Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Patient Characteristics and the Safety of Stent Placement for Malignant Vena Cava Syndrome in Japan: A Nationwide Analysis

Mizuki Ozawa

mizukiozawa0717@gmail.com

National Cancer Centre Japan

Rakuhei Nakama

National Cancer Centre Japan

Norihiko Inoue

Showa medical university

Yoshihisa Miyamoto

The University of Tokyo

Miyuki Sone

National Cancer Centre Japan

Kiyohide Fushimi

Institute of Science Tokyo

Research Article

Keywords: Malignant vena cava syndrome, vena cava stenting, superior vena cava syndrome, inferior vena cava syndrome, interventional radiology, complication rates

Posted Date: June 26th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9500775/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at Supportive Care in Cancer on October 21st, 2026. See the published version at https://doi.org/10.1007/s00520-026-11400-8.

Abstract

Purpose

Malignant superior or inferior vena cava (SVC/IVC) syndrome, resulting from tumor invasion or compression, causes severe symptoms and reduces quality of life. Although stent placement is widely accepted as a palliative treatment, its safety in large, multicenter populations remains unclear.

Methods

We conducted a retrospective cohort study using the Japanese Diagnosis Procedure Combination nationwide inpatient database. Patients who underwent SVC/IVC stent placement for malignant vena cava syndrome between April 2019 and March 2023 were included. Patient characteristics, underlying malignancies, adverse events, therapeutic interventions, 7-day mortality after stent placement, and 30-day in-hospital mortality after admission were assessed. Adverse events were identified using International Classification of Diseases, 10th Revision codes.

Results

We analyzed 301 patients from 137 hospitals (187 with SVC and 114 with IVC). Lung tumors were most common in the SVC group, whereas liver tumors predominated in the IVC group. Multiple stents were more frequently required in IVC cases. Overall, adverse events occurred in 34 patients (10.6%). Respiratory failure was significantly more common in the SVC group, while other complications were comparable between groups. Red blood cell transfusion was required in 10 patients (3.3%); no patient required invasive interventions such as embolization. Mortality was 5.0% at 7 days after stenting and 11.6% at 30 days after hospitalization, with no significant difference between the groups.

Conclusion

Stent placement for malignant vena cava obstruction demonstrated a relatively low complication rate and no serious adverse events requiring invasive intervention, supporting its safety and effectiveness as a palliative option, even in advanced malignancy.

Introduction

Obstruction of the superior or inferior vena cava (SVC/IVC) due to tumor invasion or extrinsic compression can result in malignant vena cava syndrome. Malignant SVC syndrome presents with symptoms such as upper limb and facial edema, dyspnea, and, in severe cases, coma, and may be fatal [1–3]. In contrast, malignant IVC syndrome manifests as edema of the lower extremities, pelvis, genital

organs, and skin; ascites and abdominal distension; and renal or hepatic dysfunction. Although it is rarely fatal, it substantially impairs patients' quality of life (QOL) [4–6].

Vena cava stent placement is a feasible and effective treatment for malignant vena cava syndrome, with reported technical success rates of 97.7–100% and clinical success rates of 60–86.4% [3, 5–9]. A randomized controlled trial (RCT) demonstrated that stent placement provides greater improvement in QOL than conservative management, including anticoagulation, diuretics, and albumin administration [9]. Systematic reviews of both SVC and IVC stenting have similarly reported favorable outcomes [10, 11]. However, safety and complication rates remain insufficiently characterized. A previous phase II RCT (n = 28) reported a 14.3% incidence of treatment-related grade ≥ 3 adverse events, based on the Common Terminology Criteria for Adverse Events, version 3 [9]. Given the small sample size, the reliability of these estimates is limited. Moreover, existing systematic reviews include heterogeneous populations with varying etiologies (including benign conditions) and stent types [10–12], which may limit the generalizability of their findings. Furthermore, although the Cardiovascular and Interventional Radiological Society of Europe Quality Assurance Guidelines for malignant SVC stenting [13] recommend stent placement as a standard therapeutic option, the supporting evidence is largely derived from small observational studies, and robust safety data remain scarce. Adequately powered RCTs are needed to precisely estimate safety and complication rates; however, conducting such trials may be challenging because most eligible patients have advanced-stage cancer and are receiving palliative care.

