Long-Term Central Venous Access in the Oncology Patient

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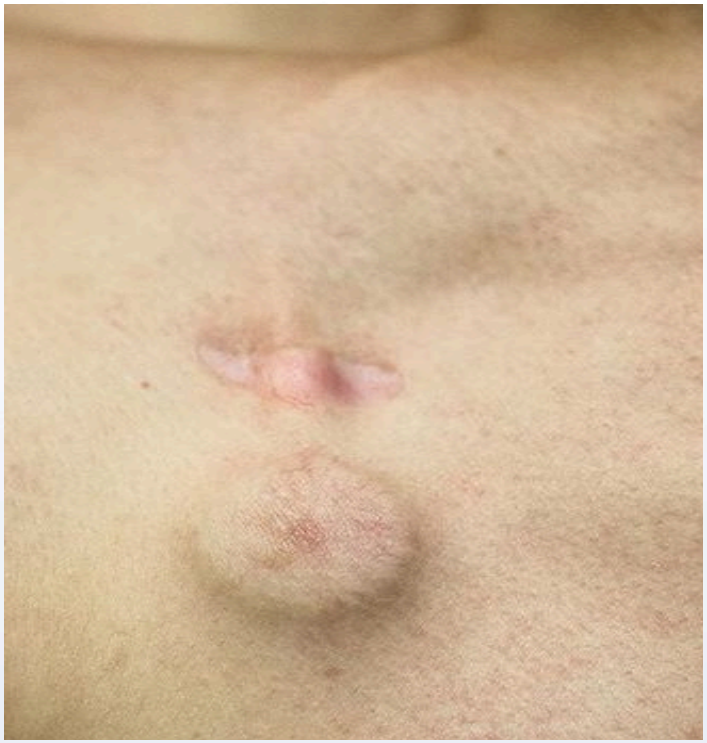
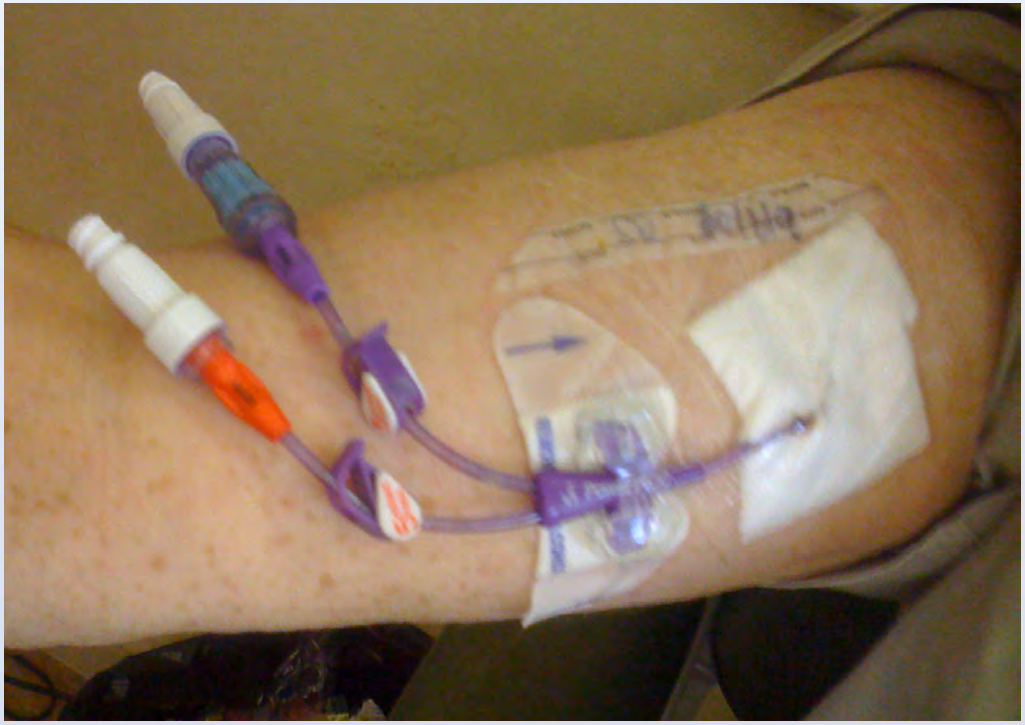
Objectives

- Identify factors that increase risk of infusion therapy complications for oncology patients
- Describe two strategies to maintain LTCVA for oncology patients



Central Venous Access Devices in Oncology



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Indications for LTCVA in Oncology

- Medications and Oncologic Treatments
- Frequency, delivery, and duration
- Vein status
- Contrast media
- Transfusional needs
- Blood specimens
- Transplant candidate
- Patient preference

Povoski, 2014

Device and Patient Selection

- Treatment Regimen
  - Agent
  - Cancer diagnosis
  - Schedule
  - Patient
  - Social support

Vesicants and Irritants

Vesicants

Amascrine
Carmustine
Cisplatin
Dactinomycin
Daunorubicin
Docetaxel
Doxurubicin
Epirubicin
Idarubicin
Mitomycin
Oxaliplatin
Paclitaxel
Vinblastine
Vincristine
Vinorelbine

