CLINICAL STUDY

Concurrent Central Venous Stent and Central Venous Access Device Placement Does Not Compromise Stent Patency or Catheter Function in Patients with Malignant Central Venous Obstruction

Katherine Clark, MD, Jeffrey Forris Beecham Chick, MD, MPH, Shilpa N. Reddy, MD, Benjamin J. Shin, MD, Gregory J. Nadolski, MD, Timothy W. Clark, MD, and Scott O. Trerotola, MD

ABSTRACT

Purpose: To determine if concurrent placement of a central venous stent (CVS) and central venous access device (CVAD) compromises stent patency or catheter function in patients with malignant central venous obstruction.

Materials and Methods: CVS placement for symptomatic stenosis resulting from malignant compression was performed in 33 consecutive patients who were identified retrospectively over a 10-year period; 28 (85%) patients had superior vena cava syndrome, and 5 (15%) had arm swelling. Of patients, 11 (33%) underwent concurrent CVS and CVAD placement, exchange, or repositioning; 22 (67%) underwent CVS deployment alone and served as the control group. Types of CVADs ranged from 5-F to 9.5-F catheters. Endpoints were CVS patency as determined by clinical symptoms or CT and CVAD function, which was determined by clinical performance.

Results: All procedures were technically successful. There was no difference between the 2 groups in clinically symptomatic CVS occlusion ($P = .2$) or asymptomatic in-stent stenosis detected on CT ($P = .5$). None of the patients in the CVS and CVAD group had recurrent clinical symptoms, but 3 (30%) of 10 patients with imaging follow-up had asymptomatic in-stent stenosis. In the control group, 3 (14%) patients had clinically symptomatic CVS occlusion and required stent revision, whereas 4 (21%) of 19 patients with imaging follow-up had asymptomatic in-stent stenosis. During the study, 2 (20%) functional but radiographically malpositioned catheters were identified (0.66 per 1,000 catheter days).

Conclusions: Presence of a CVAD through a CVS may not compromise stent patency or catheter function compared with CVS placement alone.

ABBREVIATIONS

CP = chest port, CVAD = central venous access device, CVS = central venous stent, IJ = internal jugular, SVC = superior vena cava

Central venous occlusion may be a cause of morbidity and mortality. Although malignancy accounts for many cases, secondary to either extrinsic compression or venous invasion, benign causes are common (1,2). Central venous stent (CVS) placement has been established as an effective option for treatment of central

From the Division of Interventional Radiology (K.C., J.F.B.C., S.N.R., B.J.S., G.J.N., T.W.C., S.O.T.), Department of Radiology, Hospital of the University of Pennsylvania, Perelman School of Medicine, 1 Silverstein, 3400 Spruce Street, Philadelphia, PA 19104, and Division of Vascular and Interventional Radiology (S.N.R.), Radiology Associates of the Main Line, Main Line Health System, Bryn Mawr Hospital, Bryn Mawr, Pennsylvania. Received September 1, 2016; final revision received December 20, 2016; accepted December 21, 2016. **Address correspondence to** S.O.T.; E-mail: Scott.trerotola@uphs.upenn.edu

T.W.C. receives royalties from Teleflex (Morrisville, NC) and Merit Medical Systems, Inc (South Jordan, Utah). S.O.T. receives personal fees from MedComp (Harleysville, Pennsylvania), B. Braun Medical Inc (Bethlehem, Pennsylvania), BARD Peripheral Vascular, Inc (Tempe, Arizona), Lutonix, Inc (New Hope, Minnesota), W.L. Gore & Associates (Flagstaff, Arizona), Cook, Inc (Bloomington, Indiana), and Teleflex, and receives royalties from Cook, Inc, and Teleflex. None of the other authors have identified a conflict of interest.

Current affiliation of J.F.B.C.: Division of Vascular and Interventional Radiology, Department of Radiology, University of Michigan Medical Center, Ann Arbor, Michigan.

J Vasc Interv Radiol 2017; XX:■■■–■■■

http://dx.doi.org/10.1016/j.jvir.2016.12.1222

venous obstruction (3–6). Although stenosis and occlusion are common problems with CVS, assisted patency rates are favorable and allow for long-term symptom relief in patients with comorbidities (4,7–12). As a result, CVS placement is performed not only as a palliative measure but also increasingly as first-line treatment for central venous disease.

