Management of Superior Vena Cava Syndromes: How I Do It

JEFFREY FORRIS BEECHAM CHICK, MD, MPH, FCIRSE, FSVM
Associate Professor
Co-Director / The Deep Vein Institute
Deputy Program Director / Interventional Radiology Residency
Director / Quality and Safety
University of Washington

UW Medicine

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DISCLOSURES AND ACKNOWLEDGMENTS

Jacob J. Bundy, MD, MPH

Christopher R. Ingraham, MD

Kyle J. Cooper, MD, RPVI

Mark H. Meissner, MD

Joseph J. Gemmete, MD, FSIR

David S. Shin, MD

Anthony N. Hage, MD

Ravi N. Srinivasa, MD, FSIR

GOALS AND OBJECTIVES

01

- Background
- Indications
- Clinical evaluation
- Pre-procedural imaging

02

- Timing
- Anticoagulation

03

- Equipment
- Reconstruction steps
- Unique scenarios

04

- Post-procedural care
- Technical successes
- Clinical outcomes
- Stent patencies

BACKGROUND

01

- 60% malignant
- 40% benign

02

- Endovascular reconstruction
- External beam radiotherapy
- Systemic chemotherapy

03

- Unilateral bare metal reconstructions

04

- Bilateral reconstructions
- Mimic normal anatomy
- Maximize access

05

- Stent-grafts
- Superior patency
- Prevent extravascular leakage, hyperplasia, and tumor ingrowth

INDICATIONS

1. Superior vena cava syndromes
2. Recurrent deep venous thromboses
3. Post-thrombotic syndromes
4. Restriction of normal activities
5. Reduction in quality of life

CLINICAL EVALUATION

01

- Time course of symptoms
- Functional impairments

02

- Comorbidities

03

- Anticoagulation status

04

- Prior medical and surgical interventions

05

- Complete blood counts
- Basic metabolic panels
- Coagulation studies

PRE-PROCEDURAL IMAGING

01

- Plain films

02

- Venous duplex ultrasounds

03

- Computed tomography venography (CTV)

04

- Magnetic resonance venography (MRV)

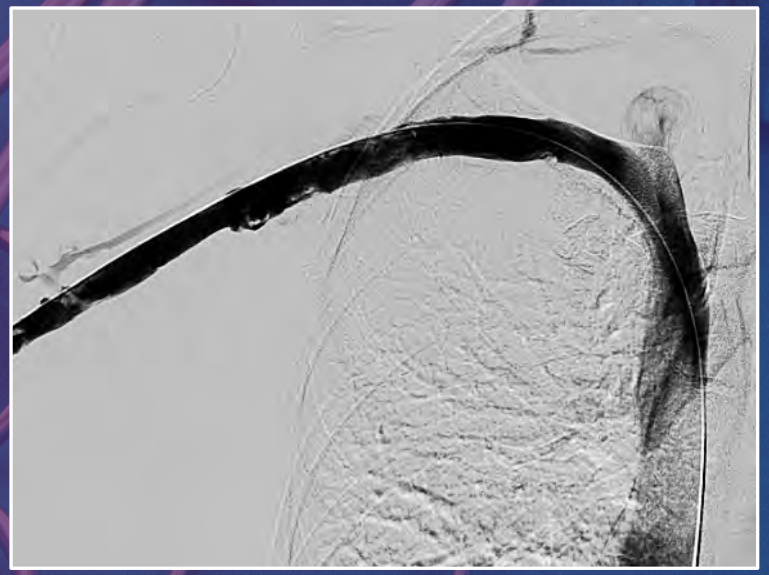
TIMING

01

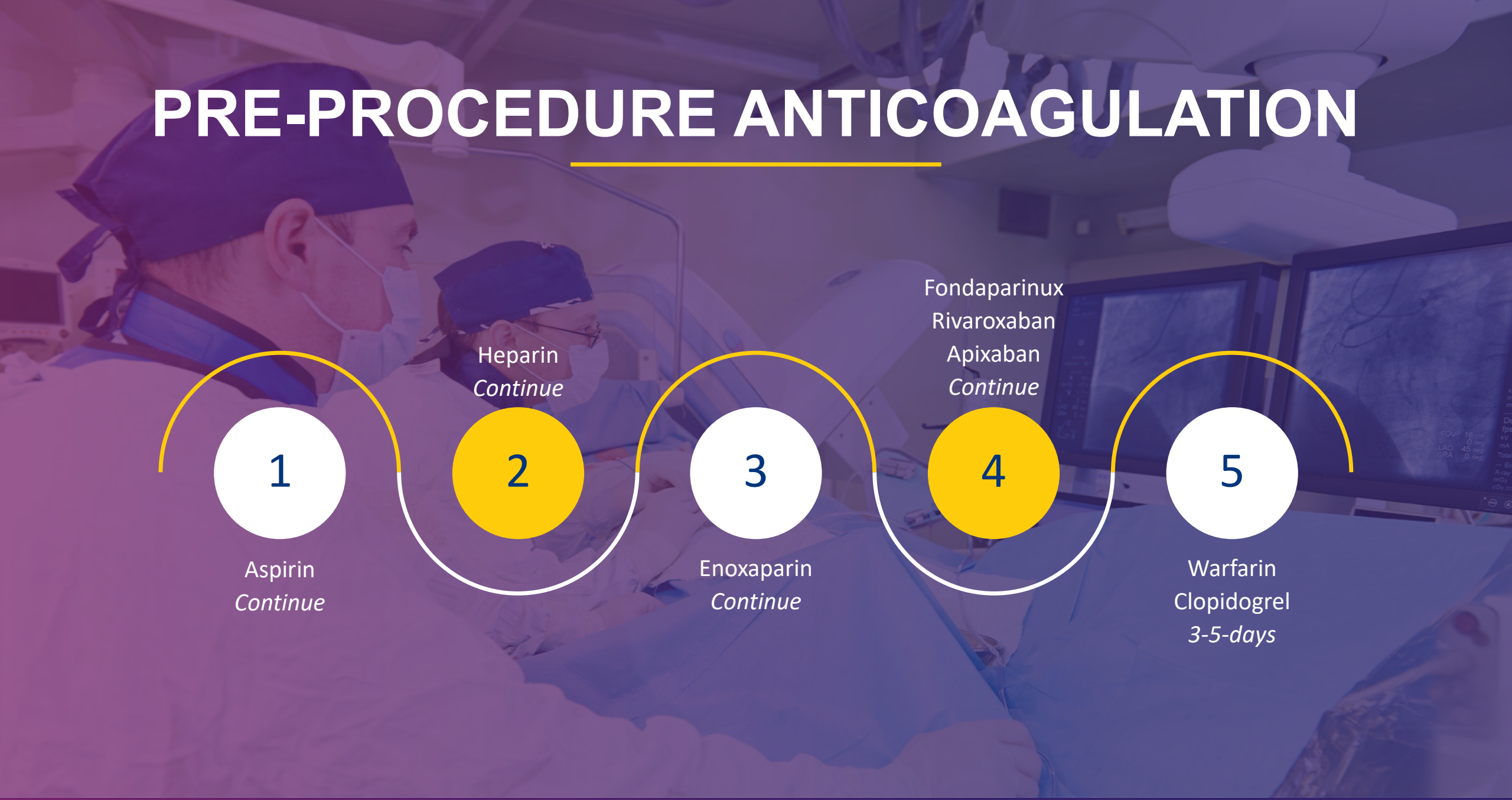
Acute occlusions
< 2-weeks

02

Chronic occlusions
> 6-weeks



PRE-PROCEDURE ANTICOAGULATION



1. Aspirin
   Continue
2. Heparin
   Continue
3. Enoxaparin
   Continue
4. Fondaparinux
   Rivaroxaban
   Apixaban
   Continue
5. Warfarin
   Clopidogrel
   3-5-days

EQUIPMENT

01

- Ultrasound
- Intravascular ultrasound

02

- Micropuncture set
- 6-10-French sheaths

03

- Flush catheters
- Hydrophilic catheters
- TriForce crossing set
- Hydrophilic guidewires
- Steel reinforced guidewires

05

- 4-16-mm high-pressure balloons
- 12-20-mm Abre stents
- 12-20-mm Cook Zilver Vena stents
- 8-11-mm VBX stent-grafts

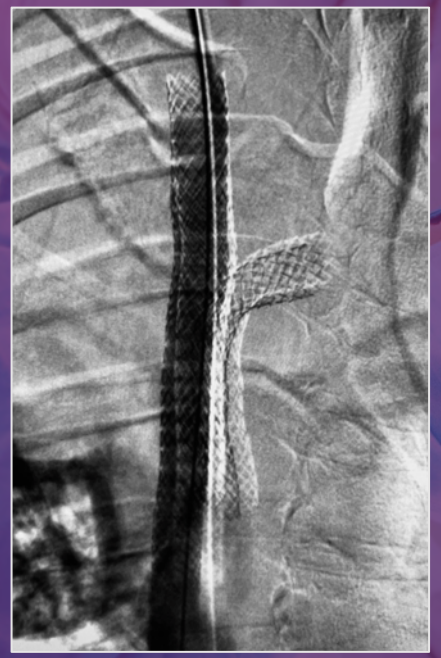
04

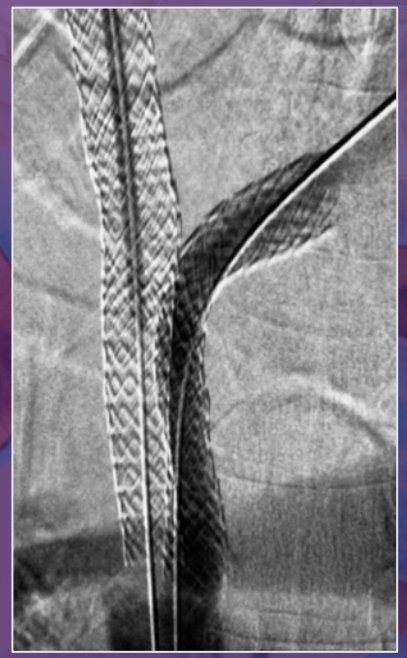
- BRK trans-septal
- Rösch-Uchida transjugular
- AMPLATZER vascular plugs

ANESTHESIA

01 Moderate sedation

02 General anesthesia





VASCULAR ACCESS

01

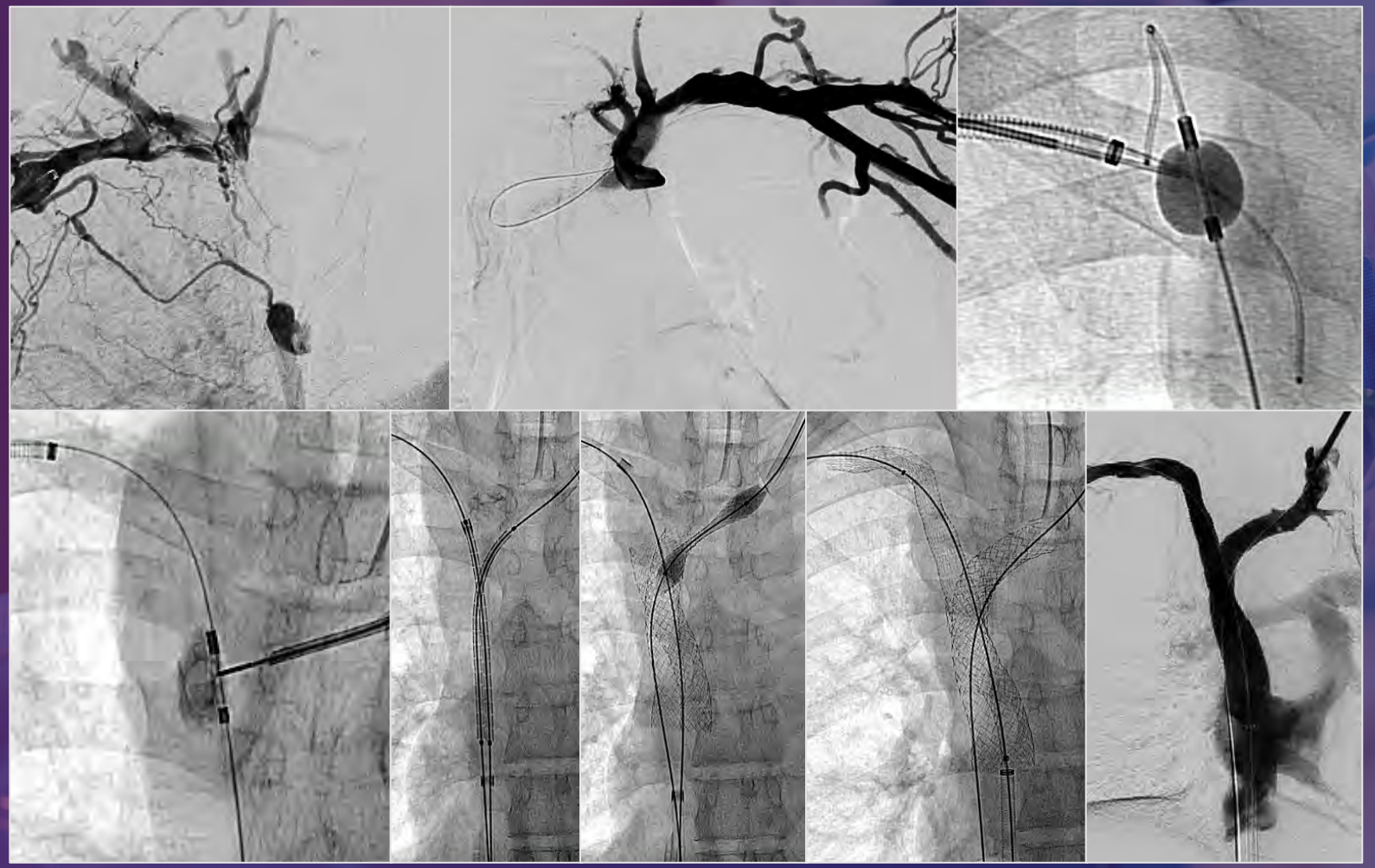
- Internal jugular veins
- External jugular veins
- Brachial veins