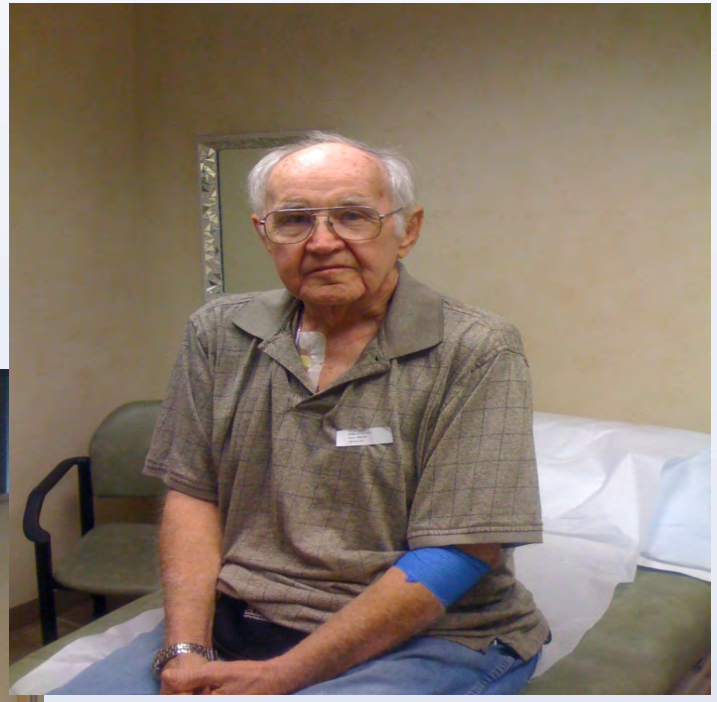
Irritants

Bendamustine
Bleomycin
Bortezemab
Carboplatin
Cyclophosphamide
Fluouracil
Etoposide
Gemcitabine
Irinotecan
Mitoxantrone
Topotecan

Chemotherapy Agent

Chemotherapy Agent

Vein Status
Age and Cancer



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Catheter and Infusion Complications in the Oncology Patient

- Pneumothorax
- Hemothorax
- SQ hematomas
- Catheter tip malposition
- Catheter fracture
- Drug extravasation
- Venous thrombosis
- Infection

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Central Line-Associated Blood Stream Infections

- Costly
- Potentially life threatening
- Extended hospital stays
- Treatment delays

O'Grady et al., 2011; Shah et al., 2013

Common Definitions

- Systemic:
  - Catheter-related bloodstream infection CRBSI
  - Central line associated bloodstream infection CLRBSI
- Local:
  - Insertion site
  - Port pocket
  - Tunnel

O'Grady, 2011; Shah, 2013

Etiology of CLABSI

- Contamination on insertion
- Contamination of hub or catheter by hands, fluids, devices
- Hematogenous seeding
- Contamination of infusate
- Catheter material

DeLa Cruz et al., 2012; INS, 2010; O'Grady, 2013; ONS, 2011

Oncologic Risk Factors for CLABSI

- Patient status
  - Neutropenic
  - Immunocompromised
  - Poor wound healing
- Fibrin sheath or thrombus formation

VAD Infections and Symptoms

- Local/Tunnel/Port Pocket:
  - swelling, tenderness, erythema, drainage

Treatment of VAD Infection

- Daily documentation of site assessment
- Local:
  - Clean area chlorhexidine
  - Apply sterile gauze and tape dressing daily
  - Warm compresses
  - PO/ IV antibiotics 10 to 14 days

Shah et al., 2013

VAD Infections and Symptoms

- Tunnel and port pocket infection
  - IV antibiotics
  - Usually removal of device

VAD Infection Symptoms and Diagnosis

- Systemic: fever, chills, diaphoresis, hypotension, mental status change
- Cultures:
  - VAD and percutaneous
  - Catheter tip
- Same organism from percutaneous and catheter tip
- Same organism from percutaneous and catheter blood culture

Shah et al., 2013

Common Organisms

- Coagulase-negative staphylococci
- Staphylococcus aureus
- Candida species
- Enterococci species

- O'Grady et al, 2011; Mermel, et al., 2009

Treatment of VAD Infection

- Systemic Infection
  - Administer IV antibiotics
  - Rotate lumens for multi-lumen catheters
  - Antibiotic lock technique
  - Thrombolytic therapy

Schiffer et al., 2013; Shah et al., 2013

VAD Removal for Infection

- Persistent or recurrent tunnel infection
- Fungus, gram-negative bacilli, *S aureus*, entercoccus, yeast
- Persistent symptoms of infection after antibiotics
- Confirmed VAD sepsis

Schiffer et al., 2013; Shah et al., 2013

Prevention of Central Line-Associated BSI

- Incorporate central line insertion bundle
  - Hand washing before and after care
  - Maximal barrier precautions upon insertion
  - Optimal catheter site selection
  - Chlorhexidine skin antisepsis
  - Removal of line if not needed

O'Grady et al., 2011; Mermel, et al., 2009; Shah et al., 2013

Prevention of Central Line-Associated BSI

- Consistent maintenance procedures
- Strict sterile/aseptic technique
- Alcohol decontamination prior to hub access
- Routine surveillance for infection rates
- Patient and caregiver education
- Monitor patients with co-morbid diseases closely

INS, 2010; ONS, 2011

VAD Infection Summary

- Variability exists in VAD practice
- Standardized evidence based interventions are needed
- Meticulous aseptic/sterile technique vital

Catheter Occlusion

- Incidence: 41% of central venous catheters
- Interruption of therapy
- Infiltration or extravasation
- Infection
- Increased cost of treatment
- Patient trauma, emotional distress

(Camp-Sorrell, 2010)

Types of Catheter Occlusions

- Thrombotic (58%)
  - Clot or thrombus within or around device or in surrounding vessel

- Multi-factorial

(Gorski et al., 2010)

Patient-related Risk Factors for Thrombus

Change or trauma to vessel wall	Traumatic insertion/catheter malposition
	Long duration of catheter use
	Hypertension
Change in blood flow	Dehydration
	Diminished activity/bed rest
	Hypotension
	Atrial fibrillation
	Tumor
Increased blood coagulability	Inflammatory disease
	Chronic renal failure
	Sepsis
	Malignancy

Falanga, 2011

Catheter-related Risk Factors for Thrombus

- Catheter size
- Catheter tip malposition
- Left-sided insertion
- Duration of catheter use
- Improper maintenance