In recent years, studies using large-scale clinical databases have been conducted to address such common limitations in interventional radiology research [14, 15]. Compared with prior studies constrained by small sample sizes and heterogeneous populations, analyses using such clinical databases enable evaluation of nationwide, standardized, and substantially larger cohorts, facilitating more comprehensive assessment of patient characteristics and clinical outcomes. Therefore, this study aimed to characterize patients with malignant vena cava syndrome undergoing vena cava stent placement and to strengthen the evidence on its safety by evaluating complication rates using a Japanese nationwide inpatient database.

Materials and Methods

Data source and ethics

This retrospective, population-based cohort study was conducted using the Diagnosis Procedure Combination (DPC) database, a nationwide inpatient database in Japan. The DPC database collects data on approximately 7 million inpatients annually from over 1,700 hospitals, covering approximately 90% of all tertiary care hospitals in Japan [16, 17]. The database includes patient characteristics such as principal admission diagnoses, comorbidities present at admission, complications after admission, surgical procedures coded using original Japanese codes, medical costs, and length of hospital stay. Comorbidities and complications on and after admission were recorded using the International Classification of Diseases, 10th Revision (ICD-10) codes. A previous validation study reported that the

diagnostic and procedural records in this database have approximately 80% sensitivity and 90% specificity [18]. This study was approved by the Institutional Review Board of the Institute of Science Tokyo (M2000-788). The requirement for informed consent was waived because all data were anonymized.

Participants

Patients who underwent SVC or IVC stent placement for malignant vena cava syndrome between April 2019 and March 2023 were included. Cases were identified by combining the diagnosis codes for malignant SVC or IVC syndrome with device codes for stent placement. In Japan, only one type of self-expanding bare-metal stent has been approved for coverage under the National Health Insurance for the treatment of malignant vena cava syndrome since October 2019.

Definitions

We collected data on age, sex, body mass index, underlying diseases, Charlson Comorbidity Index (CCI) [19, 20], number of stents used, and repeat stent placement during the same hospitalization. Underlying diseases and CCI were classified according to ICD-10 codes based on tumor site, excluding lymphoma, leukemia, and metastatic solid tumors. Patients were subsequently categorized into two groups according to the site of stent placement: the SVC group and the IVC group.

Adverse events and their corresponding interventions were defined, and their incidence was assessed. Adverse events were identified using ICD-10 codes as follows: infection (A419, T814); arrhythmia (I499, R000, R001); cardiac tamponade (I319, I971); heart failure (I500, I501, I509); pneumothorax (T812, J930–J931, J938–J939); hemothorax (J942); pleural effusion (J90); mediastinitis (J985); respiratory failure (J985, J9600–J9601, J9609, J9690–J9691, J9699); disseminated intravascular coagulation (D65); pulmonary artery thromboembolism (I269); and renal dysfunction (N289, N19, N179, N990). Therapeutic interventions for adverse events were defined as those performed within 7 days following vena cava stent placement and included red blood cell transfusion, transcatheter arterial embolization, percutaneous drainage, and surgical procedures. We also assessed 7-day mortality after stent placement and 30-day in-hospital mortality.

Statistical analysis

Continuous variables are summarized as means with standard deviations, and categorical variables as numbers and percentages. Differences in baseline characteristics between the SVC and IVC groups were assessed using the chi-square test or Fisher's exact test, as appropriate. The Mann–Whitney *U* test was used to compare the distributions of continuous variables, including time to in-hospital death, between groups. A two-sided *P*-value < 0.05 was considered statistically significant. All statistical analyses were performed using Stata (version 18.0; StataCorp LLC, College Station, TX, USA) and R: A Language and

Environment for Statistical Computing (version 4.5.1; R Foundation for Statistical Computing, Vienna, Austria).

Results

A total of 301 patients underwent vena cava stent placement across 137 hospitals during the study period. Table 1 summarizes the patient and procedural characteristics. IVC and SVC stent placements were performed in 114 and 187 patients, respectively. The mean patient age was 67.7 years. Over 95% of the patients had a CCI score ≥ 2. In the IVC group, the most common underlying disease was liver tumors (54/114, 47.4%), including both primary and metastatic lesions, whereas lung tumors predominated in the SVC group (148/187, 79.1%). Additionally, the use of two or more stents was significantly more frequent in the IVC group than in the SVC group ($p < 0.001$). No significant difference was observed in the rate of repeat stent placement during the same hospitalization between the groups.

