Module: Palliative Interventional Radiology

Learning Objectives

Attitudes

- Appreciate the role of Interventional Radiology (IR) in providing assistance when caring for palliative patients
- Value the wide scope of palliative procedures IR can offer
- Recognize the ability of IR to bundle palliative procedures
- Appreciate the potential for misaligned clinician and patient expectations for palliative IR procedures

Knowledge

- Recognize the ways IR can relieve common symptoms in the palliative setting
- Describe the basic modalities of imaging used in IR procedures
- Compare differences between enteric and vascular access options
- Describe IR drainage for intraabdominal, biliary, and renal systems
- Explain options for pain reduction in palliative IR
- Describe the ability of IR to improve symptoms of thromboembolic disease
- Identify common conditions for angioembolizations and common embolic agents

Skills

- Evaluate and apply when IR consultation could be beneficial for patients in the palliative setting
- Recommend appropriate vascular access
- Identify and coordinate the approrpiate procedure for a patient requiring palliative enteric access
- Select appropriate pain interventions to palliate refractory pain
- Design treatment plans for patients that may benefit from bundling IR interventions

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Introduction

Interventional Radiology (IR) is an invaluable service when caring for palliative patients and can offer a variety of minimally invasive palliative procedures to improve patients' quality of life. IR's wide scope of practice may palliate symptoms by offering pain interventions, vascular and enteric access, embolizations or ablations of primary tumors or metastases, treatment of venous disease, and other complications from advanced diseases. Bundling some of these interventions (e.g. celiac plexus block at the same time as a biliary drain for obstructive pancreatic cancer) is an advantage of the variety of treatments IR provides. Additionally, many of these interventions can be performed under moderate sedation with local anesthetic. This is an important consideration for patients who have complex co-morbidities and may not tolerate general anesthesia for surgery. For example, surgical gastrostomy tube placement requires general anesthesia versus percutaneous placement of a gastrostomy tube in IR can be performed using moderate sedation. IR consultation may help treatment plans align with patients' goals of care and promote patient centered care. However, despite all these advantages it is important to be selective, thoughtful and realistic when considering the benefits versus burdens of IR procedures. Common pitfalls encountered by many clinicians include underestimating the discomfort created by indwelling tubes and catheters and idealistic views of their potential benefits.

Imaging Modalities

Ultrasound

Ultrasound (US) is essential for procedures involving vascular access and may be the primary imaging modality for fluid collection drainage. It can be an important adjunct for biliary interventions as well. Limitations include bowel gas or body habitus obscuring views.

Fluoroscopy

Fluoroscopy is another foundational imaging modality for most IR procedures including vascular procedures, enteric access, biliary interventions, and urologic interventions. IR procedure rooms have a rotating C-arm for fluoroscopy that can be controlled by the operator to provide dynamic imaging during procedures.

CT

CT may also be used as a primary modality for many procedures in IR, for example when placing a drain for deep intraabdominal, pelvic, or retroperitoneal fluid collections that are not amenable to US only. It can also be a useful adjunct for many IR procedures in facilities that have both fluoroscopy and CT scanner in a single procedure room.

Intravascular Ultrasound

Intravascular ultrasound (IVUS) provides a radial image for endovascular interventions such as thrombectomy or stenting. It offers the ability to make precise measurements of vessels from within for accurate device or stent sizing.

Digital Subtraction Angiography

Digital subtraction angiography (DSA) is a type of fluoroscopy for imaging blood vessels which eliminates static structures in the imaging field (e.g. bone) to highlight the vasculature when contrast is injected through a catheter during endovascular procedures.

Cone Beam CT

Cone beam CT is an imaging modality in which the fluoroscopy C-arm rotates around the patient circumferentially to create cross sectional imaging during a fluoroscopic procedure.

CT Fluoroscopy

CT fluoroscopy is an imaging modality that uses a CT scanner to take short segment axial images and can be useful for CT guided procedures requiring frequent repositioning of a needle such as lung biopsy, abdominal fluid collection drainage, or ablation procedures.

Access

Vascular

Vascular access is incredibly important for palliative care as IV infusions such as chemotherapy can be an important part in helping manage patients' symptoms, as in metastatic malignancy.

Placement of central venous access with a **tunneled catheter** can offer excellent long term vascular access to palliative patients and lower the risk of catheter associated infection.

Placement of a **port** can offer long-term central venous access with a more comfortable and discrete profile.