Schiffer et al., 2013

Catheter-related Thrombus Formation

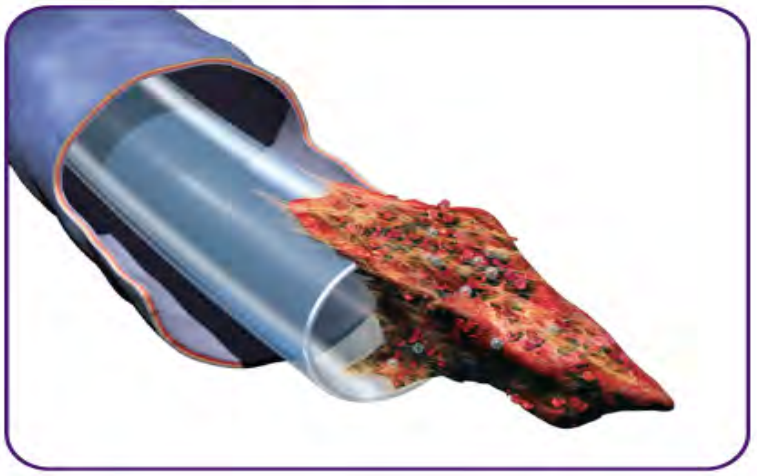
- Catheter insertion
  - Initiates biofilm/fibrin layer formation
  - Blood on catheter surface forms fibrin layer
  - Catheter colonized by pathogens in biofilm
  - Bacteria produce barrier to normal defenses

Fibrin tail allowing infusion

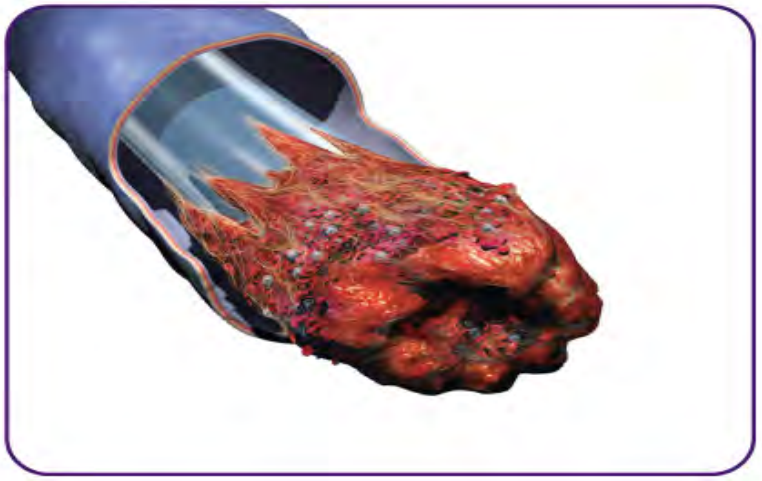
Beginning to flap back with start of withdrawal