Table 1
Patient and Procedural characteristics

Patient	**All patients (n = 301)**	**SVC stent (n = 187)**	**IVC stent (n = 114)**	***P* value**
Age (y)				0.32
Mean ± SD	67.7 ± 11.6	67.2 ± 11.4	68.6 ± 11.8	
Range	35–92	35–90	40–92	
Sex				0.04
Male	183	122	61	0.054
Female	118	65	53	
Charlson Comorbidity Index, n (%)	12 (4.0)	9 (4.3)	3 (2.6)	
0–1	179 (59.5)	119 (64.1)	60 (52.7)	
2–4	110 (36.5)	59 (31.6)	51 (44.7)	
≥ 5				
Underlying Disease				0.78
(Site of tumor), n (%)				0.17
Breast	7 (2.3)	4 (2.1)	3 (2.6)	
Mediastinum	3 (1.0)	3 (1.6)	0 (0.0)	
Lung	159 (52.8)	148 (79.1)	11 (9.6)	< 0.001
Esophagus	6 (2.0)	4 (2.1)	2 (1.8)	0.82
Gastric	7 (2.3)	2 (1.1)	5 (4.4)	0.41
Intestine or Colon	16 (5.3)	1 (0.5)	15 (13.2)	0.06
Liver (primary)	25 (8.3)	1 (0.5)	24 (21.1)	< 0.001
Liver (metastatic)	37 (12.3)	7 (3.7)	30 (26.3)	< 0.001
Pancreas or Gallbladder	18 (6.0)	0 (0.0)	18 (15.8)	<0.001
Kidney or Urinary Tract	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Adrenal	1 (0.3)	0 (0.0)	1 (0.9)	0.20
Genital	6 (2.0)	3 (1.6)	3 (2.6)	0.54
Lymphoma or Leukemia	11 (3.7)	10 (5.3)	1 (0.9)	0.04

Patient	All patients (n = 301)	SVC stent (n = 187)	IVC stent (n = 114)	*P* value
Metastatic solid tumor	97 (32.2)	57 (30.5)	40(35.1)	0.41
Other	12 (4.0)	5 (2.7)	7 (2.7)	0.12
Number of stents placed, n (%)				<0.001
1	203 (67.5)	147 (78.6)	56 (49.1)	
2	91 (30.2)	39 (20.9)	52 (45.6)	
3	4 (1.3)	0 (0.0)	4 (3.5)	
4	3 (1.0)	1 (0.5)	2 (1.8)	0.82
Repeat stent placement, n (%)				
Yes	6 (2.0)	4 (2.1)	2 (1.8)	
No	295 (98.0)	183 (97.9)	112 (98.2)	

SVC, superior vena cava; IVC, inferior vena cava; BMI, body mass index; PCN, percutaneous nephrostomy; SD, standard deviation; N/A, not available.

Number of stents indicates the total count used during the initial procedure.

Repeat stent placement was defined as any additional stenting performed after the initial procedure during the follow-up period.

Table 2 presents the details of complications following vena cava stent placement. Overall, 34 complications occurred in 32 patients (32/301, 10.6%). Respiratory failure was significantly more common in the SVC group than in the IVC group ($p = 0.001$), whereas no significant differences were observed for other complications. The most common postprocedural treatment was red blood cell transfusion, which was performed in four patients in the SVC group and six patients in the IVC group, with no significant between-group difference (2.1% vs. 5.3%, p = 0.14). No patient required invasive interventions such as embolization, percutaneous drainage, or surgery. Fifteen patients (5.0%) died within 7 days after stent placement, and 35 patients (11.6%) died within 30 days after hospitalization; there was no statistically significant difference between the SVC and IVC groups (7-day: 5.9% vs. 3.5%, p = 0.36; 30-day: 12.3% vs. 10.5%, p = 0.64).