02

- Common femoral veins
- Great saphenous veins

BLUNT ENDOLUMINAL RECANALIZATION

SHARP EXTRALUMINAL RECANALIZATION



THROMBECTOMY

01

- EkoSonic endovascular
- UniFuse
- Cragg-McNamara

02

- Arrow-Trerotola
- Cleaner 15/XT

03

- Indigo aspiration

04

- AngioJet rheolytic

05

- AngioVac system
- FlowTriever thrombectomy
- ClotTriever thrombectomy

RESTORATION OF LUMEN

01

- Contrast venography
- Intravascular ultrasound

02

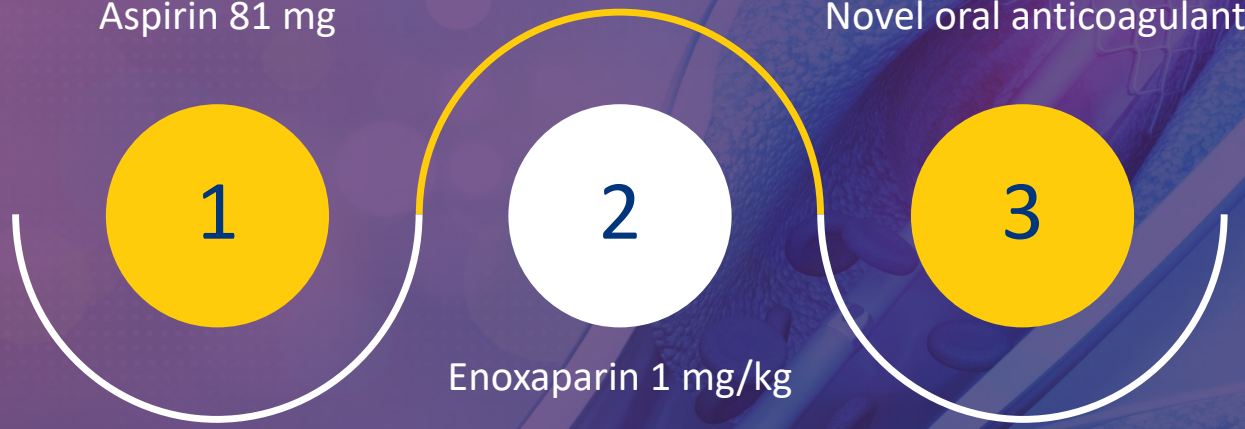
- Superior vena cava
  - 16-20-mm

03

- Brachiocephalocaval
  - 12-14-mm

CHEST AND PERICARDIAL DRAINS

POST-PROCEDURE ANTICOAGULATION



OUTCOMES

01

- *Technical successes*
- 96.4%

02

- *Clinical successes*
- 96.4%

03

- *Adverse events*
- 14.3%

RECONSTRUCTION PATENCIES

01

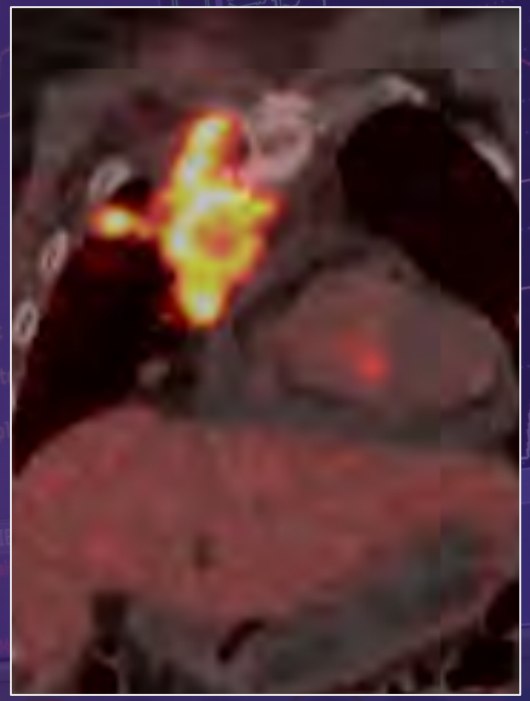
- *Primary*
- 81.7%; 77.8%; 71.8%

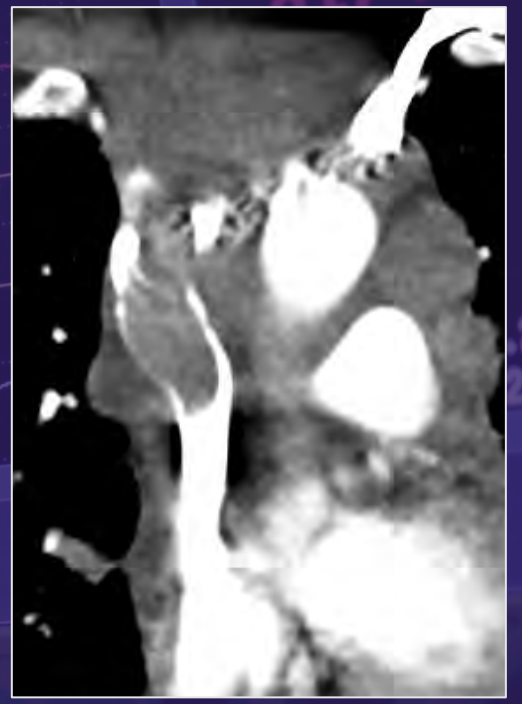
02

- *Primary-assisted*
- 92.7%; 88.8%; 88.8%

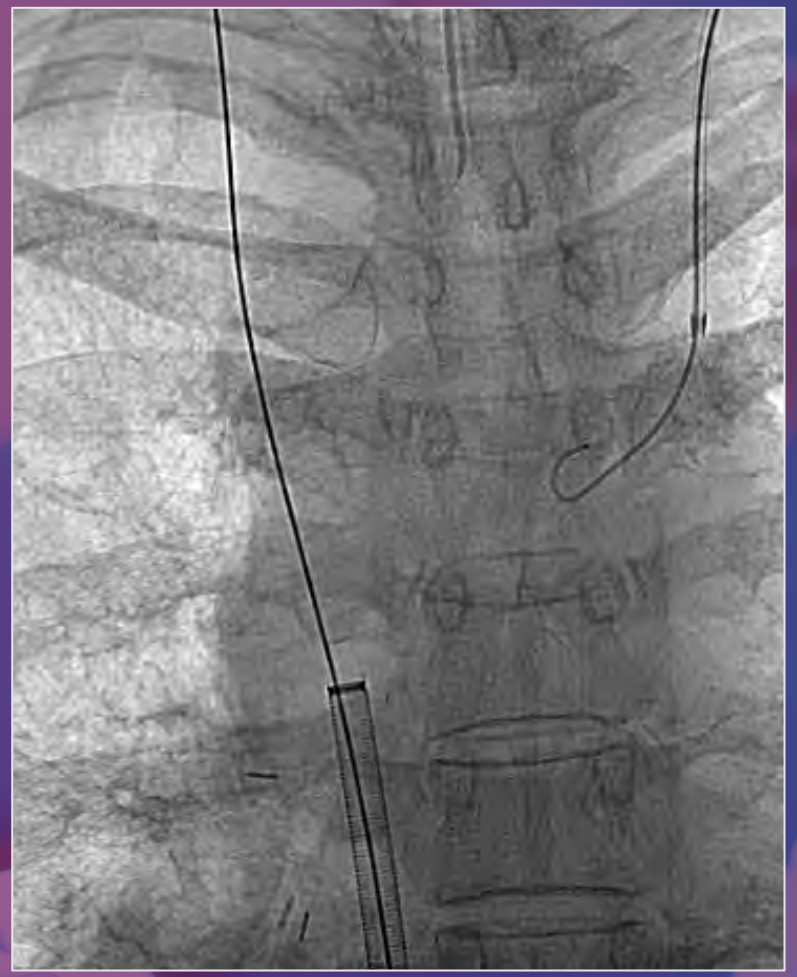
03

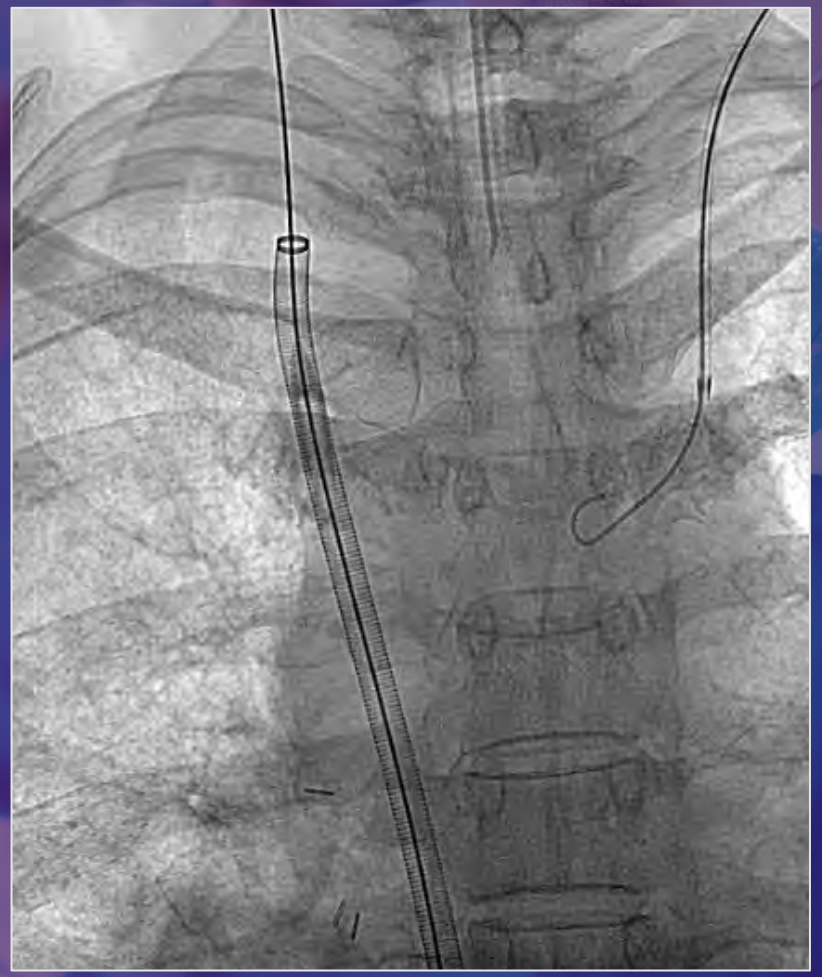
- *Secondary*
- 100%; 100%; 100%

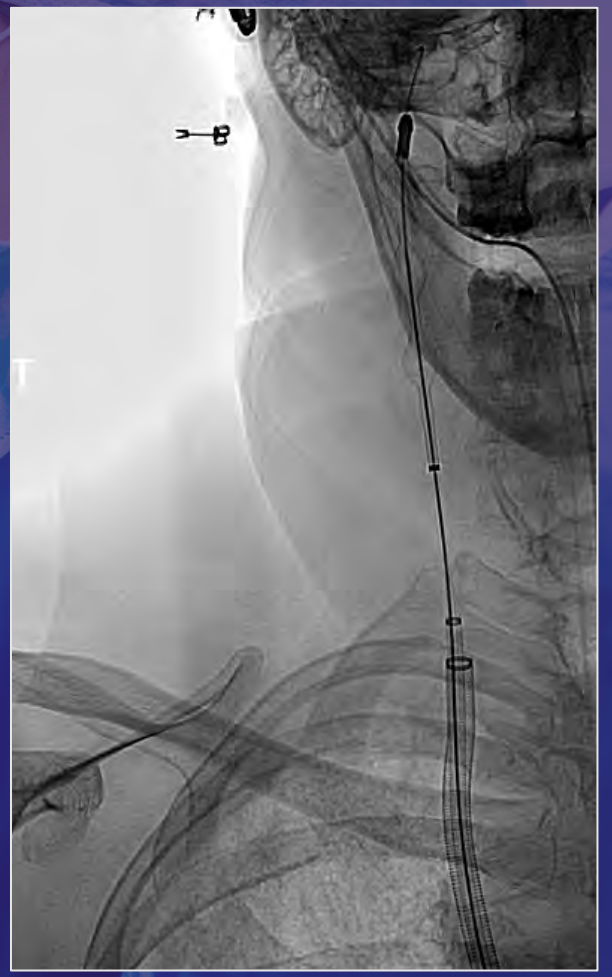




CLINICAL CASES







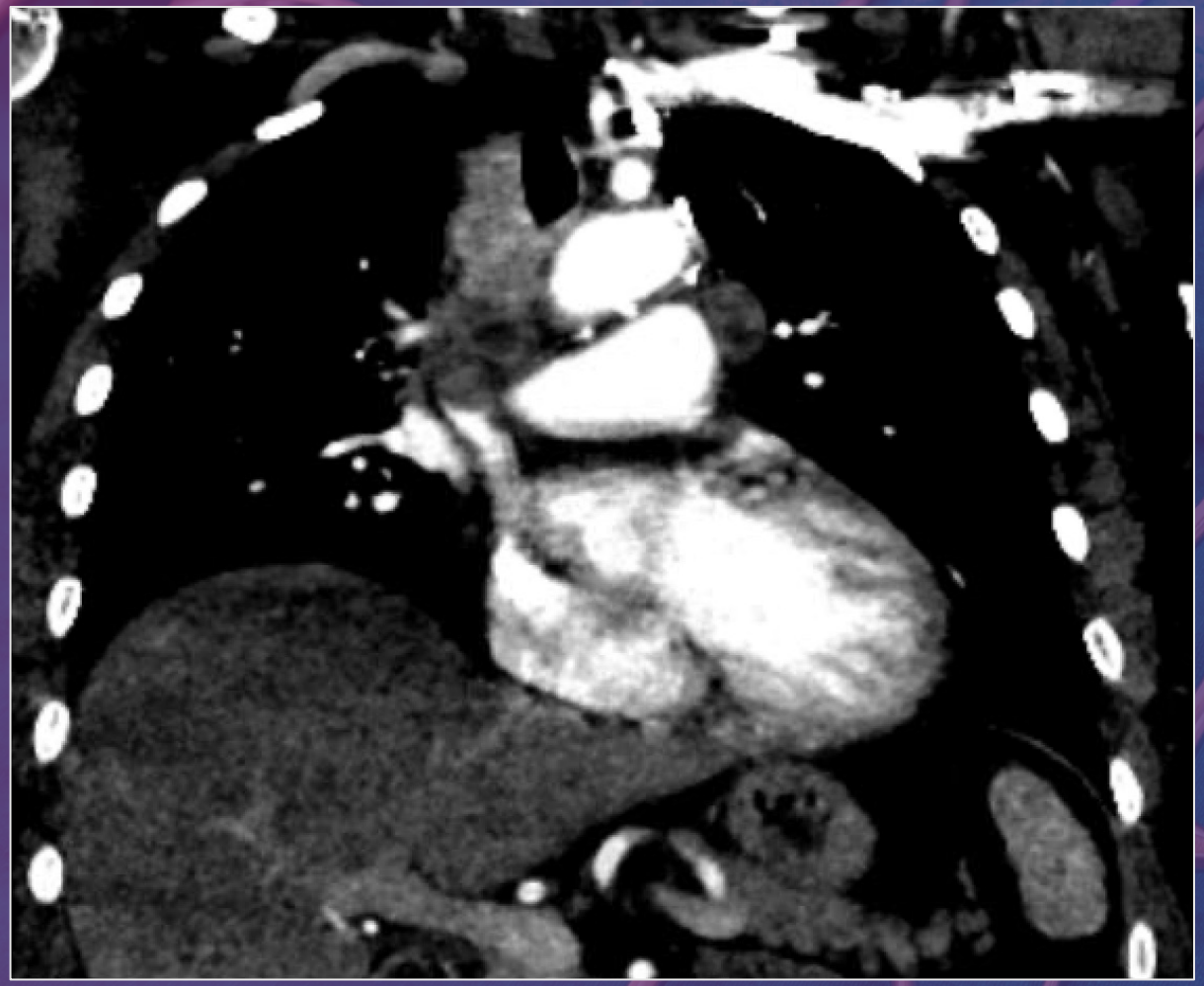
SUPERIOR VENA CAVA CASES

CASE 1

SUPERIOR VENA CAVA CASE 1

History of metastatic papillary thyroid cancer with swelling and plethora of neck and face for 17 days. Computed tomographic venography of the chest demonstrated mediastinal lymphadenopathy with thrombotic occlusion of the superior vena cava.

SUPERIOR VENA CAVA CASE 1



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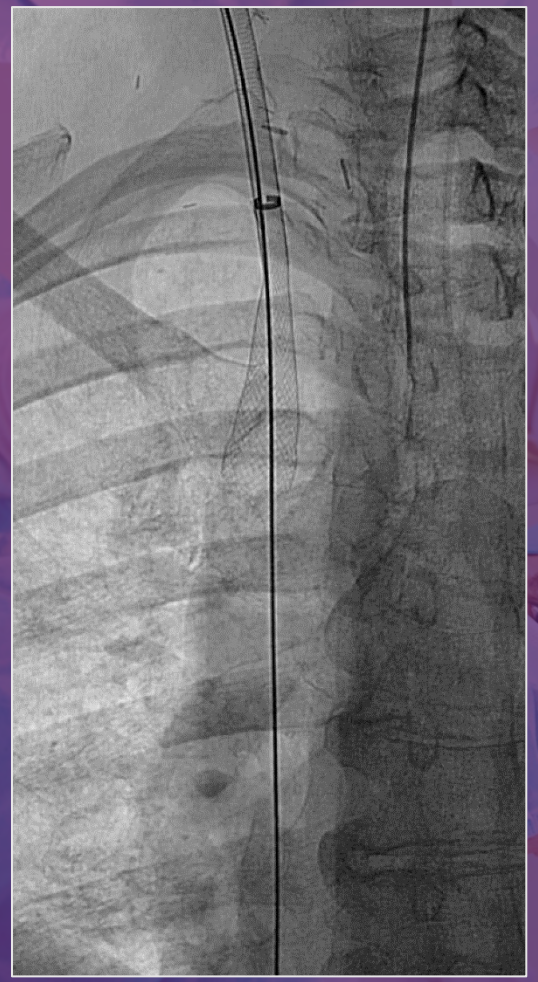