Blocking aspiration of the catheter

Types of Thrombotic Occlusions

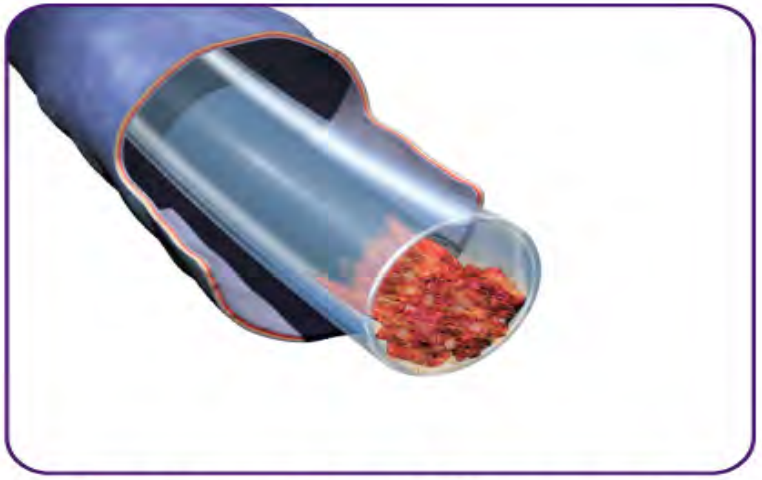


Fibrin tail



Fibrin sheath

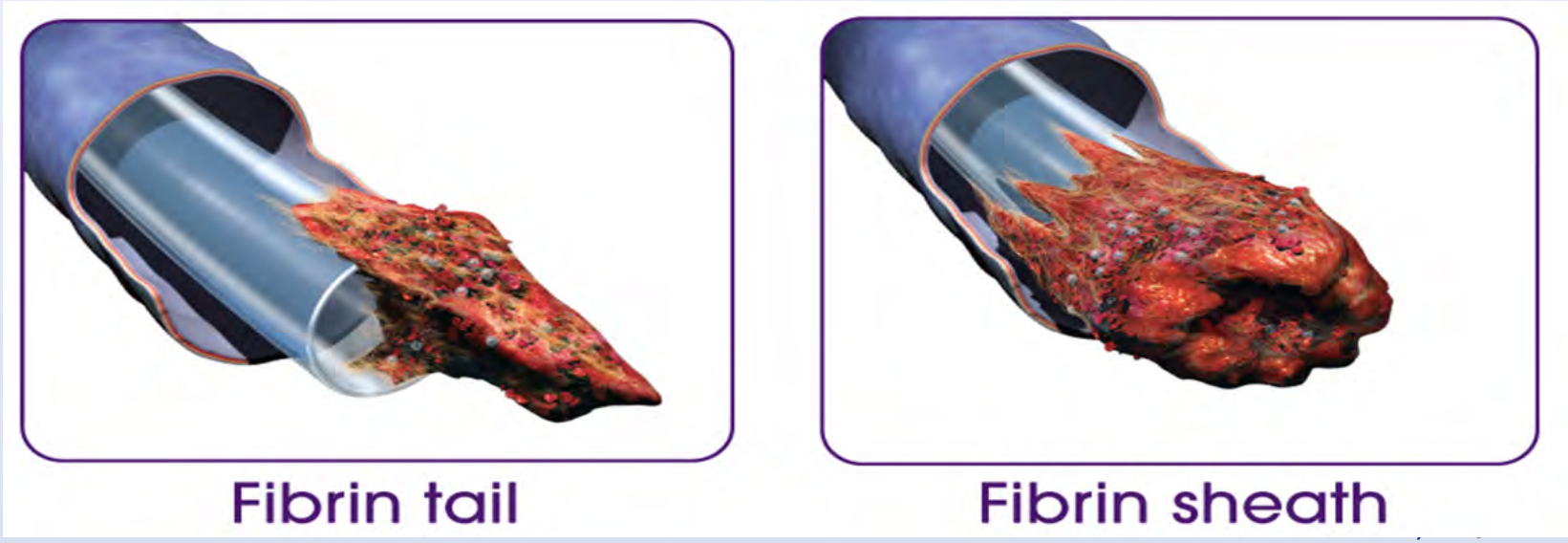
Mural thrombus



Intraluminal thrombus

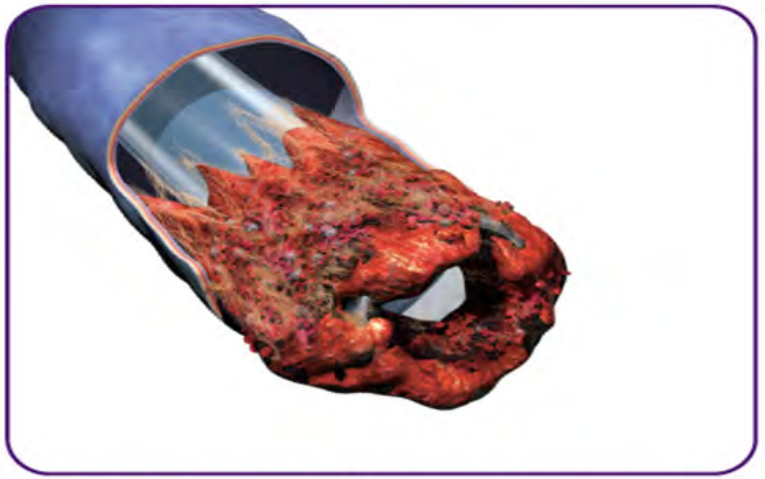
Types of Thrombotic Occlusions

- Fibrin Tail
  - Formed on every catheter at time of insertion
- Fibrin Sheath
  - Fibrin covers catheter like a “sock” and may extend back to the point where the catheter enters the vein
  - May or may not function



Types of Thrombotic Occlusions

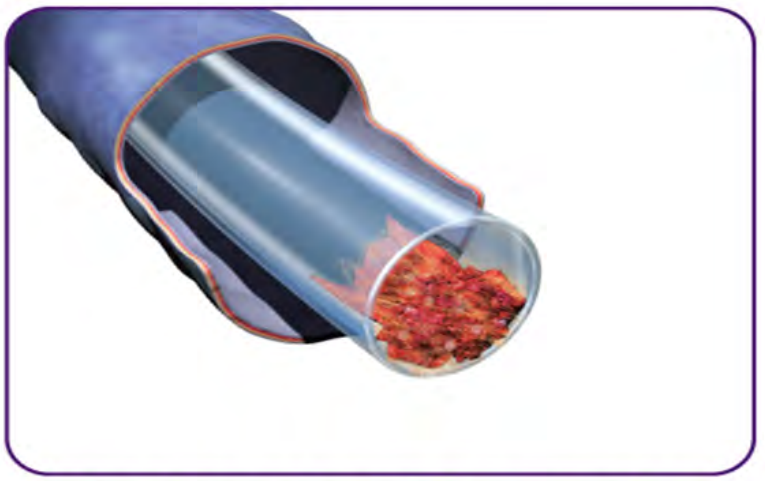
- **Mural Thrombus**
- Fibrin from vessel wall injury binds to fibrin covering catheter surface
- Contributing factors
- Endothelial injury:
  - Catheter tip causes injury: insertion or malpositioned tip
- Altered blood flow:
  - Presence of catheter in vein



Mural thrombus

Types of Thrombotic Occlusions

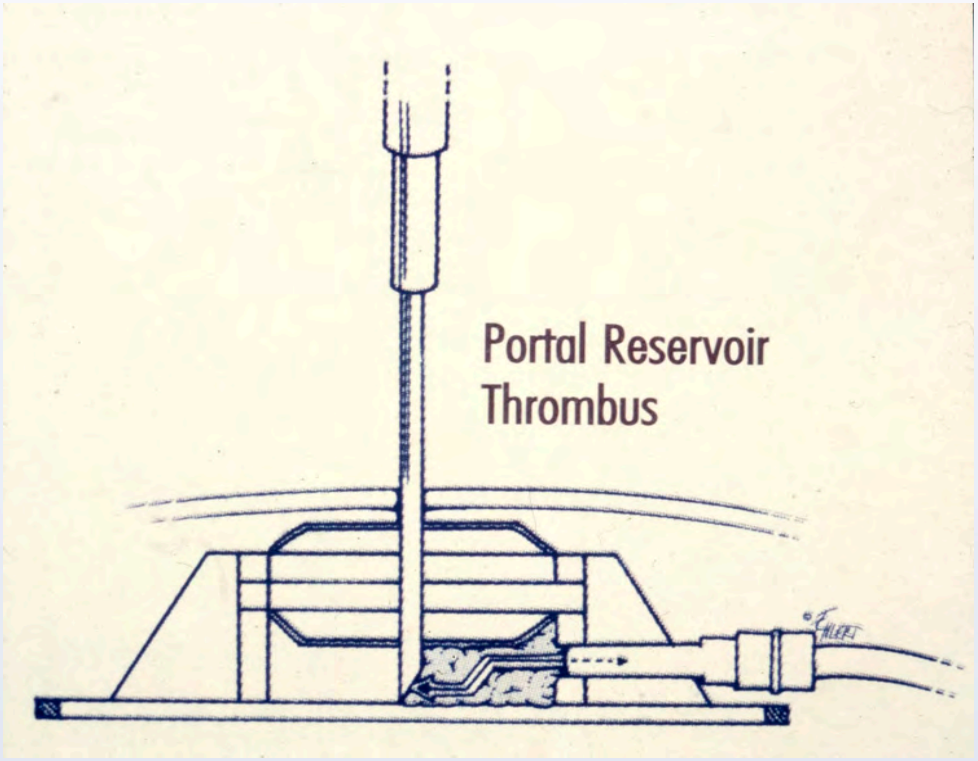
- **Intraluminal Thrombus**
- Thrombi form within the catheter lumen