Despite use of CVS for brachiocephalic and superior vena cava (SVC) obstruction, there are no guidelines regarding concurrent use of upper extremity central venous access devices (CVADs). Many patients have comorbidities that necessitate CVADs for treatment; however, it is unclear if placement of a CVAD through a CVS should be avoided because of concern that the CVAD would affect CVS patency. Furthermore, in patients with indwelling CVADs at the time of CVS placement, it is unclear if the CVAD should be removed and alternative access considered. The benefits of upper extremity central venous access include lower risk of infection and catheter occlusion as well as patient comfort compared with infradiaphragmatic access (13,14). However, because CVS patency is important for symptomatic management of central venous obstruction, the risks and benefits of maintaining an upper extremity CVAD must be considered if CVADs adversely affect patency of the CVS. The purpose of this study was to determine if concurrent placement of a CVS and CVAD compromises stent patency or catheter function in patients with malignant central venous obstruction.

MATERIALS AND METHODS

Patient Selection

This study was conducted with institutional review board approval and was in compliance with the Health Insurance Portability and Accountability Act. Patients were identified using 2 separately maintained quality improvement databases, updated daily from the division's main quality improvement database (HI-IQ; Conexsys, Inc, Lincoln, Rhode Island), and medical and imaging records. Patients presenting with symptomatic central venous stenosis secondary to malignant obstruction (n = 33), including SVC syndrome (n = 28) and arm swelling (n = 5), who underwent central venography and CVS placement from February 2002 to June 2012 were identified. Patients with benign central venous stenosis and any patients on hemodialysis, including renal transplant recipients, were excluded from the study to ensure a relatively homogeneous patient cohort in terms of underlying pathology for central venous obstruction. Patients with SVC syndrome or arm swelling were referred to interventional radiology by a primary care physician or oncologist and seen in consultation with an interventional radiology attending physician. SVC syndrome was defined as the presence of $\geq$ 1 of the following clinical symptoms: neck or facial swelling, hoarseness, stridor, chest pain, or dyspnea. Patients with arm swelling included patients with disabling arm swelling that inhibited daily activities. Patients underwent either computed tomography (CT) venography or conventional venography to delineate central venous anatomy and obstruction as well as for treatment planning. Of 33 patients, 11 (33%) had concurrent CVS and CVAD placement, exchange, or repositioning. The 22 (67%) patients who had CVS placement alone served as the control group.

Demographics

There were 20 (61%) women and 13 (39%) men. The treatment group included 6 (54%) women and 5 (46%) men, and the control group included 14 (64%) women and 8 (36%) men. Mean ages of the treatment and control groups were 67 years (range, 52–77 y) and 56 years (range, 31–85 y), respectively (P = .05) (Table 1). Comorbidities, including history of end-stage renal disease (P = .5) and venous thromboembolic disease (P = .1), were similar between the 2 groups. In the treatment group, 2 (18%) patients had renal disease and 4 (36%) had a history of venous thromboembolic disease compared with 2 (9%) patients with renal disease and 3 (14%) with a history of thromboembolic disease in the control group (P = .5 and P = .1, respectively). There was no difference between groups in the proportion of patients with SVC syndrome versus arm swelling (P = .4). In the treatment group, 9 (81%) patients presented with SVC syndrome, and 2 (19%) presented with arm swelling, all (100%) from malignant disease. In the control group, 19 (86%) patients presented with SVC syndrome, and 3 (14%) presented with arm swelling. All patients (100%) in the control group also had malignant disease.

Interventions

All procedures were performed with moderate sedation by 1 of 5 board-certified attending interventional radi-

Table 1. Patient Demographics Including Mean Age, History of ESRD or Thromboembolic Disease, and Patients Presenting with SVC Syndrome and Malignant Obstruction

Procedure	Mean Age (y)	ESRD (%)	Thromboembolic Disease (%)	SVC Syndrome (%)	Malignancy (%)
CVS + CVAD (n = 11)	67	18	36	81	100
CVS only (n = 22)	56	9	14	86	100
P value	.05	.5	.1	.4	1.0

CVAD = central venous access device; CVS = central venous stent; ESRD = end-stage renal disease; SVC = superior vena cava.