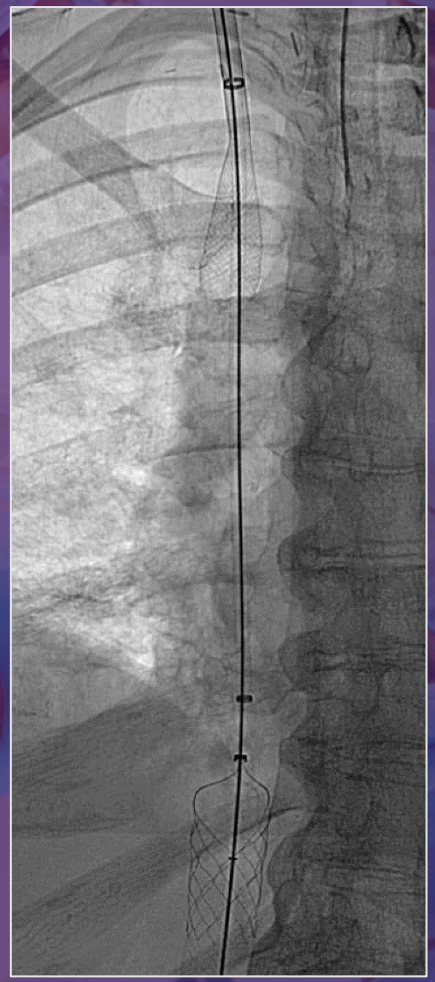

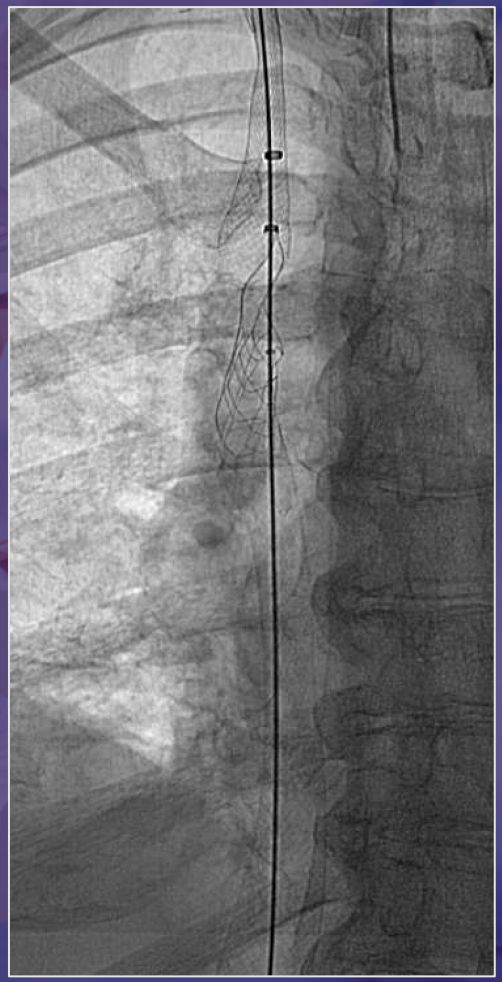

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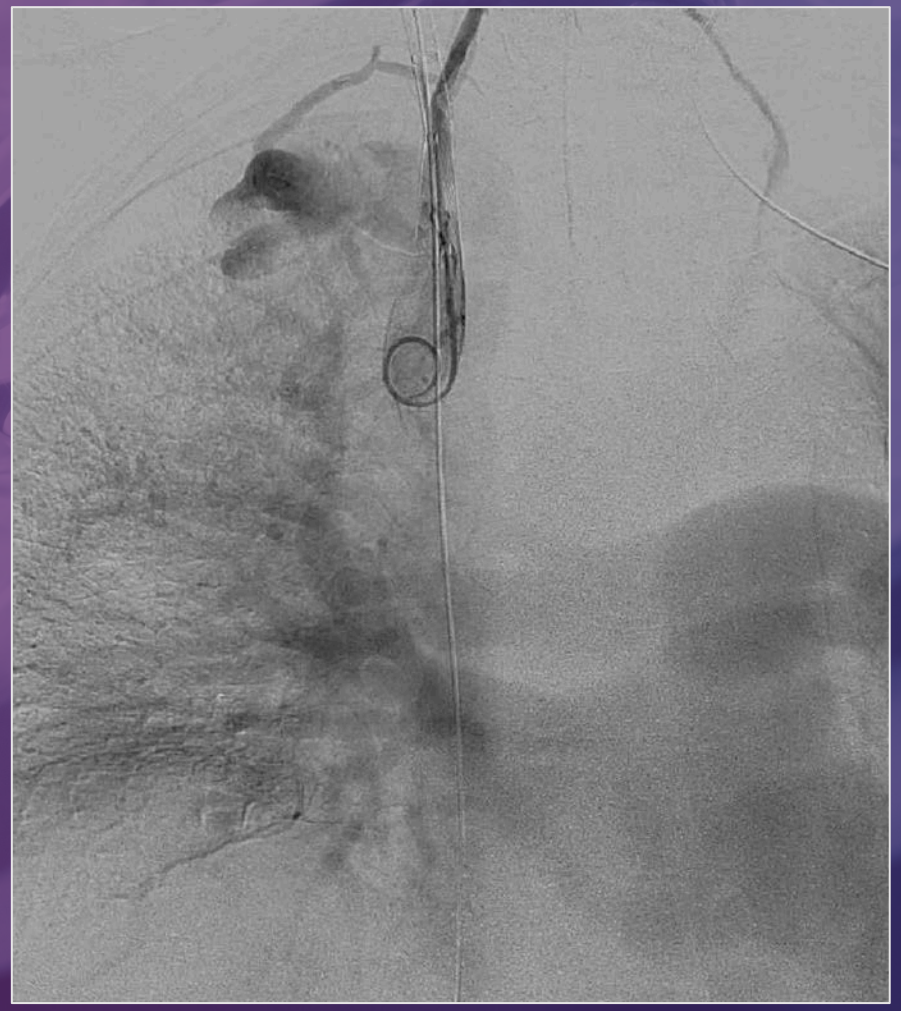

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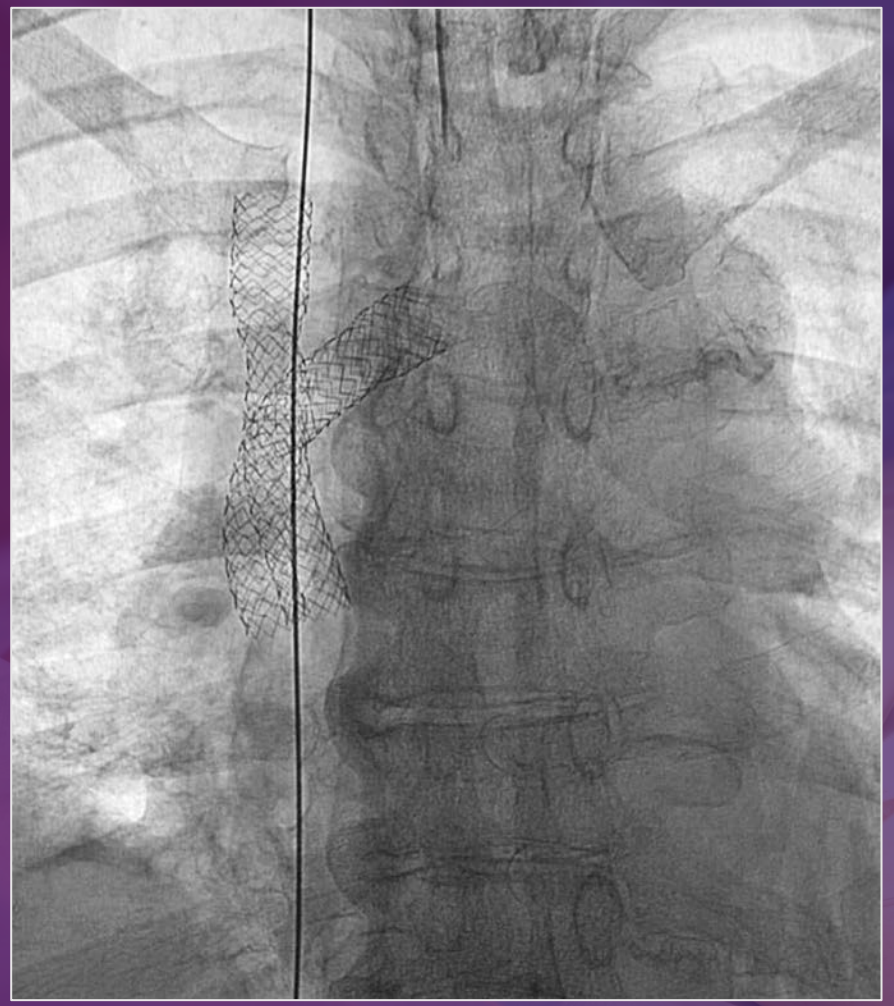

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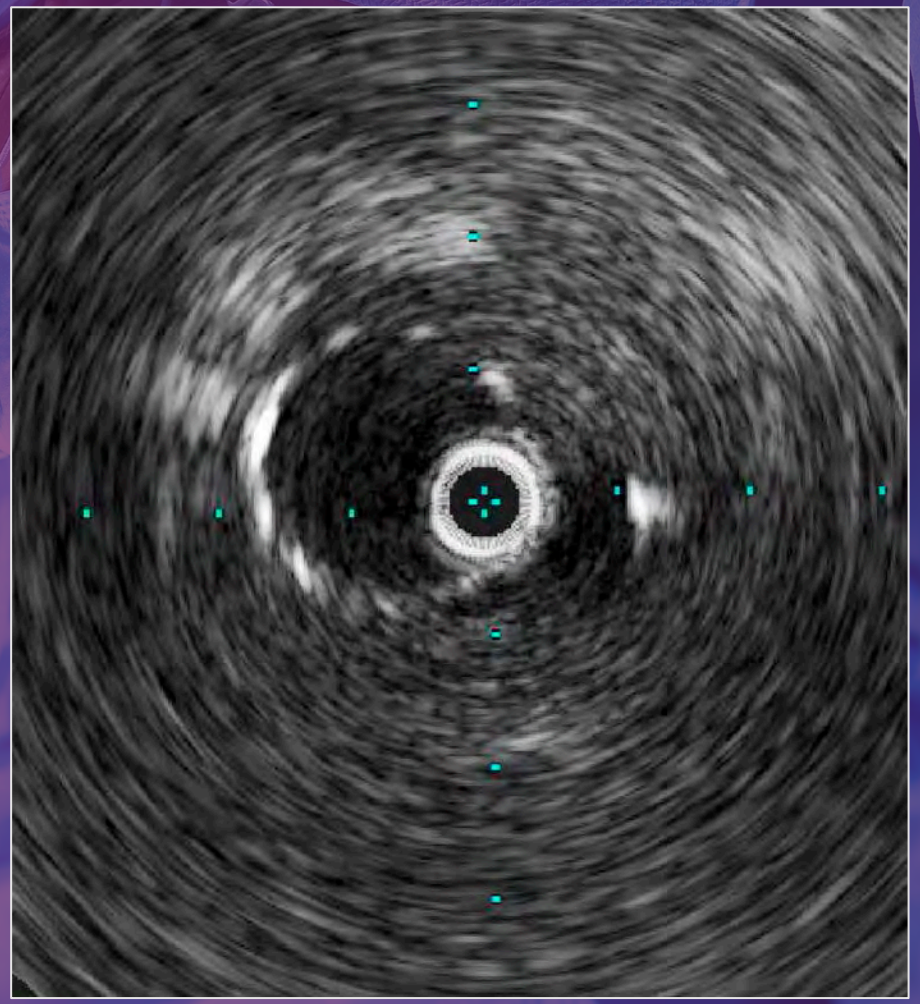