Intraluminal thrombus

- Causes:
- Pump malfunction
- Inadequate flushing
- Withdrawing blood
- Inadvertent line disconnection
- Retrograde blood flow due to increased intrathoracic pressure

Port Thrombus



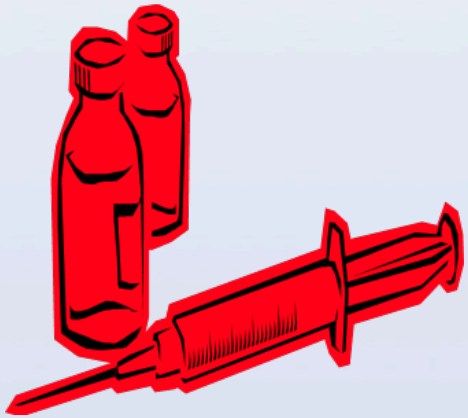
Buildup of blood in port chamber/catheter

Catheter Related Thrombosis

- Thrombotic
  - Lack of free-flowing blood return
  - Inability to infuse
  - Increased resistance
  - Sluggish flow
  - Early signs and symptoms: swelling, pain, discoloration, distended veins

Catheter-related Thrombosis Treatment

- Catheter removal?
- Symptomatic
  - Length of treatment
  - Treatment options



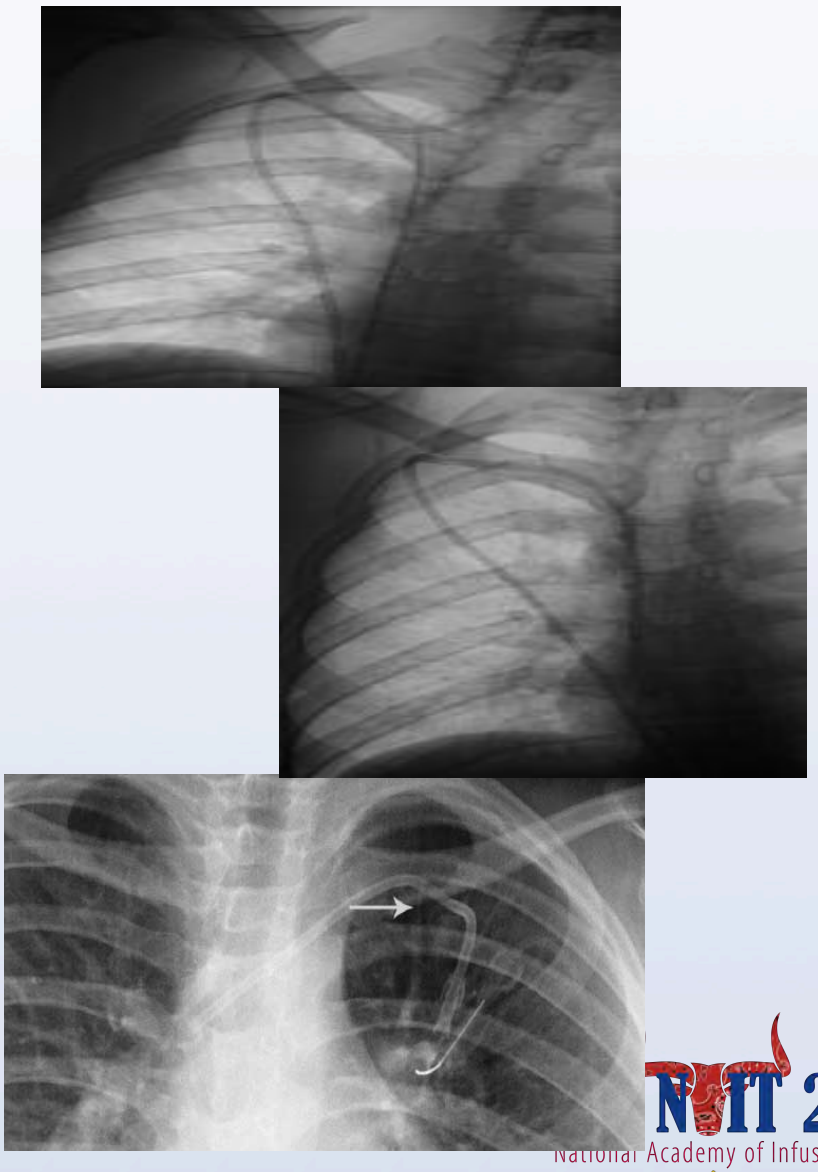
Debourdeau et al., 2013; Schiffer et al., 2013;

Types of Occlusions

- Thrombotic
- Non-Thrombotic/Mechanical
- Partial:
  - Can infuse cannot
- Complete/Total:
  - unable to aspirate

Types of Catheter Occlusions

- Non-thrombotic (42%)
  - Malpositioned tip
  - Pinch-off Syndrome
  - Other Mechanical
  - Infusate precipitate or residue



(INS, 2011)

Catheter Lumen Occlusion

- Biofilm
- Drug precipitate

Catheter Lumen Occlusion

- Biofilm
  - Starts at time of catheter insertion
  - Formed by organisms remaining on skin after antisepsis
  - During infusions
  - Tubing or cap changes
  - Medication administration
  - Flushing

Donlan, 2011

Catheter Lumen Occlusion Biofilm

Biofilm

- Less than 10 days: outer surface
- More than 30 days: inner surface
- Fibrin/thrombosis/biofilm → Increased occlusion
- Aggressive flushing → sepsis

Donlan, 2011

Drug Precipitate

- Incompatible medications or solutions infused into same catheter
- Risk for Precipitate
  - Acidic drugs: if pH increases
  - Alkaline drugs: if pH decreases
  - Lipid emulsions infusion