Table 2
Procedural outcomes following vena cava stent placement

Complications, n (%)	**All patients (n = 301)**	**SVC stent (n = 187)**	**IVC stent (n = 114)**	***P* value**
Infection	2 (0.7)	0 (0.0)	2 (1.8)	0.07
Arrhythmia	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Cardiac tamponade	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Heart failure	5 (1.7)	3 (1.6)	2 (1.8)	0.92
Pneumothorax	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Hemothorax	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Pleural effusion	11 (3.7)	8 (4.3)	3 (2.6)	0.46
Mediastinitis	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Respiratory failure	11 (3.7)	11 (5.9)	0 (0.0)	0.01
DIC	2 (0.7)	0 (0.0)	2 (1.8)	0.07
PE	3 (1.0)	2 (1.1)	1 (0.9)	0.87
Renal disfunction	0 (0.0)	0 (0.0)	0 (0.0)	N/A
7-day mortality after stenting	15 (5.0)	11 (5.9)	4 (3.5)	0.36
30-day In-hospital mortality	35 (11.6)	23 (12.3)	12 (10.5)	0.642
Procedure, n (%)				0.14
Red blood cell transfusion	10 (3.3)	4 (2.1)	6 (5.3)	N/A
Percutaneous embolization	0 (0.0)	0 (0.0)	0 (0.0)	
Percutaneous drainage	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Cardiac drainage	0 (0.0)	0 (0.0)	0 (0.0)	N/A
Surgical intervention	0 (0.0)	0 (0.0)	0 (0.0)	N/A

SVC, superior vena cava; IVC, inferior vena cava; DIC, disseminated intravascular coagulation; PE, pulmonary embolism; N/A, not available

Discussion

This study found that adverse events potentially related to vena cava stent placement for malignant vena cava syndrome occurred in 11.3% of patients. Moreover, no serious adverse events requiring invasive intervention were observed. These findings suggest that vena cava stent placement is a safe treatment option, even for patients with cancer who are often in a compromised general condition.

A previous Phase II clinical trial [9] reported an adverse event rate of 14.3% following stent placement for malignant vena cava syndrome, including major complications and procedure-related deaths. However, the small sample size (n = 28) limits the precision of this estimate, and the true rate may be either overestimated or underestimated. Systematic reviews have also suggested the safety of vena cava stenting, with a reported complication rate of approximately 8.6% for SVC stenting [10, 11]. However, these findings are primarily based on retrospective studies with heterogeneous methodologies and relatively small sample sizes. Consequently, the overall level of evidence remains modest, and the safety of IVC/SVC stenting has not been definitively established. Our study adds value by analyzing a nationwide administrative database, which enabled the assessment of complication rates in a multicenter patient cohort and may enhance the generalizability of the findings.

Among postprocedural outcomes, red blood cell transfusion occurred in 3.3% of cases; however, no patients required invasive interventions such as transcatheter arterial embolization, percutaneous drainage, or surgery. This suggests that postprocedural bleeding is generally low-grade and amenable to conservative management, including simple observation or transfusion. Furthermore, some red blood cell transfusions may not have been directly attributable to the stent procedure, as anemia is common in patients with advanced malignancies and transfusions are often part of routine clinical care [21]. A similar consideration applies to the 7-day mortality after stent placement. In this study, 15 patients (5.0%) died within 7 days post-stent placement; however, given that the study population primarily consisted of patients with advanced cancer, it is possible that not all of these deaths were directly attributable to stent placement. Among the evaluated adverse events, only respiratory failure differed significantly between groups, occurring more frequently in the SVC group. This finding may reflect the higher prevalence of dyspnea at baseline among patients with SVC syndrome.

In the SVC group, lung cancer and lymphoma (including leukemia) were significantly more prevalent as underlying diseases than in the IVC group. Conversely, both primary and metastatic liver cancers were more frequently observed in the IVC group than in the SVC group. These findings likely reflect the anatomical relationship between tumor location and the vena cava. Lung cancers are often located near the SVC, and tumor growth in this region can readily cause SVC stenosis and subsequent SVC syndrome [22]. The observed association with lymphoma may be explained by cases in which the primary lesion arises in the mediastinum, where it can exert a mass effect on the SVC. Similarly, as liver tumors progress, they may extend toward or contact the IVC, increasing the risk of invasion or compression, which can result in obstruction requiring IVC stent placement. In addition to differences in underlying disease, the proportion of cases requiring two or more stents was significantly higher in the IVC group than in the SVC group. This finding may be related to the greater anatomical length of the IVC. IVC

lesions, particularly those associated with liver tumors, often involve long or multiple segments, requiring the use of overlapping stents to achieve complete coverage of the obstruction [23].