Enteric

1. Percutaneous gastrostomy tube (G tube) - IR placement can be beneficial in a patient who may be high risk for general anesthesia required for a surgical G tube or has a contraindication to endoscopy required for a percutaneous endoscopic gastrostomy (PEG) tube.

2. Conversion of gastrostomy tube to gastrojejunostomy tube (GJ tube) - IR can provide this service for patients with a G tube that are unable to tolerate gastric tube feeds and require post pyloric enteric access.

3. Jejunostomy tube (J tube) replacement - J tubes can become dislodged and replacement using fluoroscopy can reestablish enteric access and preventing additional surgery for J tube replacement.

4. Percutaneous Transesophageal Gastrostomy tube (PTEG) is an option for enteric access in patients with a contraindication to a percutaneous gastrostomy tube (e.g. carcinomatosis) where a long-term nasogastric tube is not desirable or feasible. It is intended for patients who are at the end of life and require a way to decompress or vent the GI tract. The tube enters the lateral neck and goes into the esophagus providing patients relief from the discomforts or complications from a long-term nasogastric tube.

Drainage

- Paracentesis is a common procedure performed by radiology for accumulation of abdominal ascites with a goal of reducing symptoms.

- Thoracentesis can relieve hydrothorax in patients with ascites.

- Tunneled peritoneal or pleural catheters can provide a route for continued drainage, avoiding repeat access for drainage

- Abscess drainage can be performed using US or CT guidance.

- Percutaneous transhepatic cholangiography (PTC) can be performed if there is biliary obstruction not amenable to ERCP. Once the biliary system is accessed and imaging has been completed, other interventions such as brush biopsy, stent placement, or drainage catheter placement can be performed.

- Percutaneous nephrostomy (PCN) provides access into the into the renal collecting system and can be performed for obstructive uropathy. Subsequent interventions such as ureteroplasty or stenting into the bladder can be completed.

Pain

While pain can be an incredibly difficult problem for patients, IR can provide unique solutions. A **nerve block** is a common procedure that can be done for chronic pain refractory to conservative measures in numerous nerve distributions. Careful history and physical in conjunction with relevant imaging can guide which block is indicated. The nerve transmitting pain signals is identified under image guidance and injected with an anesthetic to disrupt transmission. This is first done as a diagnostic block with a long-acting anesthetic, and if

effective, a more durable block can be subsequently performed with a neurolytic. Blocks have a reliable pain reducing effect for months to years.

- **Celiac plexus block** is an interventional pain procedure that uses ethanol (neurolytic) to ablate the nerves sending afferent nociceptive visceral pain signals with an intent to reduce or relieve pain for patients with locally advanced pancreatic cancer or abdominal metastasis (e.g. Carcinomatosis).

- **Sacrococcygeal nerve block** can help alleviate intractable perineal pain, such as in the anal region following abdominoperineal resection or local invasion from pelvic tumors

- **Cryoneurolysis** is a technique that can treat pain by using a cryoprobe to create a reversible thermal injury (Sunderland Type 2) to the nerve transmitting pain signals. This technique can allow the nerve to regenerate over time restoring function without the aberrant pain signals prior to the procedure.

- **Intrathecal pain pump** is an implantable device that delivers pain medicines directly into the cerebrospinal fluid (CSF) and can be helpful for patients with chronic pain refractory to other methods of pain control. The devices are similar to a pacemaker with a battery that lasts 5+ years and a medicine reservoir that lasts 4-6 weeks.

- **Vertebroplasty/kyphoplasty** is a procedure for compression fractures or pathologic fracture due to bony metastases with an intent to reduce pain from axial loading. The vertebral body is accessed percutaneously with a trocar and injected with cement which can both provide fixation of the bone fragments and pain relief by destroying the nerve cells that transmit pain signals.

Ablation

Ablation of metastatic or primary tumors can be achieved using different modalities. While these procedures can be performed with curative intent, they can also be applied in the palliative setting to improve pain, decrease tumor size, and improve quality of life for patients with incurable disease.

Ablative Techniques

- **Radiofrequency ablation (RFA)** and **microwave ablation** use energy delivered through a needle-like probe generating heat that destroys tumor cells.

- **Cryoablation** uses a gas to freeze a targeted tissue zone via a probe, destroying tumor cells. Because the ice ball can be seen with imaging, this technique allows for active monitoring of the ablation zone that may be useful when ablating in proximity to important structures. This method also has the benefits of reducing pain if nerves are involved in the tumor.