Nakazawa, 2010

Common Drug Precipitates in Oncology

Drug	Cause	Precaution
Amphotericin B	Incompatible with saline	Flush before and after with dextrose
Diazepam	Poorly water soluble	Do not dilute; Consider lorazepam
Fluorouracil	Droperidol	Flush before and after
Furosemide	Frequently incompatible	Flush before and after
Heparin	Meperidine Promethazine Gentamicin Tobramycin Amikacin Vancomycin	Flush residual drug with saline prior to heparin lock
VP-16	Weakly soluble	Flush before and after

Trissel, 2011

Nursing Interventions: Drug Precipitate

- Watch for change in appearance
- Keep compatibility chart
- Check for incompatibilities with additives
- Don't piggyback into parenteral nutrition lines

Rosenthal, 2007

Best Practice: Drug Precipitate

In the absence of data confirming that two drugs are compatible,…….

one must always assume

"Incompatibility"

Catheter Occlusion Management

- t-PA (alteplase) therapy
- 2 mg/ml, wait 30 minutes, aspirate;
  - may repeat (additional 90 minutes)
- 85% cases restored within hour
- Ideal concentration, volume, administration, dwell time, frequency without evidence base

- Radiographic imaging

Flushing Protocol Overview

Access Device	Flushing
Non-tunneled peripheral	NS 1-3ml q 8, 12, or 24 hours
Central	Heparin 100 units/ml, 3 ml/day or 2ml/day per each lumen
PICC	Heparin 10-100 units/ml, 3 ml/day or 3 ml/day three times/week
Tunneled	Heparin 10-100 units/ml, 3 ml/day; 3 ml qod; 5ml three times /week; or 5 ml weekly
Implanted port	Heparin 100 units/ml, 5 ml q 4-6 weeks and after use
Groshong	NS 5-10 ml weekly or after use

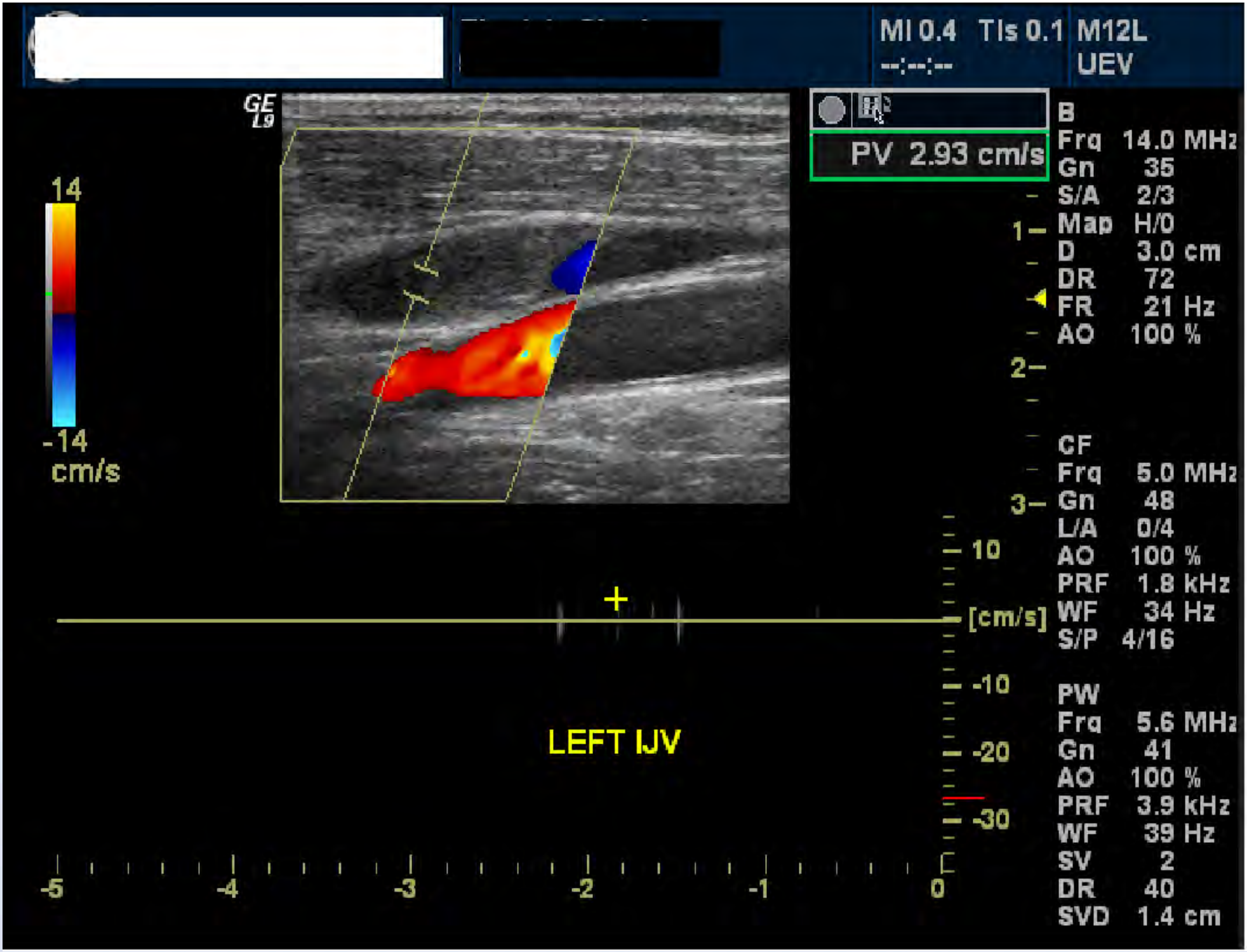
INS, 2010; ONS, 2011

Summary: Catheter Flushing

- Flushing protocols
  - Heparinized versus normal saline
  - Volume and frequency
  - Heparin use with risk of coagulopathies and HIT