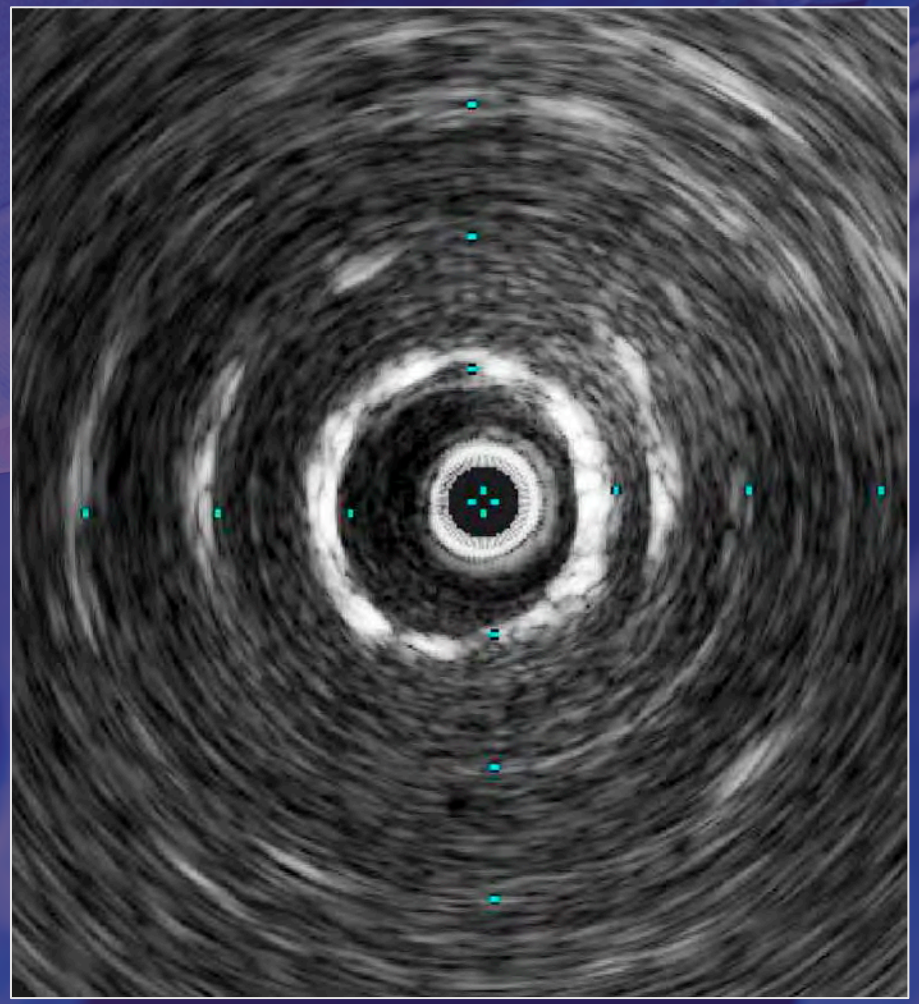

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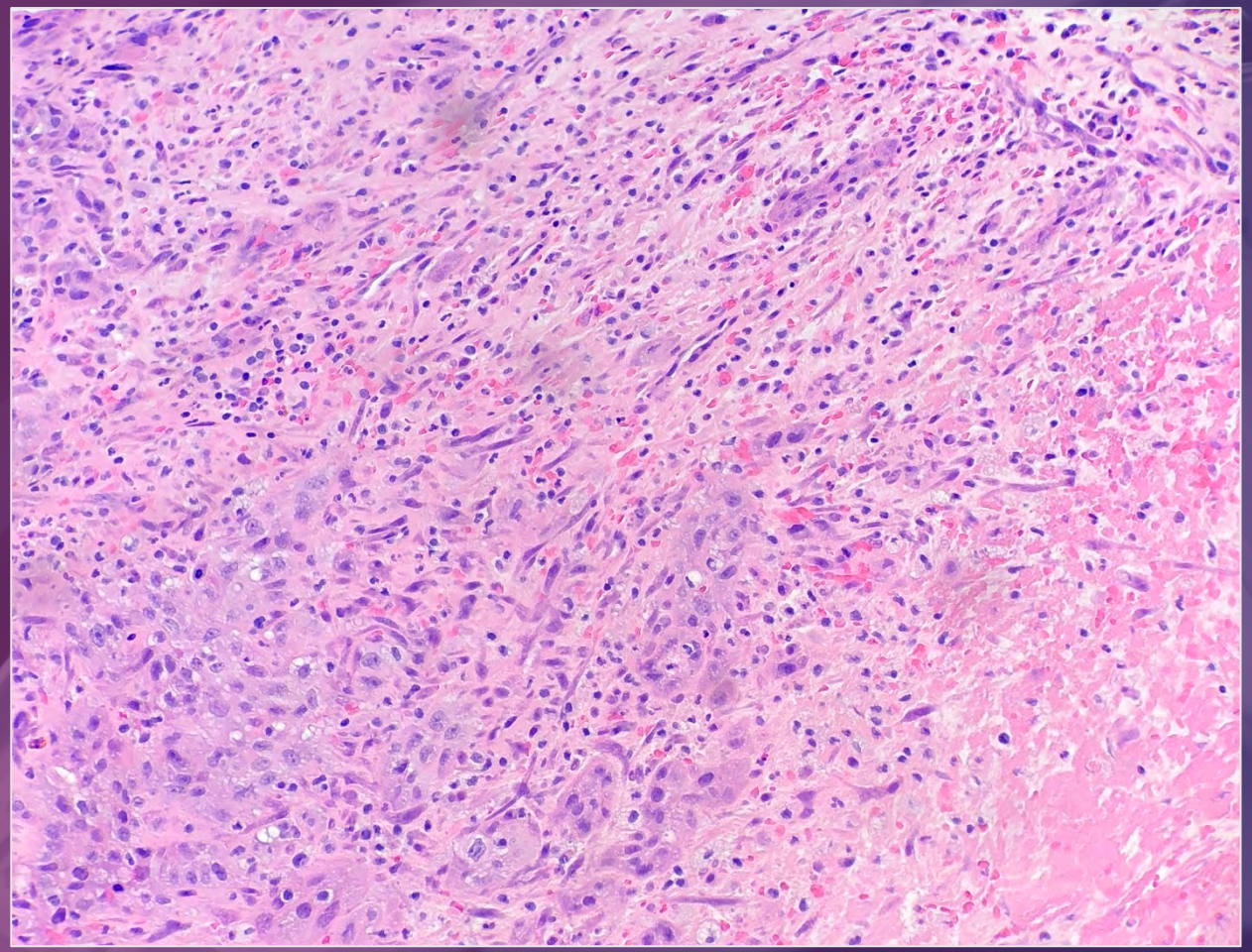
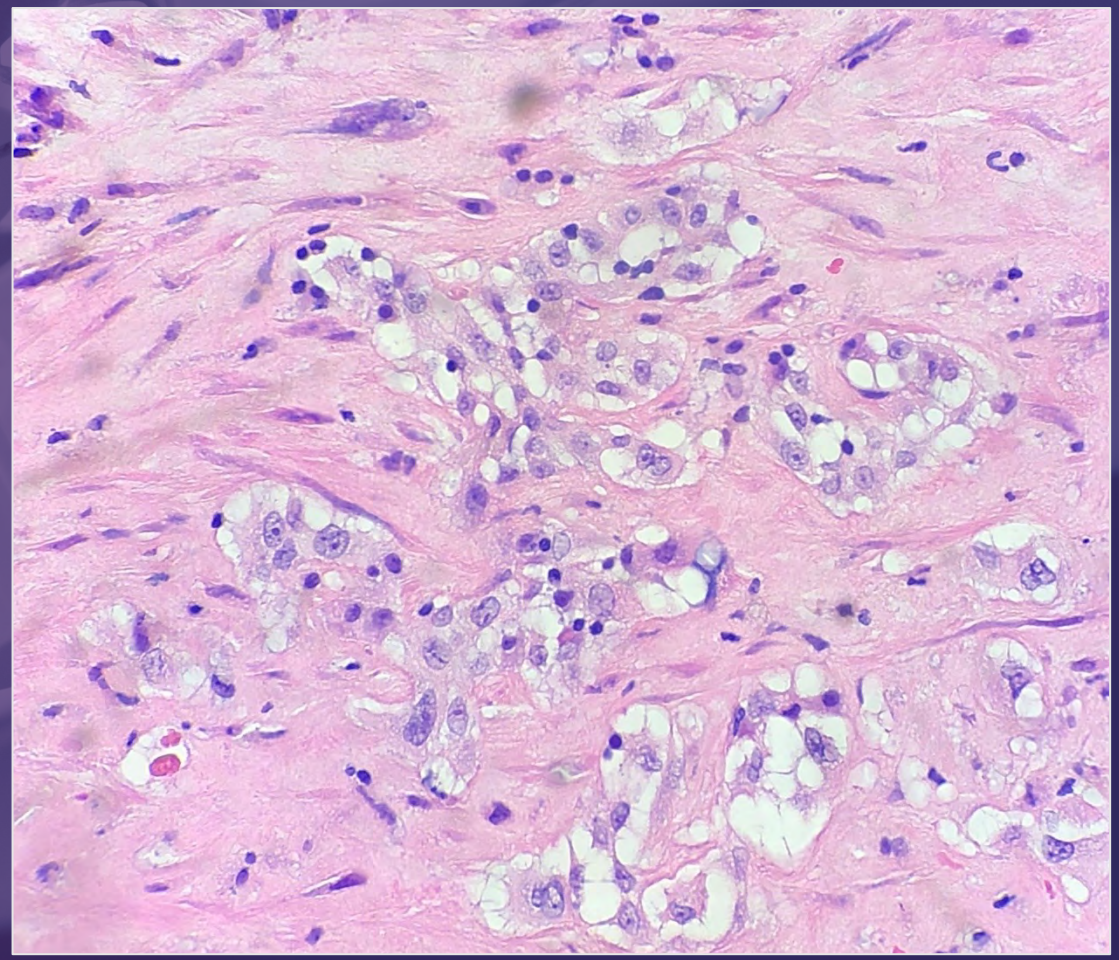




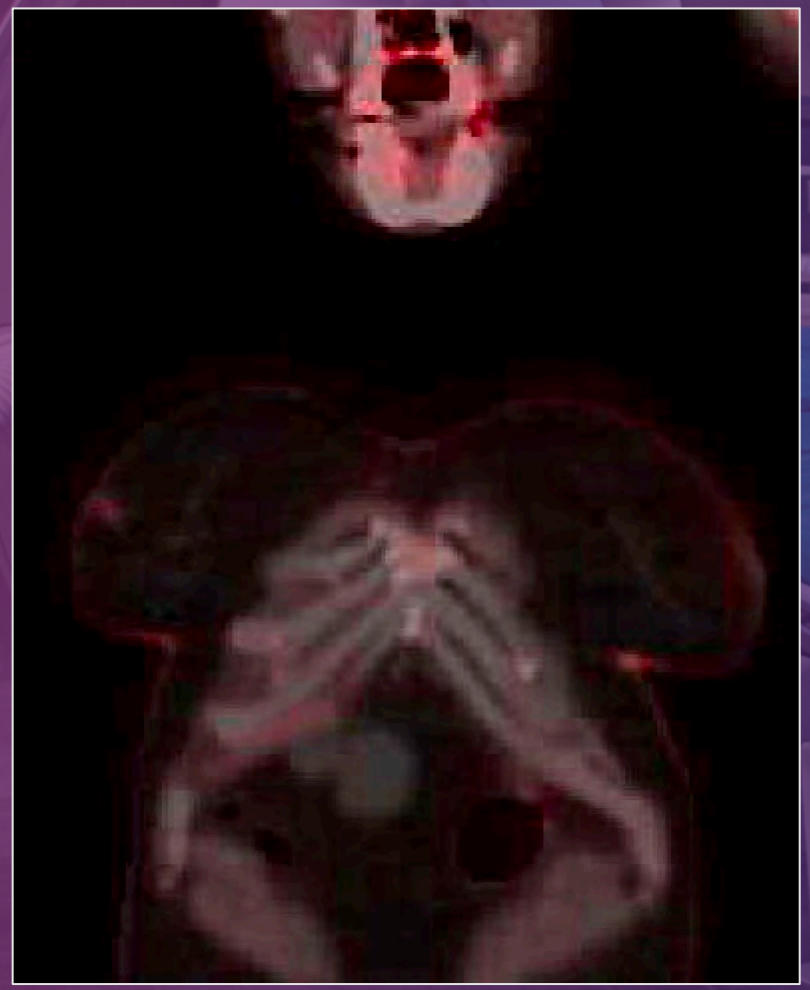
SUPERIOR VENA CAVA CASES

CASE 2

SUPERIOR VENA CAVA CASE 2

History of metastatic carcinoma of unknown origin with right, great than left, facial and upper extremity swelling for >40 days. Computed tomographic venography of the chest showed a large right upper lobe mass with extrinsic compression and (malignant) invasion of the superior vena cava.

SUPERIOR VENA CAVA CASE 2



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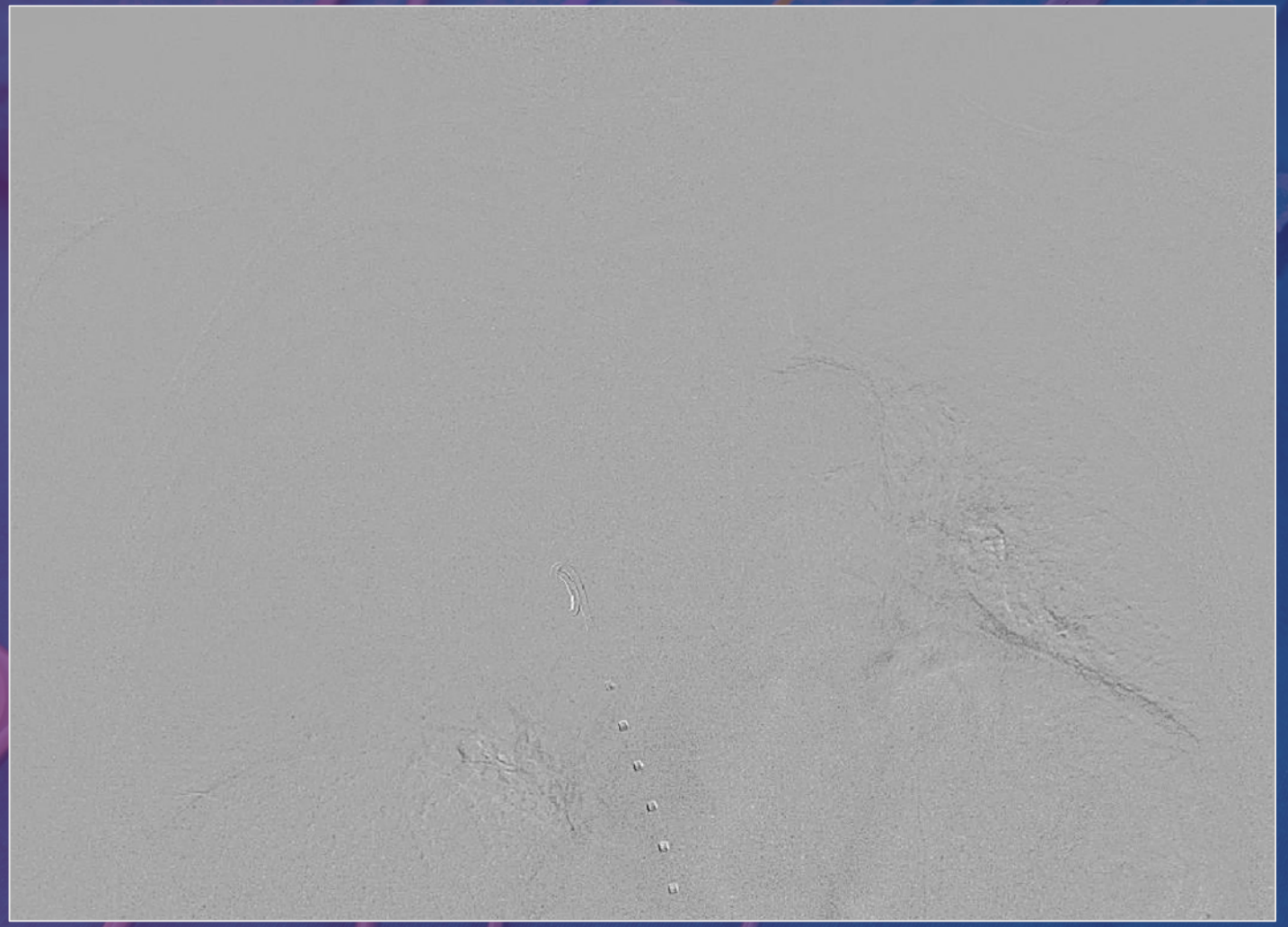

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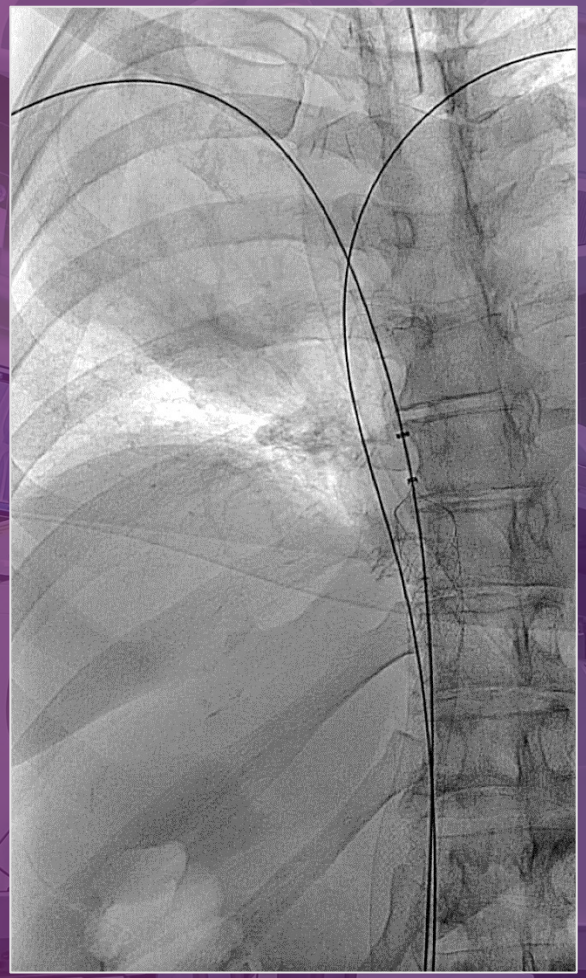