This study has several limitations. First, due to the nature of the administrative data, detailed information—such as the severity of stenosis or the use of balloon dilatation—was unavailable. Second, information on operator experience and specialty (e.g., interventional radiology, cardiology, or surgery) was not available and may have influenced procedural outcomes. Third, the analysis was limited to early complications after vena cava stent placement; long-term outcomes remain unclear. Fourth, only one stent type approved for insurance reimbursement in Japan was included in our study period, precluding comparisons among different stent types (e.g., covered versus uncovered or self-expanding versus balloon-expandable). Finally, the clinical efficacy of vena cava stent placement, including its impact on patients' QOL, could not be assessed due to limitations of the DPC database. Future studies integrating electronic medical records and professional society registries are needed to address these limitations.

In conclusion, this nationwide Japanese database study demonstrated a relatively low complication rate following vena cava stent placement for malignant vena cava syndrome. No serious adverse events requiring invasive intervention were observed. These findings suggest that the procedure may be safely performed, even in patients with advanced cancer and multiple comorbidities.

Declarations

Conflicts of Interest:

none.

Ethical Approval:

This study was approved by the Institutional Review Board of the Institute of Science Tokyo (M2000-788).

Informed Consent:

The requirement for informed consent was waived because all data were anonymized.

Funding:

This study was funded by a Grant-in-Aid for Research on Policy Planning and Evaluation from the Ministry of Health, Labour and Welfare, Japan (24AA2006). The funding body had no role in the design of the study; collection, analysis, or interpretation of data; or in writing the manuscript.

Author Contribution

All authors made substantial contributions to the study concept or the data analysis or interpretation; drafted the manuscript or revised it critically for important intellectual content; approved the final version of the manuscript to be published; and agreed to be accountable for all aspects of the work.

Acknowledgement

We would like to thank Editage (www.editage.com) for English language editing. Dr. Miyamoto has an academic affiliation with the Department of Real-world Evidence, which is a cooperative program between The University of Tokyo and DeSC Healthcare.

This study has never been presented anywhere.

Data Availability

The data used in this study are not publicly available due to restrictions imposed by the data provider and relevant regulations. Access to the data may be granted upon reasonable request to the data provider, subject to appropriate approvals.

References

1. Kishi K, Sonomura T, Mitsuzane K et al (1993) Self-expandable metallic stent therapy for superior vena cava syndrome: clinical observations. Radiology 189:531–535. https://doi.org/10.1148/radiology.189.2.8210386
2. Rowell NP, Gleeson FV (2002) Steroids, radiotherapy, chemotherapy and stents for superior vena caval obstruction in carcinoma of the bronchus. Clin Oncol 14:338–351. https://doi.org/10.1053/clon.2002.0095
3. Tanigawa N, Sawada S, Mishima K et al (1998) Clinical outcome of stenting in superior vena cava syndrome associated with malignant tumors. Comparison with conventional treatment. Acta Radiol 39:669–674. https://doi.org/10.3109/02841859809175494
4. Kudo H, Yata Y, Orihara T, Kageyama M, Takahara T, Sugiyama T (2006) Malignant inferior vena cava syndrome. Intern Med 45:219–220. https://doi.org/10.2169/internalmedicine.45.1662
5. Brountzos EN, Binkert CA, Panagiotou IE, Petersen BD, Timmermans H, Lakin PC (2004) Clinical outcome after intrahepatic venous stent placement for malignant inferior vena cava syndrome. Cardiovasc Intervent Radiol 27:129–136. https://doi.org/10.1007/s00270-003-0009-x
6. Kuetting D, Thomas D, Wilhelm K, Pieper CC, Schild HH, Meyer C (2017) Endovascular management of malignant inferior vena cava syndromes. Cardiovasc Intervent Radiol 40:1873–1881. https://doi.org/10.1007/s00270-017-1740-z
7. Oudkerk M, Heystraten FMJ, Stoter G (1993) Stenting in malignant vena caval obstruction. Cancer 71:142–146. https://doi.org/10.1002/1097-0142(19930101)71:1%3C142::aid-