Summary: Catheter Occlusion

- Be Safe!
  - Listen to the patient! Stop for any problems!
- Controversial issues:
  - t-PA therapy: ideal concentration, volume, administration, dwell time, frequency
  - Frequency of radiographic imaging
  - Infusion with no blood return
  - When to remove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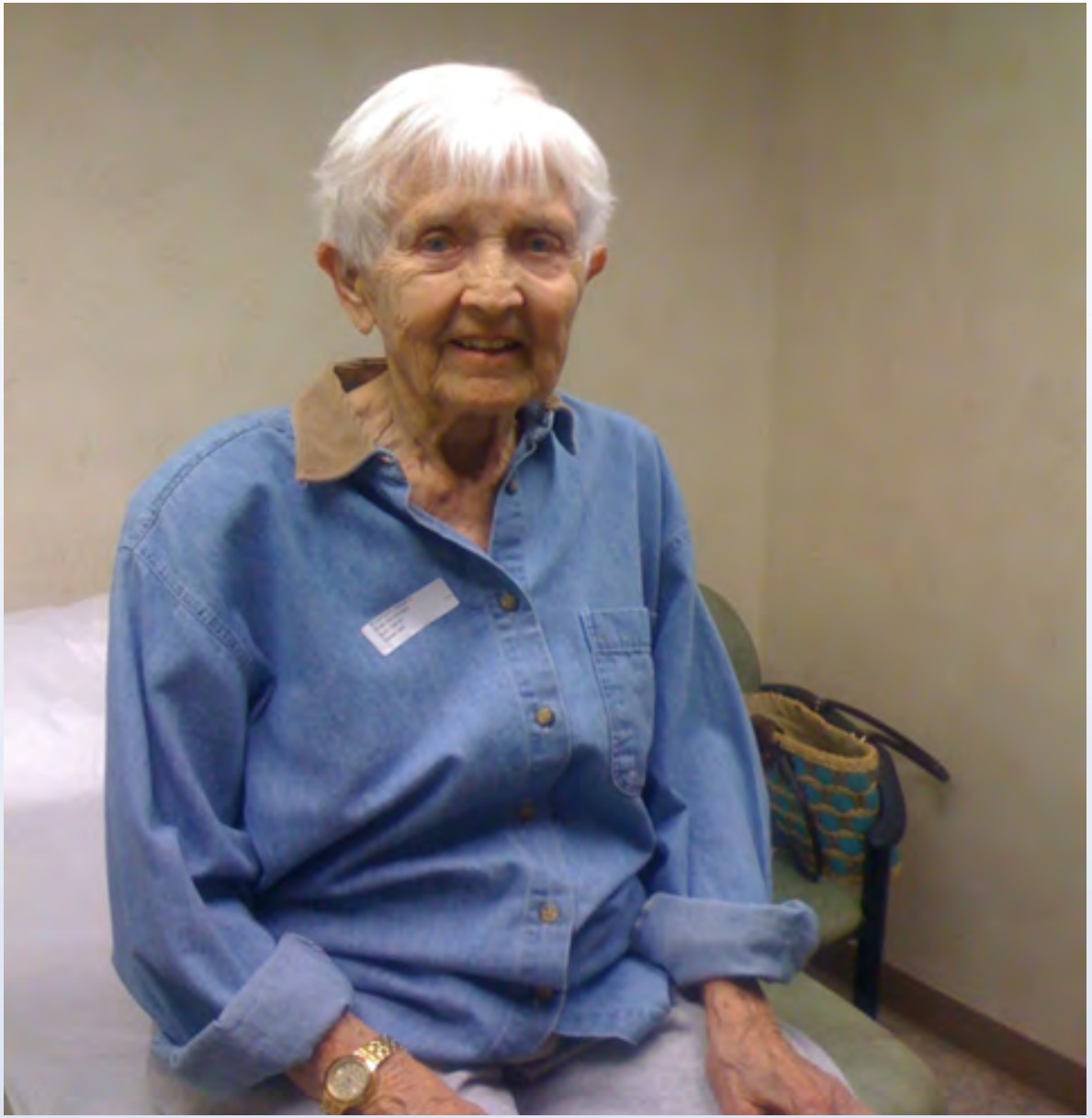