- **High Intensity Focused Ultrasound (HIFU)** utilizes intense ultrasonic frequencies to generate heat within the targeted tissues and destroy the tumor cells.

Angioembolization

Transarterial embolization can be performed to treat solid organ tumors or hyperplasia and is commonly used for the following conditions:

- Hepatocellular carcinoma (HCC)
- Colorectal or neuroendocrine metastases to the liver
- Angiomyolipoma of the kidney
- Uterine fibroids
- Benign prostatic hyperplasia
- Bleeding (e.g. Hemorrhoids, hemorrhagic pancreatic pseudocyst, bronchial artery hemorrhage)

All arterial embolizations use the same basic principles. Arterial access is established using the Seldinger technique, a catheter is placed and advanced over a wire to select the vessel supplying the tumor, organ, or tissue target, and an embolic is delivered. This induces stasis subsequently causing ischemia and necrosis.

Types of Embolics

- Gel foam
- Adhesive embolic (glue)
- Liquid embolics (cohesive material)
- Metallic coils
- Vascular plug
- Embolic beads
- Chemotherapeutic drug-eluting beads
- Radioactive beads (microscopic particles containing Y-90 which degrade emitting ionizing radiation which injure the tumor cells)

Lymphangiography and Thoracic Duct Embolization

Thoracic duct embolization can treat recurrent chylothorax due to disruption of thoracic duct by surgery, radiation, or tumor invasion.

Lipiodol, an oil based iodinated agent, is injected into an inguinal lymph node and imaged with fluoroscopy until it collects in the cisterna chyli. Filled with contrast, this target is accessed with a long needle. A wire is advanced into the thoracic duct followed by a catheter through which an embolic is injected, resolving the chyle leak.

Vascular

Venous thromboembolic disease can cause severe symptoms impacting quality of life including pain, swelling, and difficulty ambulating. Patients with malignancy are predisposed to thromboembolic disease and may benefit from venous intervention.

- Mechanical Thrombectomy – acute clot can be removed using a catheter to extract the thrombus with suction, rotational, or coring device.
- Thrombolysis – a catheter with many side holes is advanced into the vessel containing the clot and heparin or tPA is infused to help lyse the thrombus.
- IVC filter can be placed for patients with venous thromboembolic disease who may have a contraindication to anticoagulation or have recurrent pulmonary embolisms despite being on anticoagulation. It may prevent a life-threatening pulmonary embolism.

Venous Angioplasty and Stenting

Venous stents can be placed for venous outflow obstruction due to extrinsic compression of a vein (e.g. SVC syndrome, pelvic venous disease). This can relieve symptoms such as swelling, pain, and development of venous collaterals, and can significantly improve quality of life. Angioplasty, or ballooning of the vessel, is performed first to restore the luminal diameter. The permanent venous stent then exerts radial force to maintain patency.

Caveats

Gaps between clinician-anticipated outcomes and patients' lived experiences likely exist across many palliative interventions, but they have been particularly well described in the context of PEG tubes. As investigators in the RAMBO project noted, "Patients also described unrealistic expectations for the intervention, believing percutaneous venting gastrostomy/gastrojejunostomy would lead to full resolution of symptoms, a return to normal eating, and prolonged life expectancy." Similar findings have been consistently reported in other studies that directly elicit patient-reported outcomes. While this phenomenon may not generalize to all palliative interventions, these data underscore the importance of careful expectation-

setting and the recognition that patients may amplify the perceived benefits of proposed interventions.

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Pre/Post Test

Questions

1. What is the benefit of IR's wide scope of practice when it comes to Palliative Care?

2. Describe the basic steps of angioembolization.

3. What intervention can IR provide for chylothorax.

4. How can IR treat thromboembolic disease?

5. What does PTEG stand for and in what context would it be an appropriate enteric access option?

6. What procedure serves as an example of misaligned clinician and patient expectations for palliative interventions?

Answers

1. IR may be able to bundle interventions and provide better quality of life for patients with complex problems. An example of this could be placing an IVC filter at the same time as a thrombectomy, or a celiac plexus block at the same time as a PTC drain for malignant biliary obstruction.

2. Vascular access with the Seldinger technique, advancement of a wire into the target vessel followed by a catheter over the wire, delivery of the embolic through the catheter until stasis is achieved.