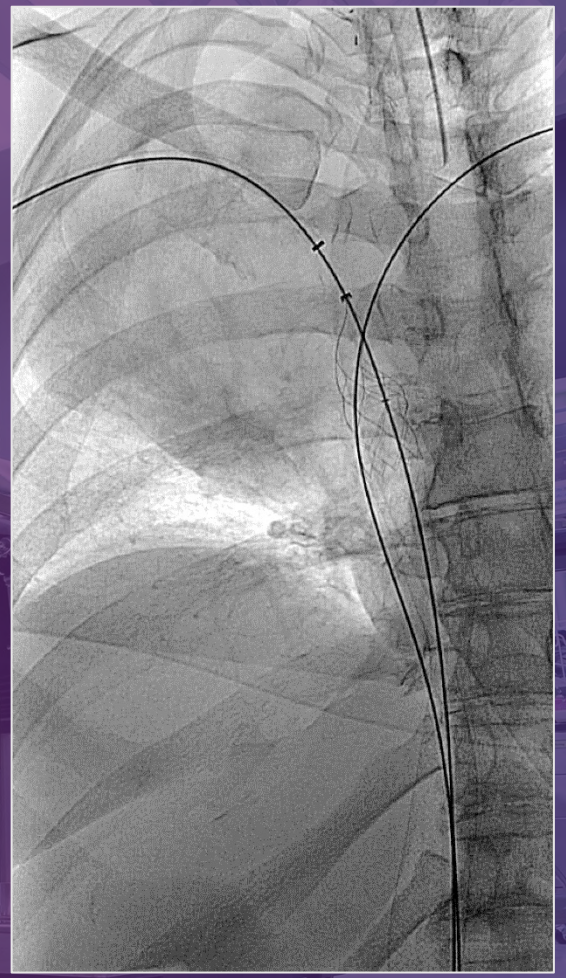

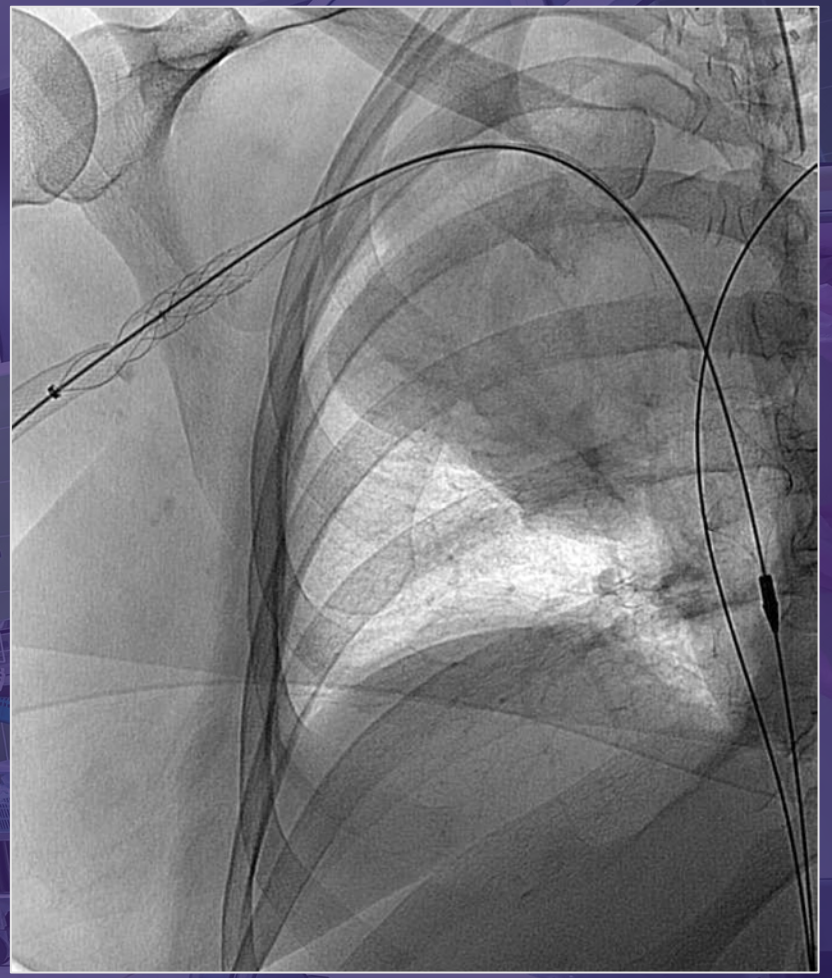

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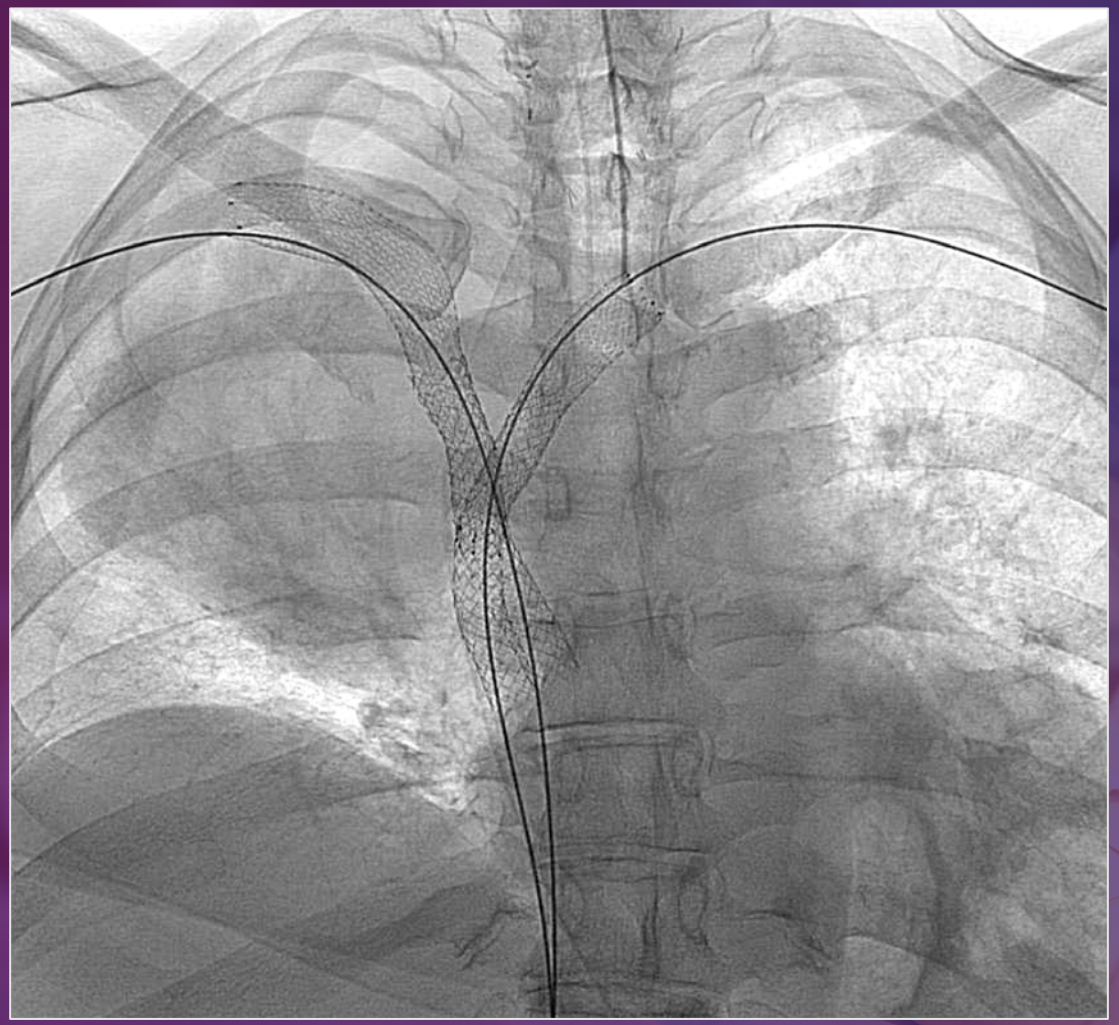

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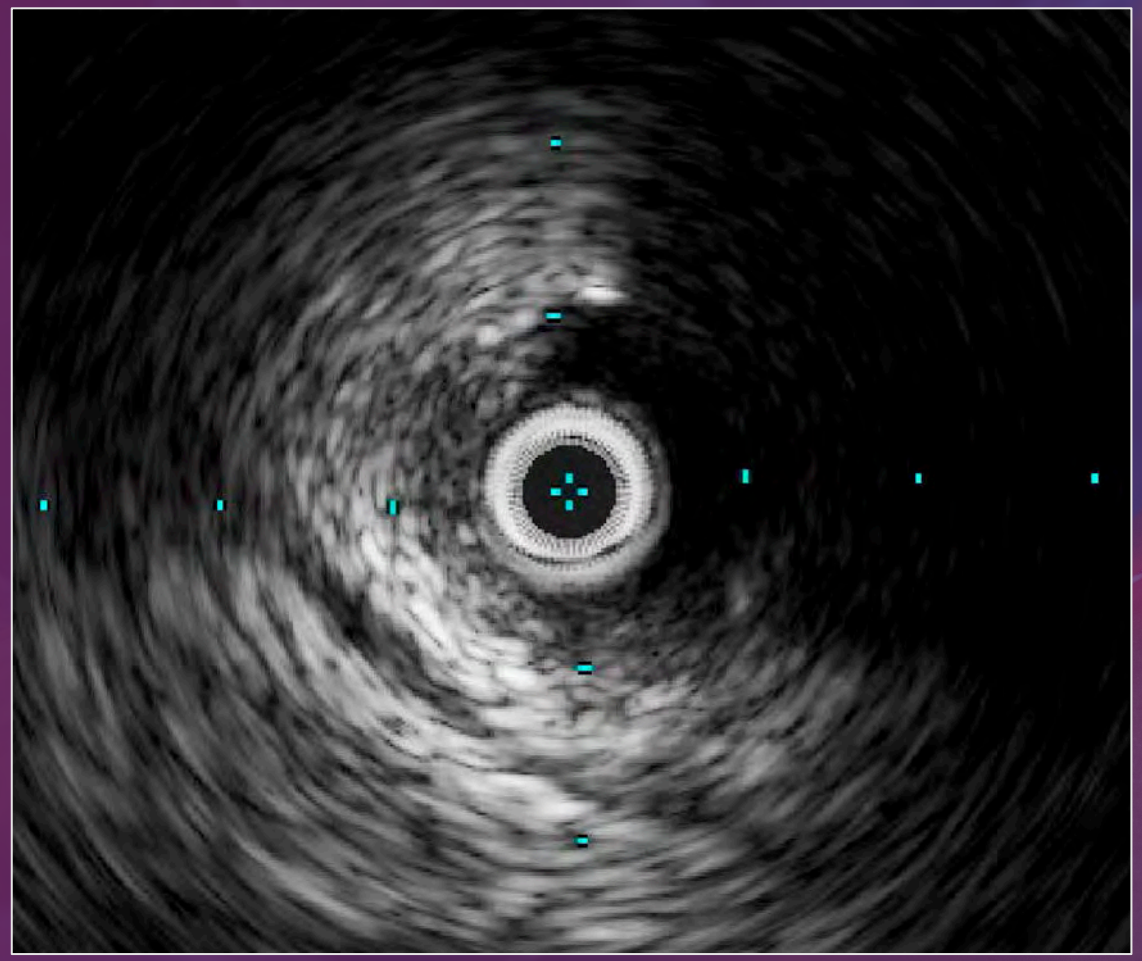

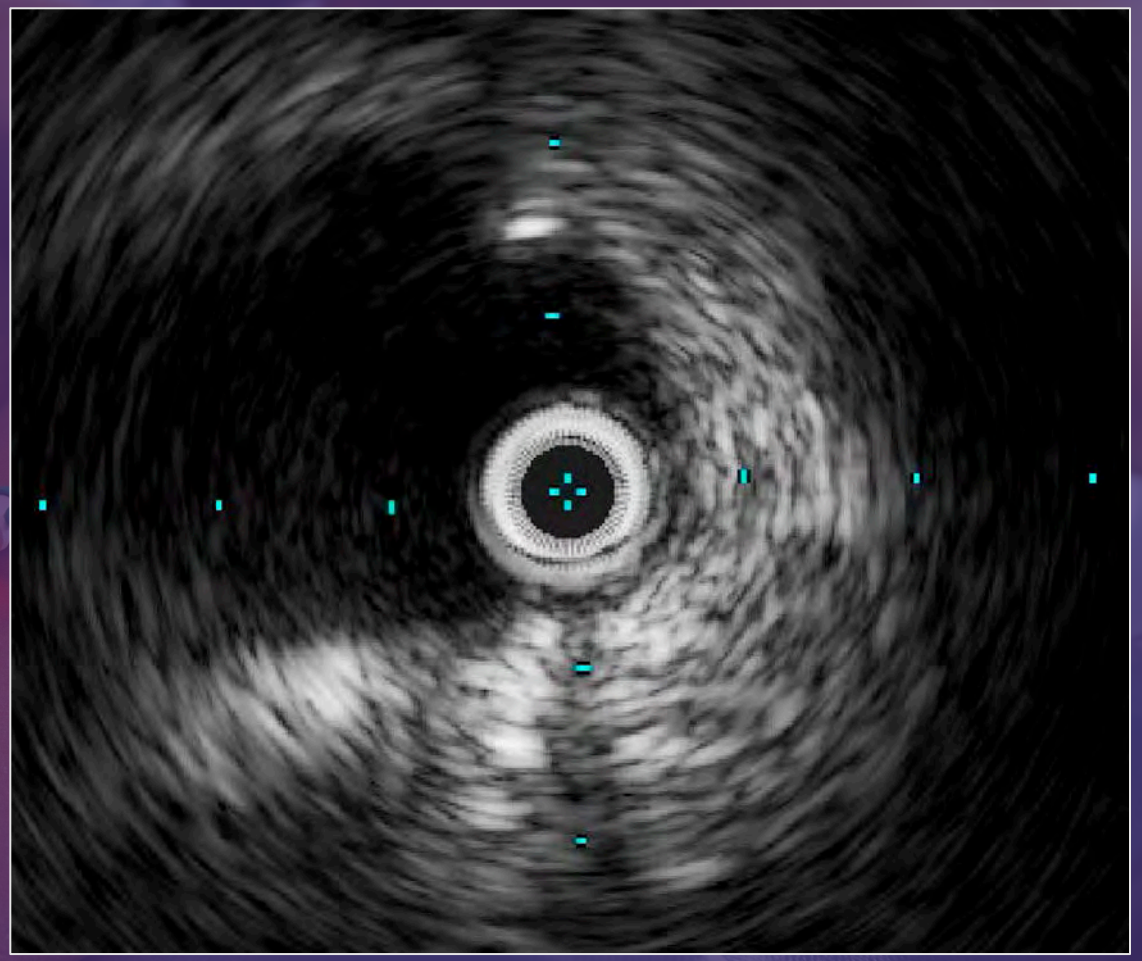

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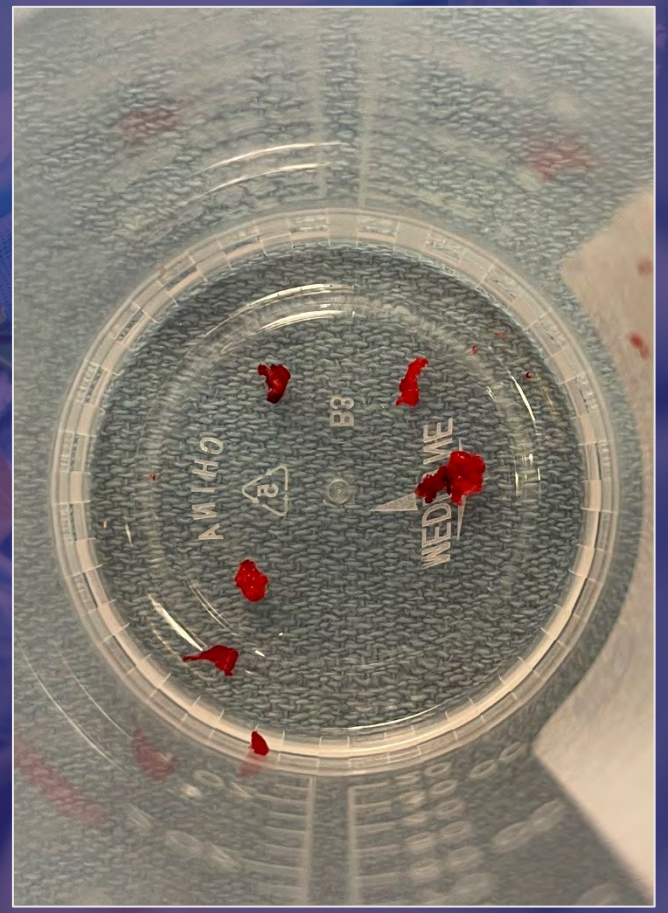

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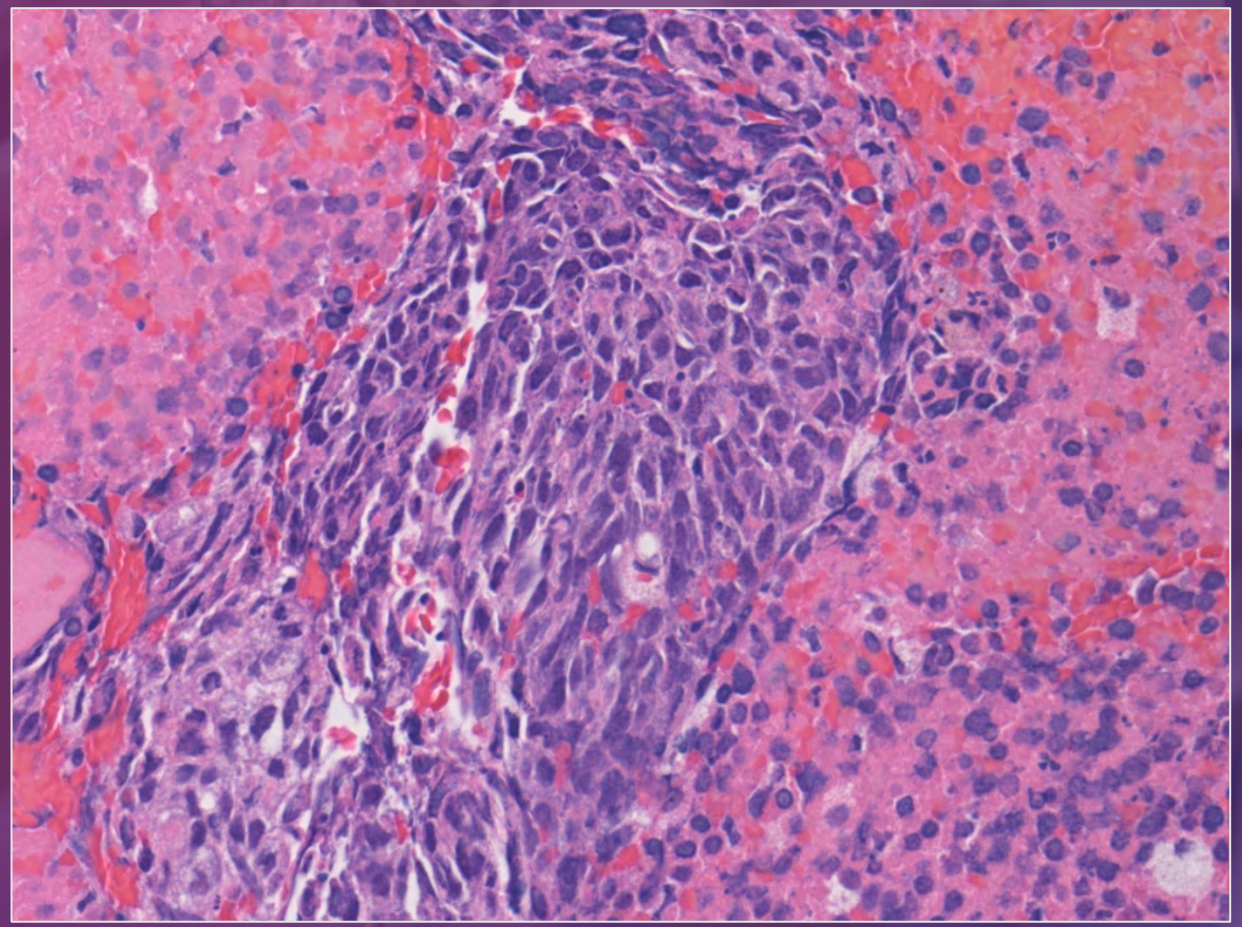
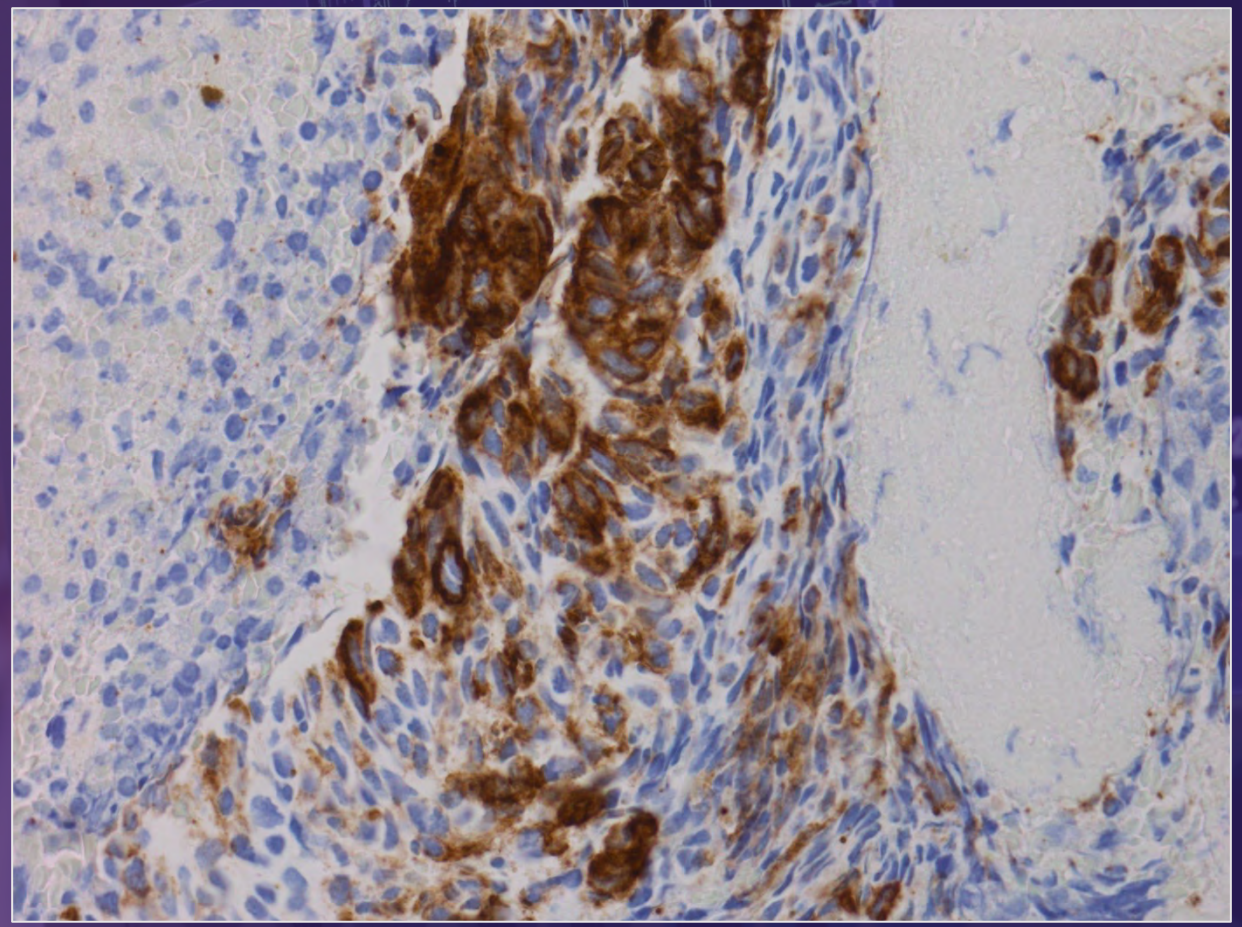