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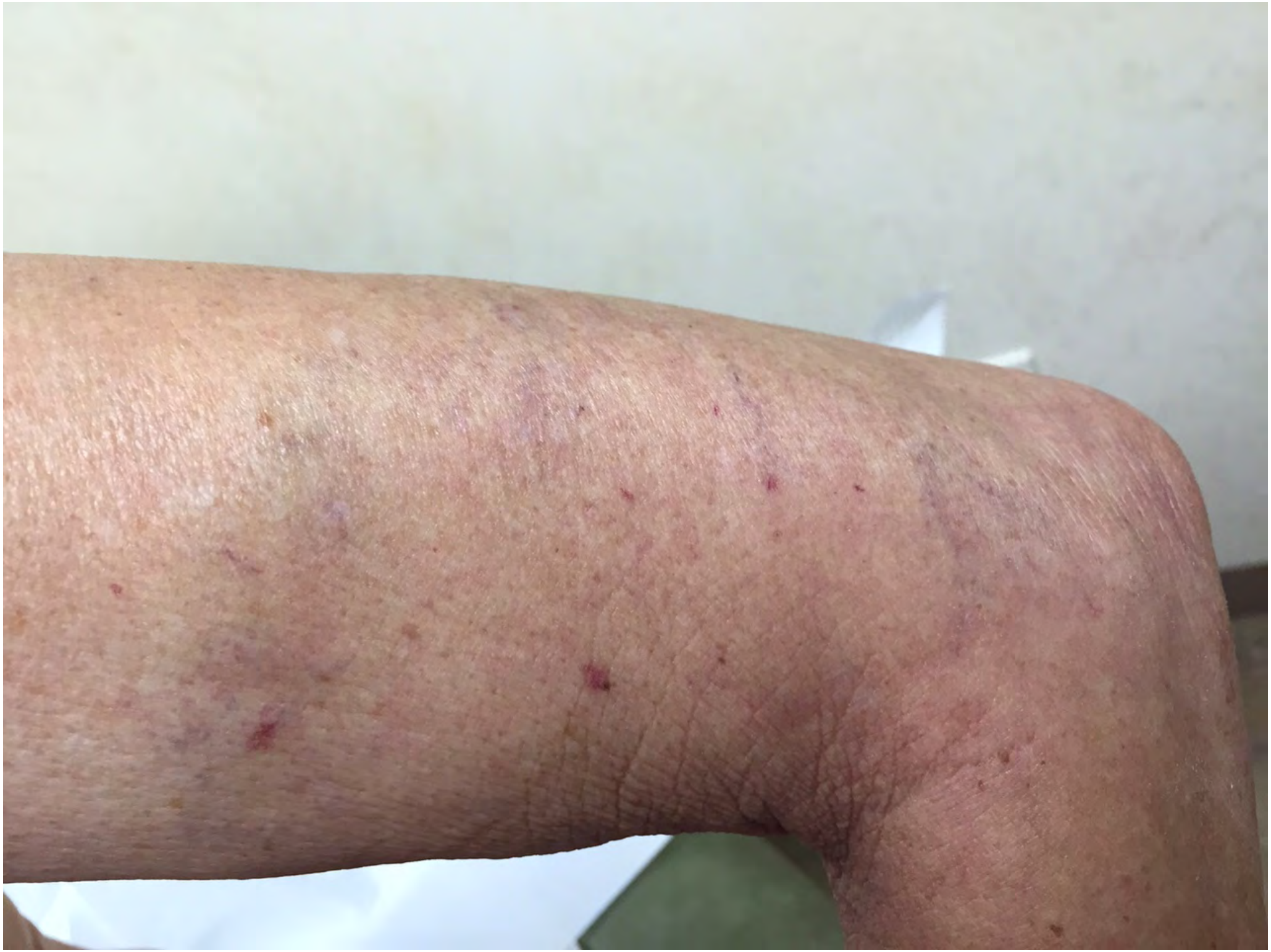

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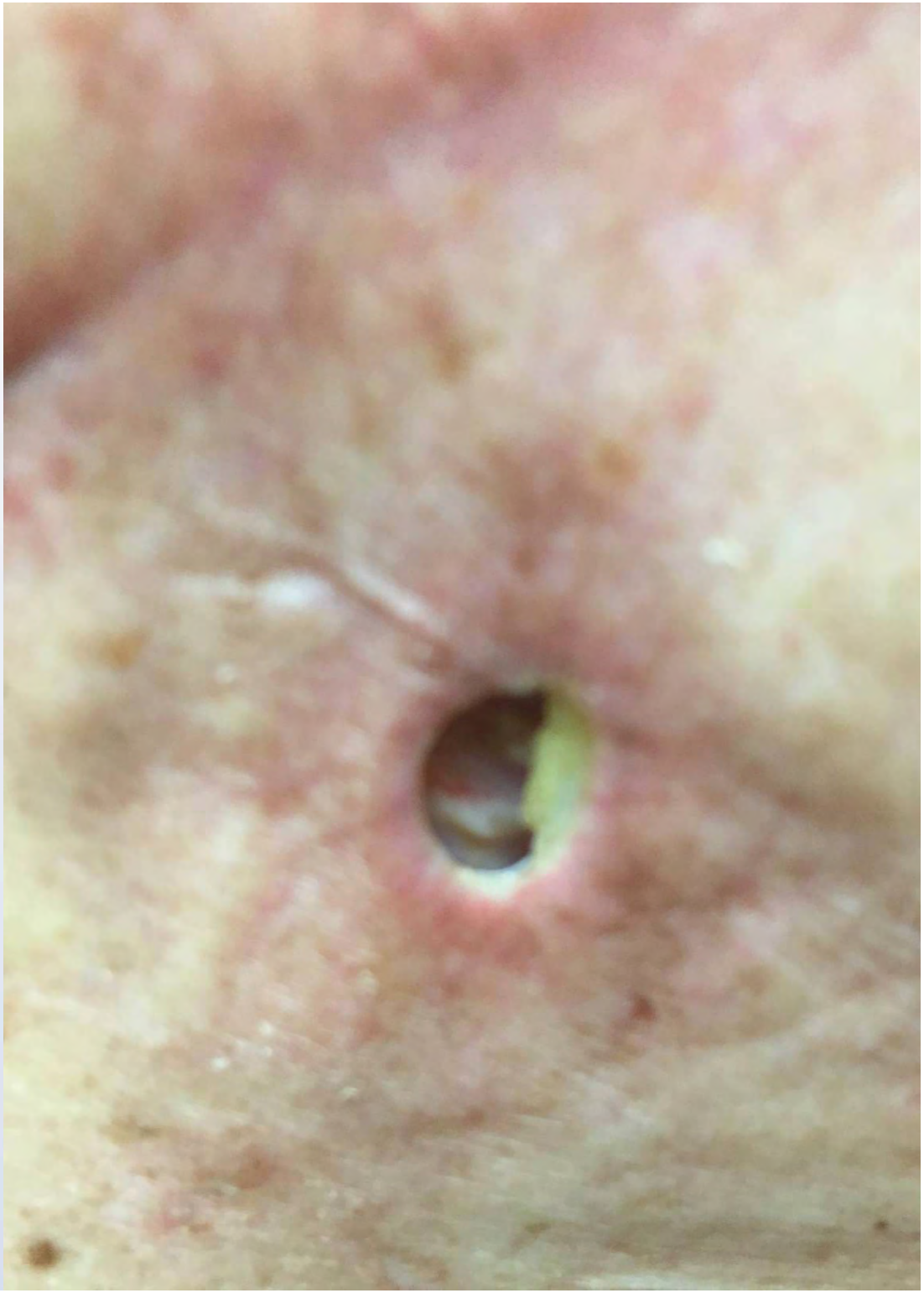

Summary: LTCVA in the Patient with Cancer

Challenge, Complex, Caution

- Individualize to situation
- Proceed with safety
- Respond to every symptom and sign