cncr2820710123%3E3.0.co;2-c

8. Sato Y, Inaba Y, Yamaura H, Takaki H, Arai Y (2012) Malignant inferior vena cava syndrome and congestive hepatic failure treated by venous stent placement. J Vasc Interv Radiol 23:1377–1380. https://doi.org/10.1016/j.jvir.2012.06.035
9. Takeuchi Y, Arai Y, Sone M et al (2019) Evaluation of stent placement for vena cava syndrome: phase II trial and phase III randomized controlled trial. Support Care Cancer 27:1081–1088. https://doi.org/10.1007/s00520-018-4397-5
10. Azizi AH, Shafi I, Zhao M et al (2021) Endovascular therapy for superior vena cava syndrome: A systematic review and meta-analysis. EClinicalMedicine 37:100970. https://doi.org/10.1016/j.eclinm.2021.100970
11. Morris RI, Jackson N, Smith A, Black SA (2023) A systematic review of the safety and efficacy of inferior vena cava stenting. Eur J Vasc Endovasc Surg 65:298–308. https://doi.org/10.1016/j.ejvs.2022.11.006
12. Wright K, Digby GC, Gyawali B et al (2023) Malignant superior vena cava syndrome: A scoping review. J Thorac Oncol 18:1268–1276. https://doi.org/10.1016/j.jtho.2023.04.019
13. Uberoi R (2006) Quality assurance guidelines for superior vena cava stenting in malignant disease. Cardiovasc Intervent Radiol 29:319–322. https://doi.org/10.1007/s00270-005-0284-9
14. Ishikawa H, Ohbe H, Omachi N, Morita K, Yasunaga H (2021) Spinal cord infarction after bronchial artery embolization for hemoptysis: A nationwide observational study in Japan. Radiology 298:673–679. https://doi.org/10.1148/radiol.2021202500
15. Nakama R, Inoue N, Miyamoto Y, Arai Y, Kobayashi T, Fushimi K (2024) Patient characteristics and procedural and safety outcomes of percutaneous transesophageal gastro-tubing: A nationwide database study in Japan. Surgery 175:368–372. https://doi.org/10.1016/j.surg.2023.09.035
16. Yasunaga H (2019) Real World Data in Japan: Chapter II The Diagnosis Procedure Combination Database. Ann Clin Epidemiol 1:76–79. https://doi.org/10.37737/ace.1.3_76
17. Hayashida K, Murakami G, Matsuda S, Fushimi K (2021) History and profile of Diagnosis Procedure Combination (DPC): development of a real data collection system for acute inpatient care in Japan. J Epidemiol 31:1–11. https://doi.org/10.2188/jea.je20200288
18. Yamana H, Moriwaki M, Horiguchi H, Kodan M, Fushimi K, Yasunaga H (2017) Validity of diagnoses, procedures, and laboratory data in Japanese administrative data. J Epidemiol 27:476–482. https://doi.org/10.1016/j.je.2016.09.009
19. Charlson ME, Pompei P, Ales KL, MacKenzie CR (1987) A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 40:373–383. https://doi.org/10.1016/0021-9681(87)90171-8
20. Sundararajan V, Henderson T, Perry C, Muggivan A, Quan H, Ghali WA (2004) New ICD-10 version of the Charlson Comorbidity Index predicted in-hospital mortality. J Clin Epidemiol 57:1288–1294. https://doi.org/10.1016/j.jclinepi.2004.03.012

21. Preston NJ, Hurlow A, Brine J, Bennett MI (2012) Blood transfusions for anaemia in patients with advanced cancer. Cochrane Database Syst Rev 2012:CD009007. https://doi.org/10.1002/14651858.cd009007.pub2
22. Quencer KB (2022) Superior Vena Cava Syndrome: Etiologies, Manifestations, and Treatments. Semin Intervent Radiol 39:292–303. https://doi.org/10.1055/s-0042-1753480
23. Devcic Z, Techasith T, Banerjee A, Rosenberg JK, Sze DY (2016) Technical and anatomic factors influencing the success of inferior vena caval stent placement for malignant obstruction. J Vasc Interv Radiol 27:1350–1360.e1. https://doi.org/10.1016/j.jvir.2016.02.030