Contents

Case 1

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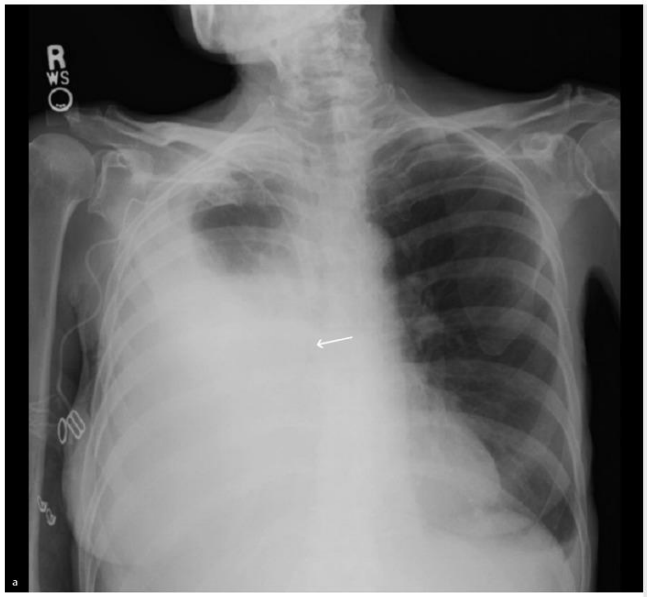

Fig. 1.1 Chest radiograph **(a)** shows a large right pleural effusion (*small white arrow*). The hospital information system indicates that the patient has a measurable coagulopathy **(b)**, with international normalized ratio (INR) of 1.77.

Clinical History

Shortness of breath (▶ Fig. 1.1).

Key Finding

Preprocedure management with a low risk of perioperative bleeding.

Top 3 Issues of Management

- **Procedure types.** The image-guided procedures categorized as "low risk of bleeding that is easily detectable and controllable" are generally venous cases, tube exchanges, and superficial percutaneous nonvascular interventions. Vascular cases include dialysis access interventions, venography, central line removal, inferior vena cava (IVC) filter placement, and peripherally inserted central catheter (PICC) placement. Nonvascular cases include drainage catheter exchanges (e.g., biliary, urinary, abscess drains), thoracentesis, paracentesis, superficial biopsies, and superficial drains.
- **Laboratory testing.** No routine laboratory testing is necessary prior to these procedures, except in the setting of warfarin anticoagulation or suspected liver disease. In these situations, international normalized ratio (INR) should be checked. Review of any laboratory results previously accomplished for the patient is also recommended.
- **Management of medications and blood products.** Treatment with fresh frozen plasma (FFP) or vitamin K is recommended if INR is greater than 2. Platelet transfusion is recommended for counts less than 50,000/μL. There is no specific threshold recommendation for red blood cell transfusion in the setting of anemia (although beware of patients who are below your typical threshold for transfusions in severe anemia whether a procedure is needed or not). Regarding medicines affecting coagulation, most adhere to the following consensus recommendations from the Society of Interventional Radiology (SIR):
  - **Warfarin:** Target INR less than or equal to 2.
  - **Low-molecular-weight heparin:** Hold one dose (12 hours) prior to the procedure.
  - **Clopidogrel:** Hold for 5 days.
  - **Non-steroidal anti-inflammatory drugs (NSAIDs):** No need to hold.
  - **Long-acting glycoprotein IIb/IIIa inhibitors** (e.g., abciximab [ReoPro]): Hold for 12 to 24 hours (with a target activated partial thromboplastin time (aPTT) ≤ 50 seconds or activated clotting time (ACT) ≤ 150 seconds).
  - **Short-acting glycoprotein IIb/IIIa inhibitors** (e.g., tirofiban (Aggrastat) or eptifibatide [Integrilin]): Hold immediately before the procedure.
  - **Direct thrombin inhibitors** (bivalirudin [Angiomax], dabigatran [Pradaxa], or argatroban): No recommendation made by the SIR.

Diagnosis

Symptomatic pleural effusion with INR 1.77; proceed with thoracentesis.

✓ Pearls

- These guidelines represent a threshold 80% consensus from experienced proceduralists.
- Management recommendations assume no other coagulation deficits are present.
- Non-proceduralists will try to get you to perform procedures outside these parameters, assuming that image guidance will mitigate bleeding risk. Do not thoughtlessly fall for this line of thinking.

Suggested Readings

Patel IJ, Davidson JC, Nikolic B, et al; Standards of Practice Committee, with Cardiovascular and Interventional Radiological Society of Europe (CIRSE) Endorsement. Consensus guidelines for periprocedural management of coagulation status and hemostasis risk in percutaneous image-guided interventions. J Vasc Interv Radiol 2012;23(6):727–736

Patel IJ, Davidson JC, Nikolic B, et al; Standards of Practice Committee, with Cardiovascular and Interventional Radiological Society of Europe (CIRSE) Endorsement. Standards of Practice Committee of the Society of Interventional Radiology. Addendum of newer anticoagulants to the SIR consensus guideline. J Vasc Interv Radiol 2013;24(5):641–645