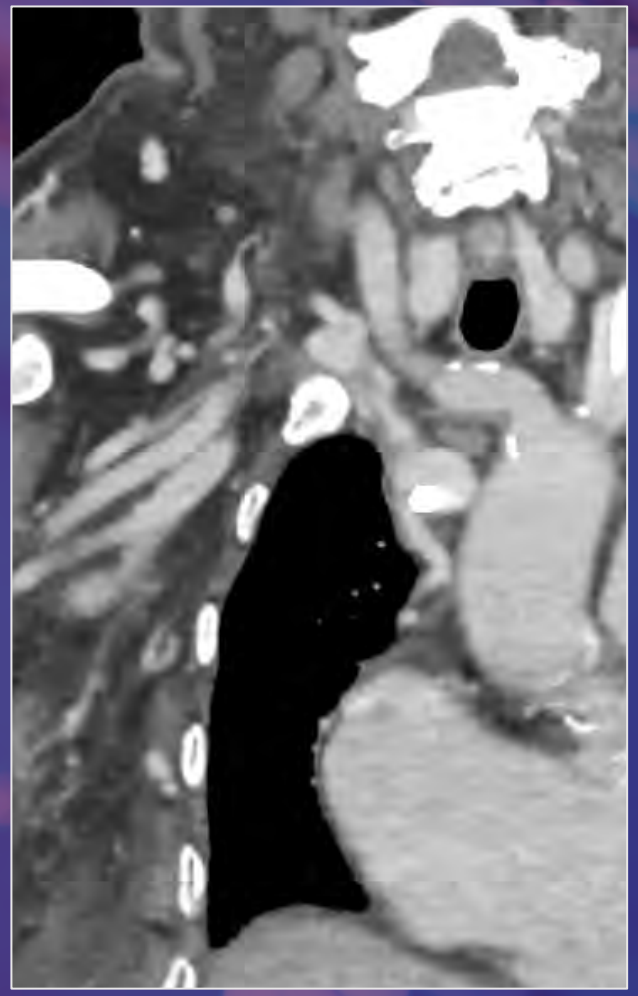
VENOUS BYPASS CASE 1

CASE 3

VENOUS BYPASS CASE 1

History of diabetes and end-stage renal disease with right brachial-to-axillary graft with axillosubclavian thrombosis, arm and facial swelling, and failed endovascular and open recanalizations.

VENOVENOUS BI-BYPASS



VENOVENOUS BI-BYPASS

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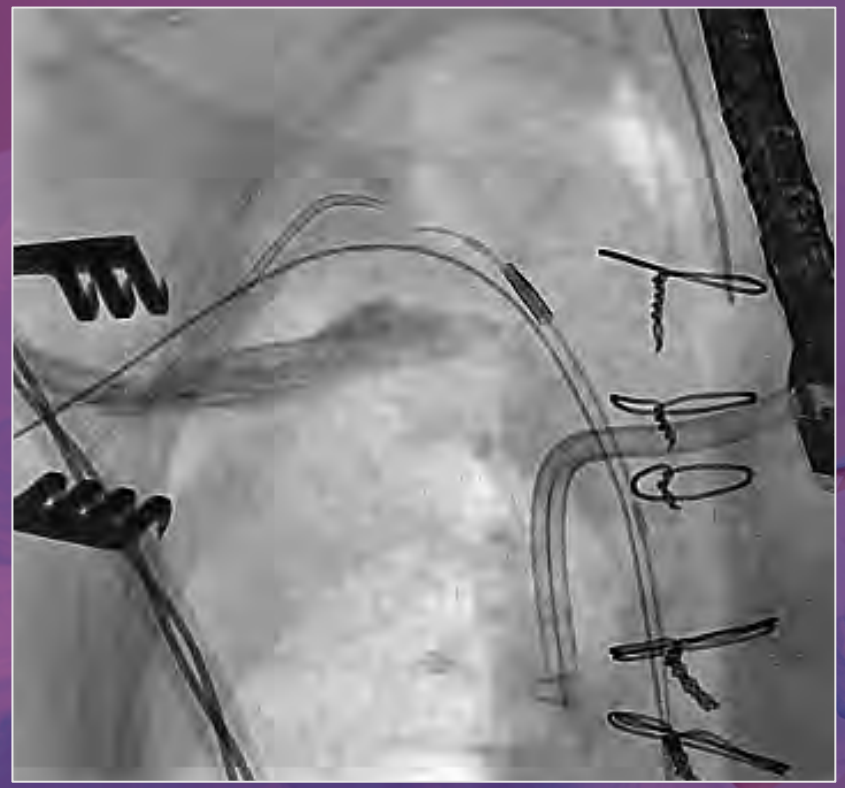

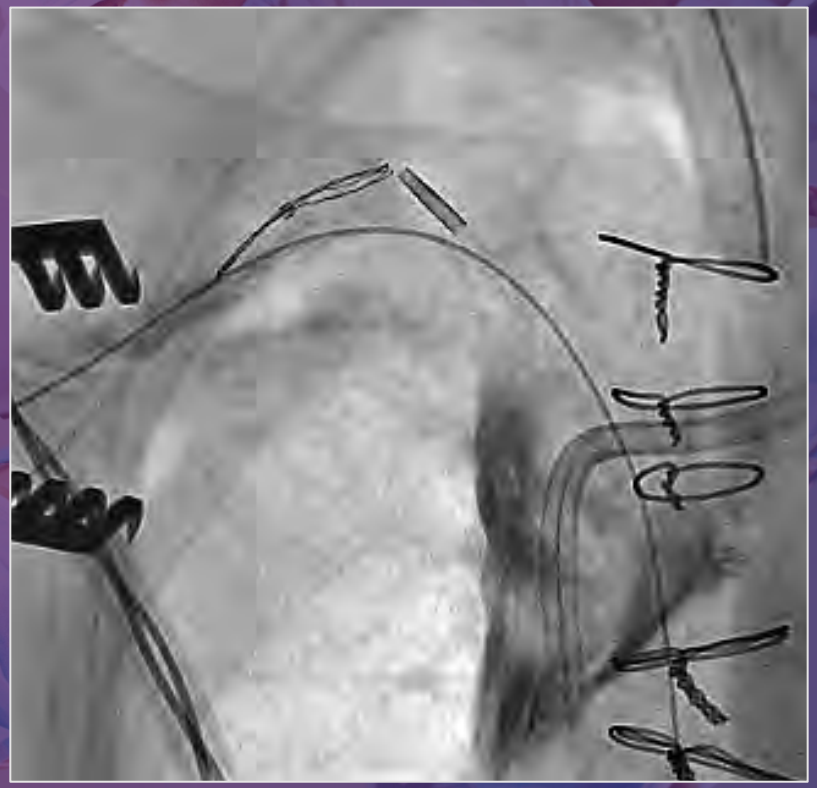

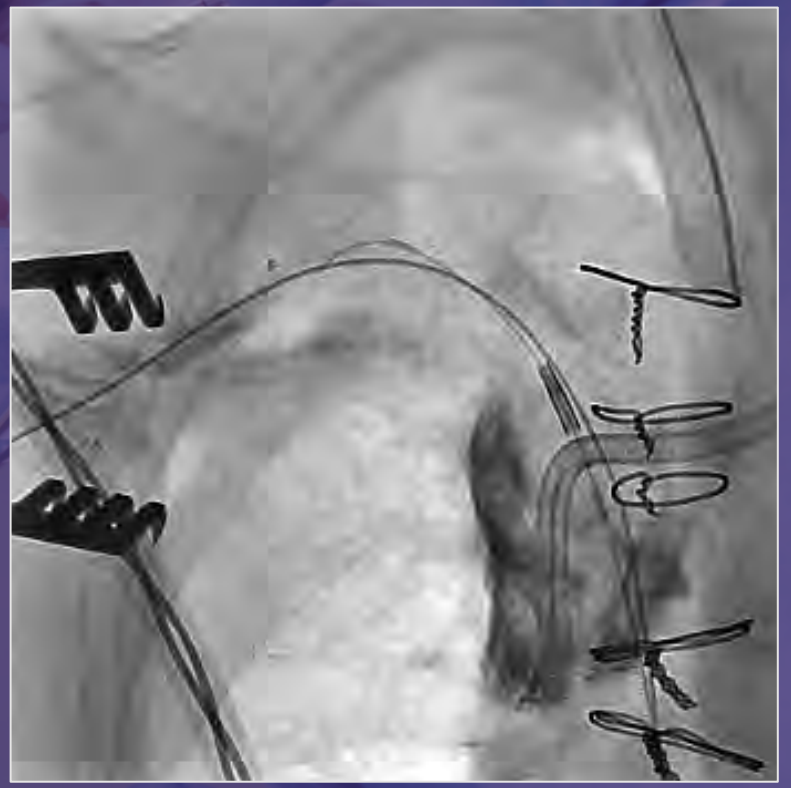

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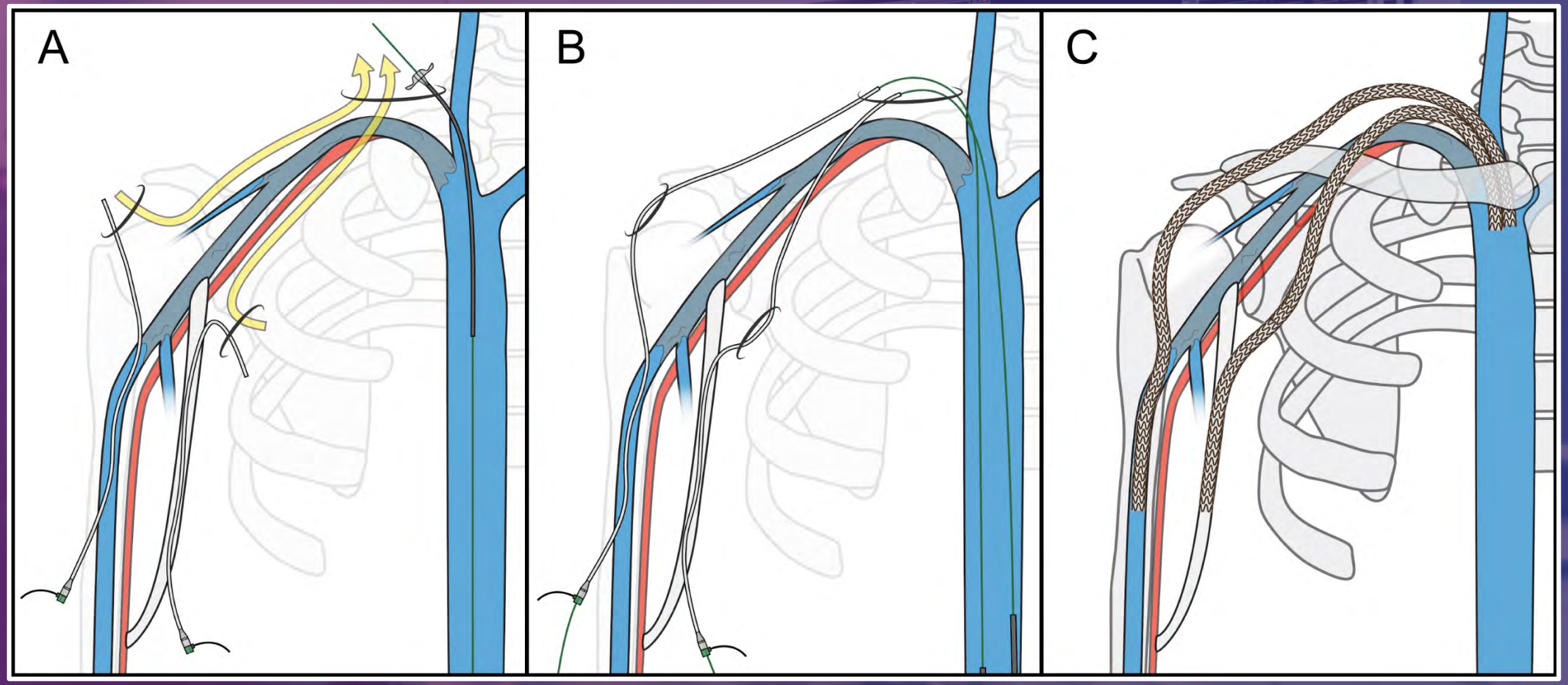