3. Thoracic duct embolization.

4. Mechanical thrombectomy or thrombolysis.

5. PTEG stands for percutaneous transesophageal gastrostomy. It can provide enteric access for a patient with a malignant bowel obstruction that requires long term enteric decompression and has a contraindication to percutaneous gastrostomy due to carcinomatosis.

6. PEG tube placement

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Case 1

M.H. is a 59-year-old female with a history of metastatic ovarian cancer complicated by peritoneal carcinomatosis and recurrent malignant ascites. Over the past few weeks, she's been experiencing early satiety, nausea, multiple episodes of non-bilious vomiting, and progressive abdominal distension. CT imaging confirms a high-grade small bowel obstruction. A nasogastric (NG) tube was placed for decompression, providing symptomatic relief. However, over the past 24 hours, she has developed painful erosions and bleeding along the nasal mucosa. Her family now expresses concern about the burden of the tube and asks about any alternatives. The palliative care team subsequently consults IR.

Questions

1. What are the goals of care in this scenario and how can IR address them?

2. Why is PTEG preferable over percutaneous gastrostomy in this patient?

Case 2

R.A. is a 63-year-old male with locally advanced, unresectable pancreatic adenocarcinoma involving the celiac axis and retroperitoneal lymph nodes. Despite undergoing palliative chemotherapy over the past three weeks, he has developed severe, dull, persistent upper abdominal pain radiating to his back. The pain is poorly controlled despite escalating doses of oral morphine and gabapentin. Furthermore, side effects such as sedation and constipation are severely impacting his quality of life. His palliative care team refers him to IR for a pain intervention.

Questions

3. What is the indication for celiac plexus block in this patient?

4. How does the celiac plexus block relieve pain, and what agents are used?

5. What are the expected outcomes and duration of pain relief after a celiac plexus block?

Case 3

D.L. is a 66-year-old female with metastatic retroperitoneal leiomyosarcoma. She was initially managed with palliative chemotherapy and radiation, but her disease has progressed. She now presents with marked bilateral lower extremity swelling, skin tightness, aching pain, and difficulty ambulating. A doppler ultrasound reveals bilateral femoral DVTs, and she is started on low molecular weight heparin. Her main goal is to be able to go home to spend time playing with her grandchildren. Despite anticoagulation, her symptoms persist. A subsequent contrast-enhanced

CT scan reveals a large mass compressing the infrarenal IVC, nearly obliterating its lumen. The patient is referred to IR for evaluation of palliative IVC stent placement to improve venous return and alleviate discomfort.

Questions

6. What clinical features suggest the need for IVC stenting in this patient?

7. What other venous interventions could IR offer to help this patient meet her goals?

Answers

1. The primary goals of care are to alleviate distressing gastrointestinal symptoms while maintaining quality of life in a terminal disease context. M.H. is a poor candidate for percutaneous gastrostomy tubes and they should be avoided. Thus, in this scenario, IR could place a percutaneous transesophageal gastrostomy (PTEG) tube to allow gastric venting and removal of the NG tube. Pursuing this option would provide gastric decompression, relieve her nausea and vomiting symptoms, and improve patient comfort.
2. PTEG is preferable for a variety of reasons. The presence of peritoneal carcinomatosis is a contraindication to percutaneous gastrostomy due to increased risk of tube malposition, bowel perforation, and poor healing. Additionally, the patient has nasal mucosal damage from the NG tube, so PTEG allows decompression avoiding further nasal trauma and improving quality of life.
3. The patient is endorsing severe visceral abdominal pain related to pancreatic cancer that is refractory to systemic opioids. The celiac plexus block is indicated given the history and imaging in conjunction with the patient's desire to reduce the opioid burden and associated side effects, thereby improving quality of life.
4. The celiac plexus is located anterior to the aorta at the T12–L1 level and transmits visceral pain signals from the pancreas, liver, stomach, and other upper abdominal organs. A celiac plexus block can disrupt these signals via neurolysis using ethanol to chemically ablate the plexus for long-term pain relief.
5. Neurolytic ablation via ethanol offers pain relief lasting anywhere from 2-6 months to permanent relief depending on tumor progression and nerve regeneration. Patients can expect to feel pain relief within 24–72 hours post-procedure. Many experience reduced opioid dependence and improved quality of life.
6. Key features that indicate this patient may benefit from stenting include the presence of a mass causing extrinsic compression causing bilateral DVTs with symptoms limiting her ability to interact with her family.
7. IR may also be able to perform a mechanical thrombectomy to improve her symptoms in addition to solving the underlying problem with IVC stenting.

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