limb venous access shows contrast opacification of multiple collateral vessels in the lateral chest wall (arrowheads), nonopacification of the right brachiocephalic vein (black arrow), and contrast opacification of the SVC via a patent azygos vein.

(AXIOM Artis; Siemens Healthcare GmbH, Erlangen, Germany) using local anesthesia and intravenous sedation. This technique was used only if the central venous occlusion could not be crossed using regular catheter/wire technique or if no suitable collateral veins were identified. In all cases, a 6-F 55-cm-long straight sheath (Cook, Inc, Bloomington, Indiana) was advanced into the SVC via a common femoral vein access. An 80-cm-long metal stiffening cannula from the Percutaneous Gastrojejunostomy Catheter Kit-WH Modification (Cook, Inc) was manually shaped with a gentle curve at the tip and advanced over a guide wire and through the sheath to aid in breaching the caudal margin of the occluded segment (Fig 3). If the initial attempt using the guide wire failed, the puncture was performed with the stiff end of the guide wire followed by reintroducing the soft end of the guide wire once the cannula tip was cephalad to the occlusion. The metal cannula and guide wire were advanced together in a cephalad direction to create a blunt dissection through the mediastinum.

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