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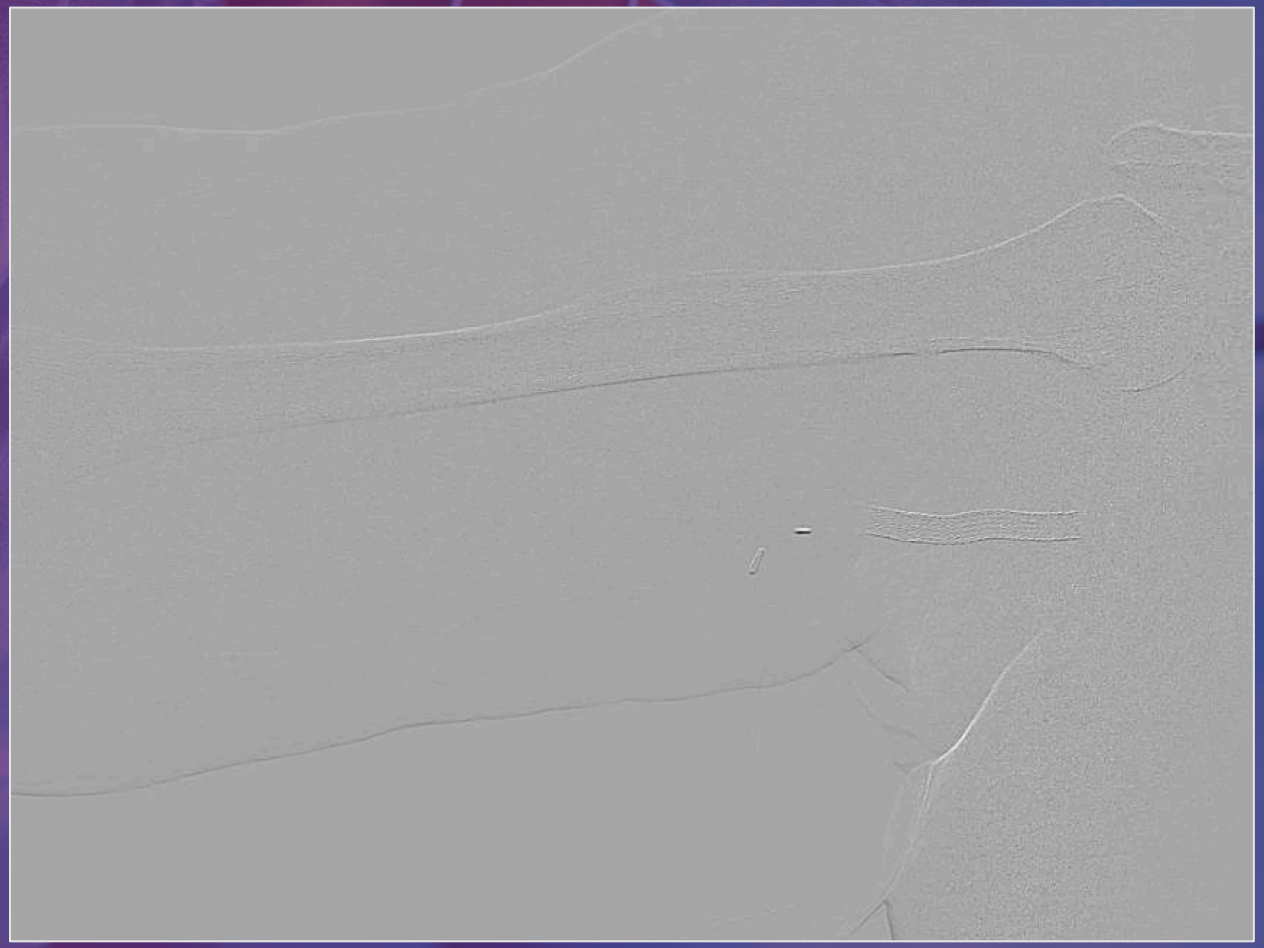

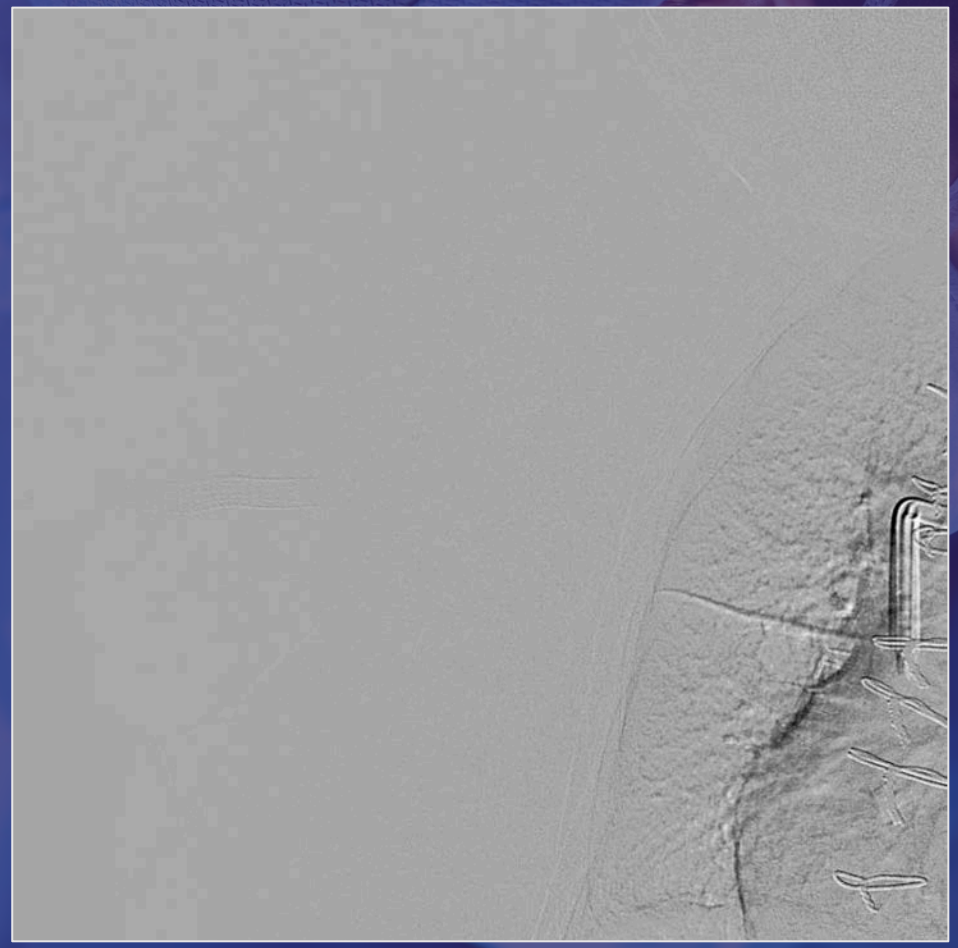

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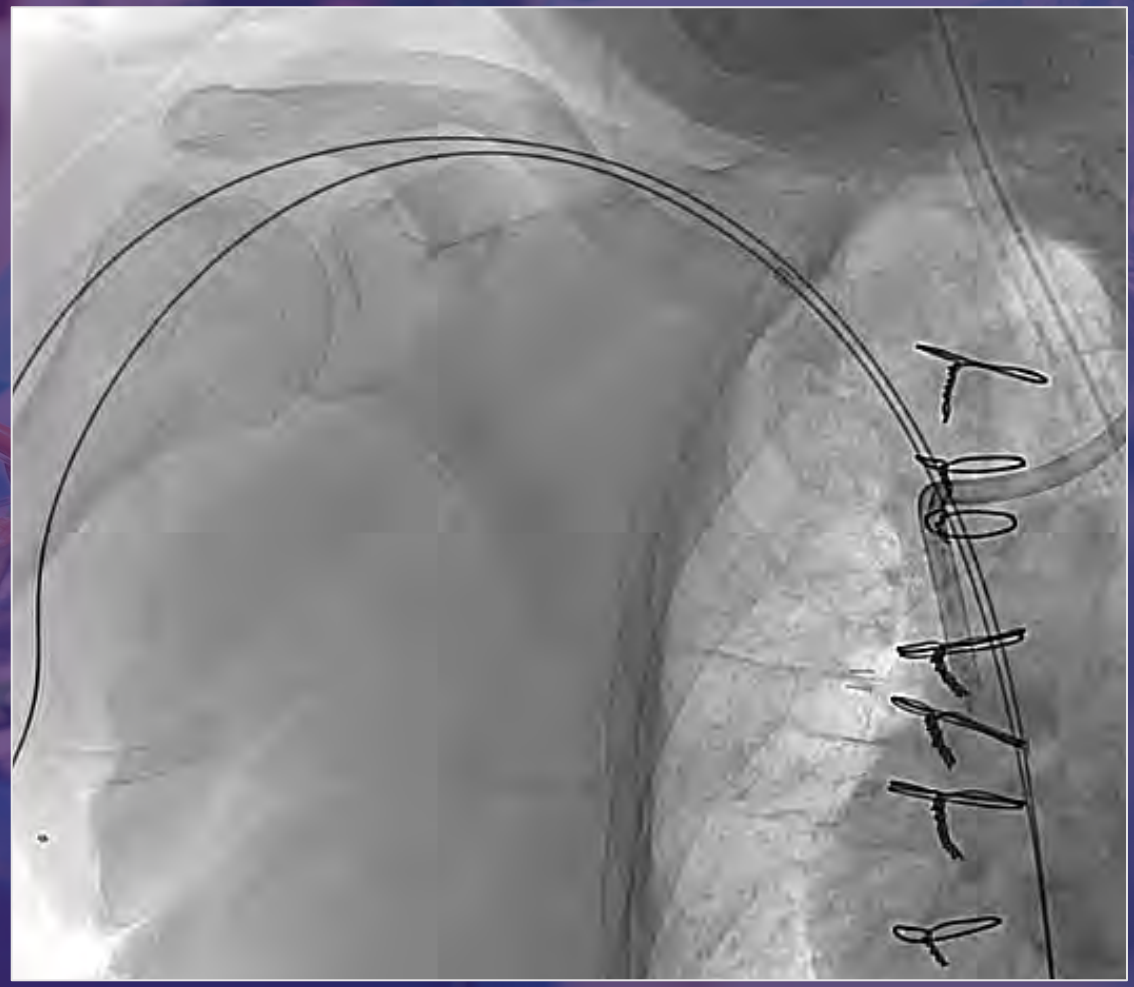

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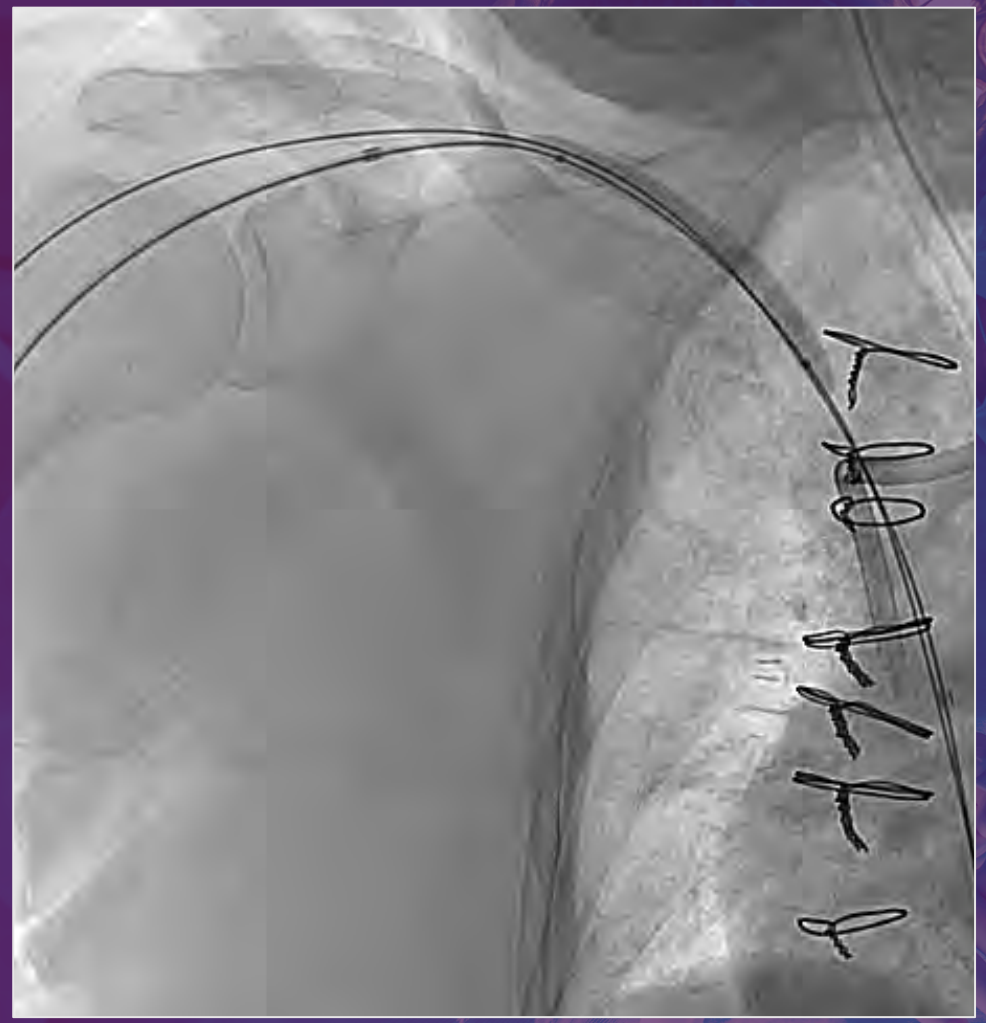

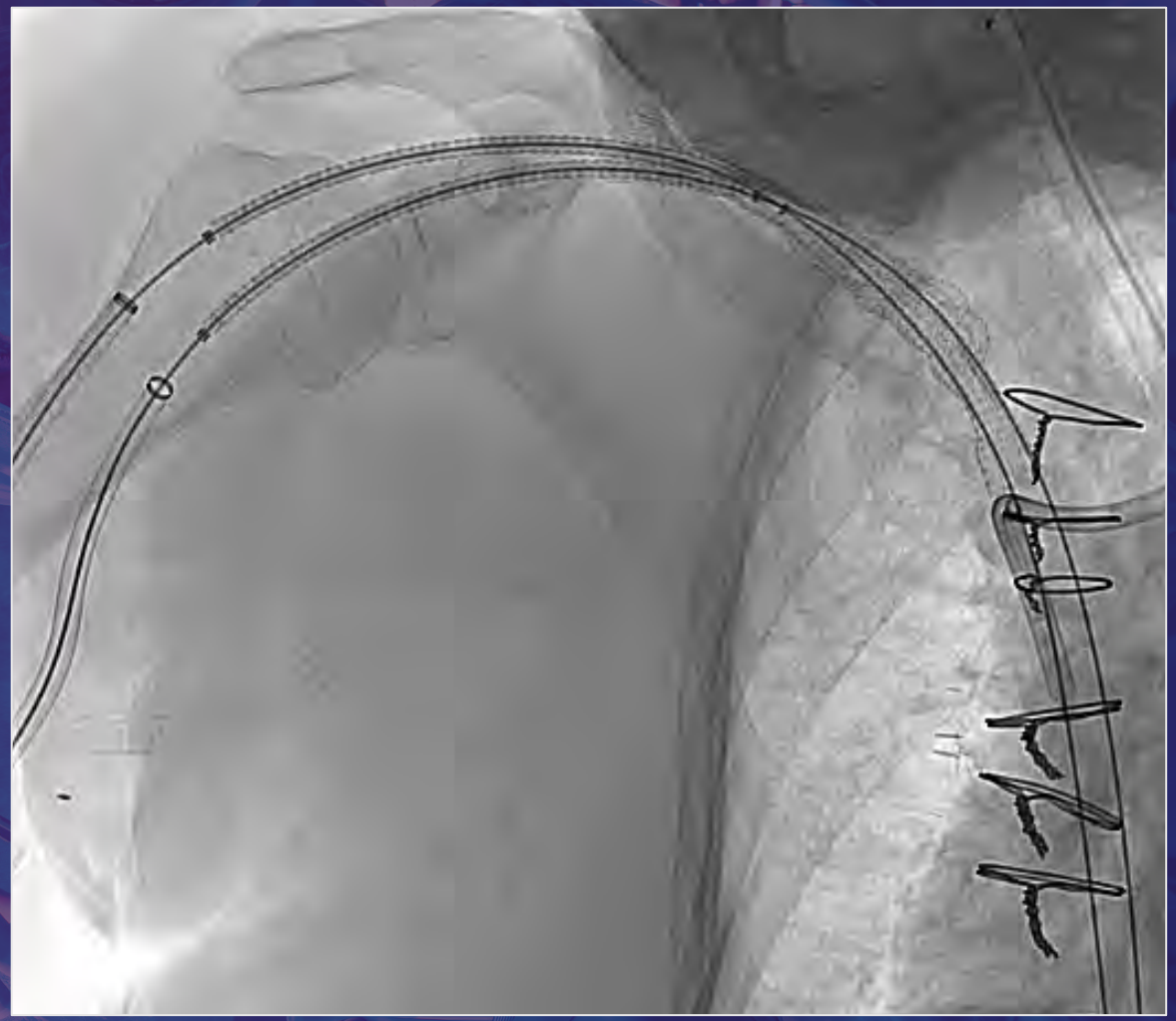

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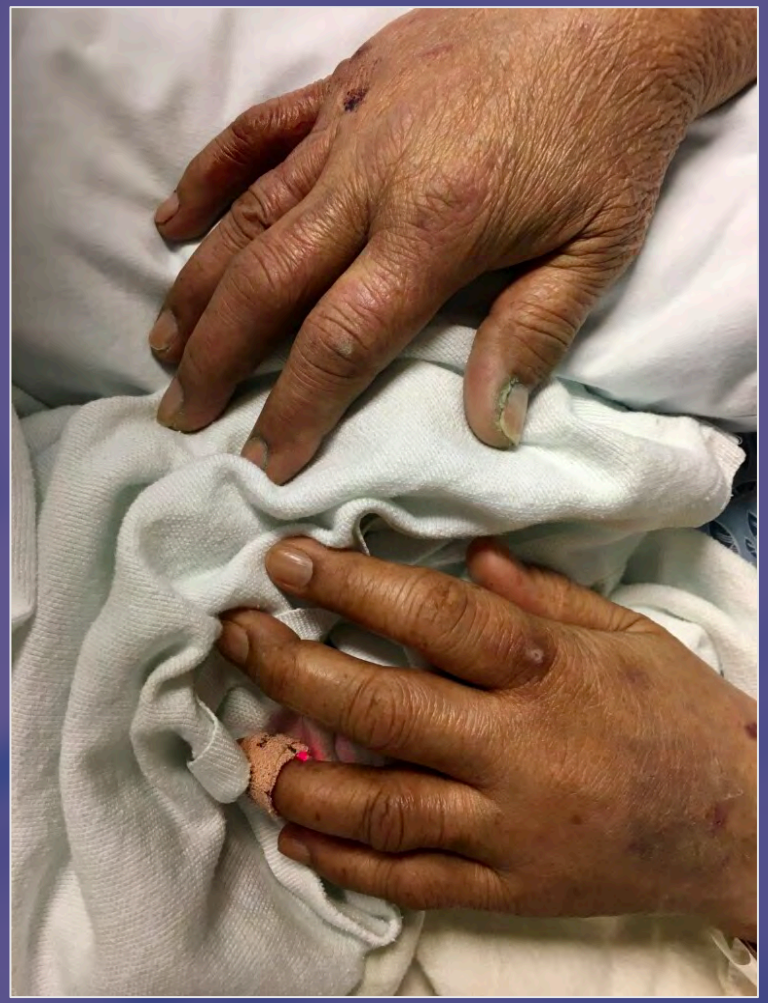

CONCLUSIONS

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- Background
- Indications
- Clinical evaluation
- Pre-procedural imaging

02

- Timing
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- Unique scenarios

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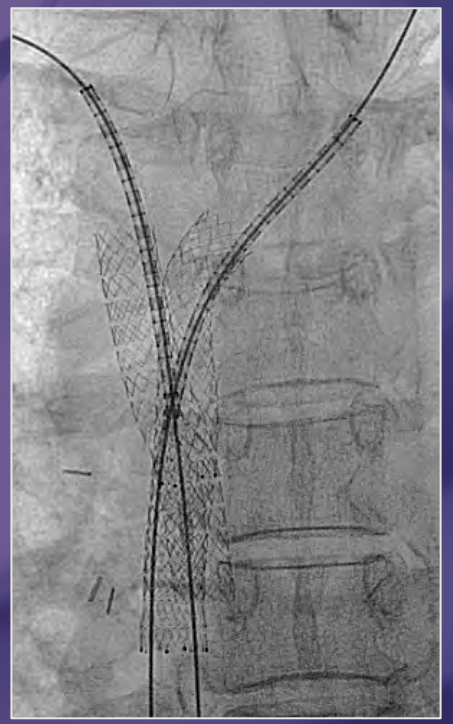

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SUGGESTED READING

Thrombectomy of Malignant Thoracic Central Venous Occlusive Disease Using Inari ClotTriever System

From: Frederic J. Bertino, MD
David S. Shin, MD
Eric J. Monroe, MD
Jason J. Siu, MD, PhD
Claudia C. Tench, MD, PhD
Jeffrey Forris Beecham Chick, MD, MPH
Section of Vascular and Interventional Radiology, Department of Radiology (F.J.B., D.S.S., E.J.M., J.F.B.C.), and Department of Laboratory Medicine and Pathology (J.J.S., C.C.T.) University of Washington 1959 Northeast Pacific Street Seattle, WA 98195

Editor:

Deep vein thrombosis of the upper extremities and thoracic central veins may lead to superior vena cava (SVC) syndrome, pulmonary embolism, and post-thrombotic syndrome (1). The Inari ClotTriever thrombectomy system (Inari Medical, Irvine, California) is a Food and Drug Administration–approved system for thrombus removal from the peripheral and central veins. The system allows for single-session thrombectomy in patients with contraindications to pharmacological thrombolytic therapies. The technical aspects and required equipment have been previously described (2). This report describes 2 patients who underwent thrombectomy for malignant thoracic central venous occlusive disease due to papillary thyroid and lung cancers using the ClotTriever system with technical and clinical successes. This series was conducted with an institutional review board approval and complied with the Health Insurance Portability and Accountability Act.

Patient 1 was a 65-year-old woman with papillary thyroid cancer who developed swelling and plethora of her face and neck for 11 days. Computed tomographic venography demonstrated mediastinal lymphadenopathy with thrombotic involvement of the SVC. The patient presented for recanalization, thrombectomy, and stent reconstruction.

Under general anesthesia (institutional preference), access to the right internal jugular and left brachial veins was obtained. Bilateral venography demonstrated >80% stenosis of the SVC with associated thrombus. Recanalization was performed to establish guide wire access to the inferior vena cava (IVC). Angioplasty was performed before thrombectomy with an 8-mm balloon. The 13-F ClotTriever thrombectomy system was then placed via the right internal jugular vein, and mechanical thrombectomy of the SVC, right brachiocephalic vein, and right internal jugular vein was performed. The extracted thrombus was sent for pathologic analysis (Fig 1a). Venography after thrombectomy showed a persistent extrinsic compression of the SVC. Reconstruction of the SVC and bilateral brachiocephalic veins was performed using two 10-mm × 79-mm VBX stent-grafts (W.L. Gore & Associates, Flagstaff, Arizona) in a double-barrel configuration. Bilateral venography after deployment showed brisk in-line flow through the stent-graft reconstructions to the right atrium. Intravascular ultrasound evaluation demonstrated well-expanded stent-grafts. Hemostasis was obtained using purse-string suture techniques.

The patient was discharged on enoxaparin 1 mg/kg twice daily and aspirin 81 mg daily. The immunohistochemistry on the extracted thrombi was positive for AE1/AE3, CF68, PAX8, and TTF1, diagnostic of thyroid carcinoma (Fig 1b). The patient was seen on day 37 after the procedure and reported resolution of the swelling and plethora. Venous duplex sonography and computed tomographic venography, performed on day 55 after the procedure, showed patency of the upper-extremity veins and brachiocephalic-vein-to-SVC stent-graft constructs.

Patient 2 was a 63-year-old woman with non–small cell lung cancer who developed right-greater-than-left swelling and pain of her face and arms for >30 days. Computed tomographic venography revealed a 12.4-cm × 10.4-cm right upper lobe mass with the occlusion of the right brachiocephalic vein and SVC. The patient presented for recanalization, thrombectomy, and stent reconstruction.

Under general anesthesia, access to the right and left brachial veins was obtained. Bilateral venography demonstrated right subclavian and right brachiocephalic vein occlusion, with >80% SVC stenosis (Fig 2a). Recanalization was performed to establish wire access down the IVC. Angioplasty was performed before thrombectomy with an 8-mm balloon. The ClotTriever thrombectomy system was then placed via the right brachial vein, and thrombectomy of the SVC, right brachiocephalic vein, and right subclavian vein was performed (Fig 2b). Venography after thrombectomy showed a persistent extrinsic compression of the SVC, right brachiocephalic vein, and right subclavian vein. Reconstruction of the SVC and bilateral brachiocephalic veins was performed using two, side-by-side, 10-mm × 79-mm VBX stent-grafts. A 13-mm × 100-mm VIABAHN stent-graft (W.L. Gore & Associates) and a 12-mm × 60-mm VICI stent (Boston Scientific, Marlborough, Massachusetts) were then deployed in overlapping fashions to the right subclavian and left brachiocephalic veins, respectively. Bilateral upper-extremity venography after the deployment showed brisk in-line flow through the stent/stent-graft constructs to the right atrium

J.F.B.C.'s e-mail: [redacted]

E.J.M. is a scientific advisor and speaker for Biogen. J.F.B.C. is a consultant and speaker for Inari Medical, Overtel, C. R. Bard, Argon Medical Devices, and Boston Scientific. None of the other authors have identified a conflict of interest.

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LETTER TO THE EDITOR — VENOUS INTERVENTIONS

Large-Bore Thrombectomy Using Inari Triever Aspiration Catheter for Thrombosed Aneurysmal Hemodialysis Access Outflow Vein

Matthew Abad-Santos[1] · Andrew J. Woerner[1] · Jeffrey Forris Beecham Chick[1] · David S. Shin[1]

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Editor

Outflow vein aneurysms are common in long-standing arteriovenous hemodialysis accesses and may pose challenges in endovascular treatment of a thrombosed circuit [1]. These aneurysmal segments are often difficult to clear adequately, leading to failed thrombectomy, pulmonary embolism, and access site abandonment [2]. The FlowTriever System (Inari Medical; Irvine, California) is designed for treatment of venous thromboembolism in the peripheral vasculature and pulmonary arteries. This report describes the use of a 20-French Triever Aspiration Catheter in a hemodialysis circuit to perform thrombectomy of a thrombosed outflow venous aneurysm.

Institutional review board approval was not required for preparation of this report. A 40-year-old woman on hemodialysis via a right brachial-axillary arteriovenous graft (AVG) created two years prior presented with recurrent graft thrombosis within the past 4 weeks.

The procedure was performed under general anesthesia given a history of pulmonary hypertension (institutional requirement). Ultrasound demonstrated thrombosis of the 6-mm AVG with the thrombus extending centrally into an aneurysmal brachioaxillary outflow vein segment measuring up to 2.8 cm. A 25-gauge needle was used to inject 6 mg of tissue plasminogen activator within the AVG and venous aneurysm. The right internal jugular vein was accessed to establish a retrograde route into the outflow vein (Fig. 1A). Given the thrombus burden within the aneurysm, the decision was made to perform a large-bore thrombectomy. Over a stiff wire, a 20-French DrySeal Flex Introducer Sheath (W. L. Gore & Associates, Flagstaff, Arizona) was advanced into the axillary vein. A 20-French Triever Aspiration Catheter (Triever20) was advanced to the central end of the thrombus (Fig. 1B). Three aspirations were performed. No nitinol mesh disks were used. Post-thrombectomy venography was performed (Fig. 1C and D), demonstrating complete removal of the original thrombus in the venous aneurysm and mobilization of a small clot from a more peripheral segment. The Triever 20 was removed, and retrograde access to the arterial anastomosis was obtained. Following a balloon sweep across the arterial anastomosis and AVG, circuit patency was restored. Two 8-mm Covera stent-grafts (Bard Medical; Covington, Georgia) were deployed in an overlapping fashion across the venous anastomosis to address the underlying high-grade (> 50%) stenosis (Fig. 1E). Following angioplasty using an 8-mm balloon throughout the AVG and stent-graft construct, completion angiography demonstrated a widely patent circuit (Fig. 1F). Hemostasis was achieved with manual compression. No neck hematoma was noted, and the patient completed multiple sessions of hemodialysis successfully prior to discharge.

In treating a thrombosed aneurysmal segment, simple balloon maceration and mobilization of thrombus through a smaller central venous segment may be ineffective and time consuming [3]. Aggressive manipulation of thrombus may lead to clinically significant pulmonary emboli [2], which is an important consideration especially in patients with

David S. Shin
dsshin@uw.edu

1 Section of Vascular and Interventional Radiology, Department of Radiology, University of Washington, 1959 Northeast Pacific Street, Seattle, WA 98195, USA

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CIRSE

LETTER TO THE EDITOR — TIPS

Portomesenteric Venous Thrombectomy Using Inari Triever Aspiration Catheter (FlowTriever)

David S. Shin[1,2] · Eric J. Monroe[3] · Frederic J. Bertino[4] · Matthew Abad-Santos[1] · Aaron Abajian[1] · Jeffrey Forris Beecham Chick[1,2]

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Introduction

Portomesenteric venous thrombosis (PMVT) may occur in individuals with hypercoagulability, cirrhosis, bowel infection, or malignancy [1]. The mainstay therapy for bland PMVT has been anticoagulation, with additional interventions, including catheter-directed thrombolysis and thrombectomy with possible transjugular intrahepatic portosystemic shunt (TIPS) creation, reserved for refractory cases [1]. This report describes three patients with PMVT treated with large-bore thrombectomy using the Inari Triever Aspiration Catheter (FlowTriever; Inari Medical; Irvine, CA). Institutional review board approval was obtained for this report.

Patient 1

A 59-year-old male with a history of hepatitis C cirrhosis presented with hematemesis. Contrast-enhanced computed tomography (CECT) of the abdomen showed cirrhosis, gastroesophageal varices, and non-occlusive thrombus within the superior mesenteric, main portal, and right portal veins. Under general anesthesia (institutional preference), a TIPS was created using an 8–10-mm × 7-cm (covered) / 2-cm (uncovered) Viatorr stent graft (W. L. Gore & Associates; Newark, DE), which was expanded to 8-mm. Post-placement portomesenteric venography confirmed persistent non-occlusive thrombus at the portomesenteric confluence (Fig. 1A). Using a bareback technique via the left internal jugular vein, a T20 Triever Aspiration Catheter was advanced through the TIPS and positioned at the thrombus. Suction thrombectomy was then performed (Fig. 1B). Follow-up portomesenteric venography demonstrated the removal of thrombus with brisk flow through the TIPS (Figs. 1C and 1D).

Patient 2

A 60-year-old male with history of alcoholic cirrhosis, status post TIPS creation for refractory ascites, presented 183 days later with recurrent ascites and duplex ultrasound findings indicating TIPS thrombosis. Under general anesthesia, a 22-French DrySeal Flex Introducer Sheath (W. L. Gore & Associates) was placed via the right common femoral vein, given no suitable large-bore access from the neck or upper extremities due to a prior thoracic central venous stent reconstruction. Aspiration thrombectomy

Jeffrey Forris Beecham Chick
jeffreychick@gmail.com

1 Department of Radiology, Section of Vascular and Interventional Radiology, University of Washington, 1959 Northeast Pacific Street, Seattle, WA 98195, USA

2 The Deep Vein Institute, University of Washington, 1959 Northeast Pacific Street, Seattle, WA 98195, USA

3 Department of Radiology, Section of Vascular and Interventional Radiology, University of Wisconsin, 600 Highland Avenue, Madison, WI 53792, USA

4 Department of Radiology and Imaging Sciences, Division of Interventional Radiology and Image-Guided Medicine, 1405 Clifton Road, Atlanta, GA 30322, USA

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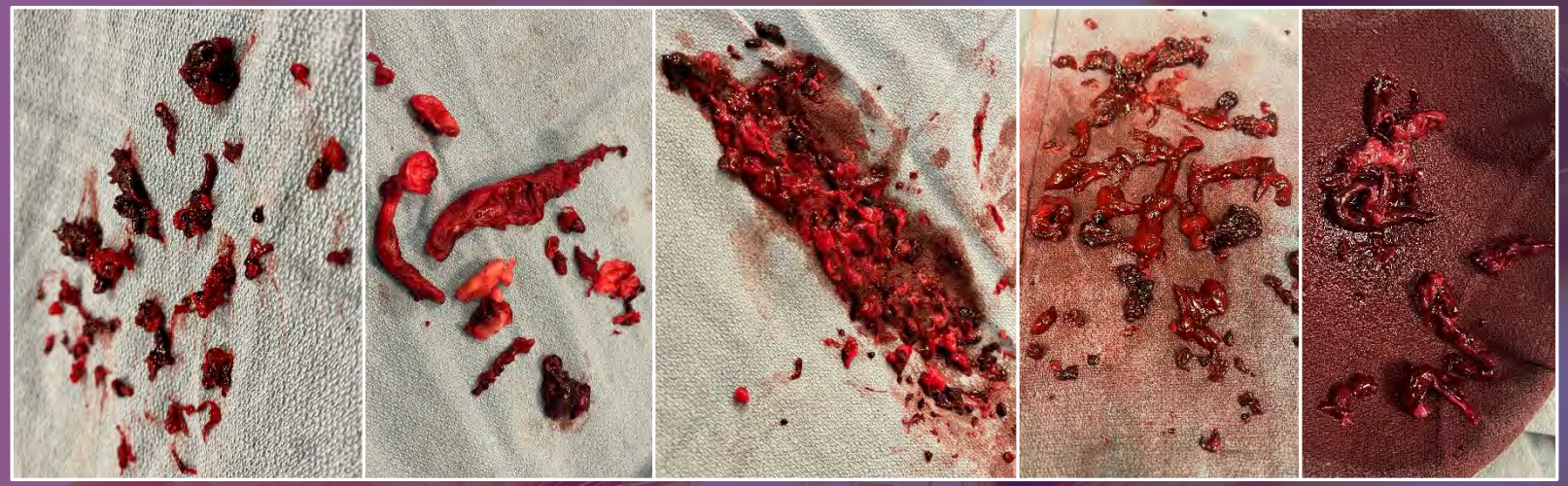

Thank You

Jeffrey Forris Beecham Chick, MD, MPH, FCIRSE, FSVM

jeffreychick@gmail.com CHICKVIR

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