Case 2

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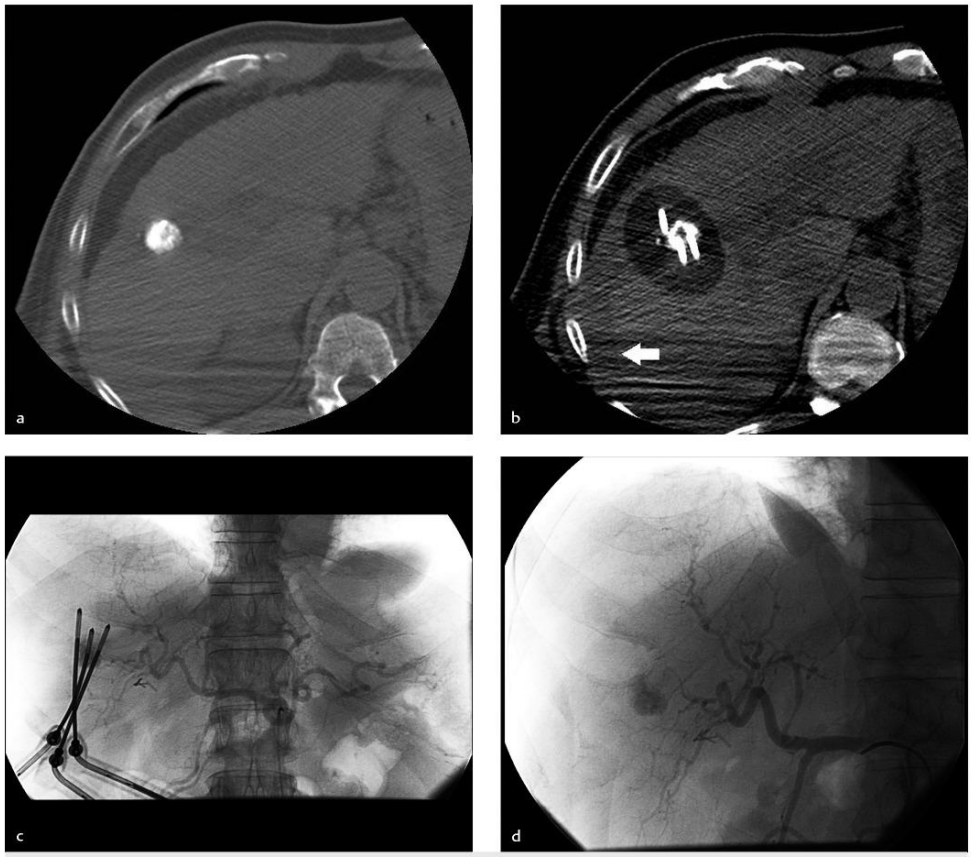

Fig. 2.1 Scout CT image **(a)** shows good ethiodol uptake in the previously treated right liver cancer, prior to placement of three cryoablation probes. After probe placement, and at the end of the second freeze cycle, a subtle subcapsular hematoma is discovered on the penultimate monitoring CT scan (**b**, *white arrow*). The patient is taken to the angiography suite with the probes left in situ. Angiograms before **(c)** and after **(d)** probe removal show no arterial contribution to the hematoma. This patient was successfully treated with transfusion medicine alone.

Clinical History

Solitary 2.5 cm hepatocellular carcinoma, status postconventional transarterial chemoembolization (TACE) 1 month previous, for CT-guided focal tissue ablation. Normal complete blood count and coagulation panel (▶ Fig. 2.1).

Key Finding

Preprocedure management with a high risk of perioperative bleeding.

Top 3 Issues of Management

- **Procedure types.** The list of image-guided procedures categorized as "procedures with significant bleeding risk that are difficult to control or detect" are generally cases with large-diameter needles or probes that create new pathways through solid, vascular organs. Vascular cases include transjugular intrahepatic portosystemic shunt (TIPS) creation. Nonvascular cases include renal biopsy, new tract biliary interventions (e.g., percutaneous biliary drain), new transrenal urinary tubes (e.g., percutaneous nephrostomy tubes), and complex ablations (e.g., renal mass ablation).
- **Laboratory testing.** Prior to these procedures, current laboratory testing should include INR, activated partial thromboplastin time (aPTT) (if the patient is on unfractionated heparin), hematocrit, and platelet count.
- **Management of medications and blood products.** Treatment with fresh frozen plasma (FFP) or vitamin K is recommended if INR greater than 1.5. Heparin cessation or reversal should occur if aPTT is greater than 1.5 times control. Platelet transfusion is recommended for counts less than 50,000/μL. There is no specific threshold recommendation for red blood cell transfusion in the setting of anemia (some use a hematocrit of 28). Regarding medicines affecting coagulation, the following guidelines should be considered:
  - **Warfarin:** Hold for 5 days before the procedure; goal INR less than or equal to 1.5.
  - **Aspirin:** Hold for 5 days.
  - **Unfractionated heparin:** Hold for 2 to 4 hours (goal aPTT ≤ 1.5 times control).
  - **Low-molecular-weight heparin:** Hold two doses or 24 hours before procedure.
  - **Thienopyridine, clopidogrel (Plavix):** Hold for 5 days (ticlopidine [Ticlid] hold for 7 days).
  - **Non-steroidal anti-inflammatory drugs (NSAIDs):** Short-acting (e.g., ibuprofen) 1 day; intermediate-acting (e.g., naproxen) 2 to 3 days; long-acting (e.g., meloxicam) 10 days.
  - **Long-acting glycoprotein IIb/IIIa inhibitors:** Hold for 24 hours (target aPTT ≤ 50 seconds; activated clotting time [ACT] ≤ 150 seconds).
  - **Short-acting glycoprotein IIb/IIIa inhibitors:** Hold for 4 hours.
  - **Direct thrombin inhibitors:** Hold off on procedure unless emergent.
  - **Direct thrombin inhibitors (emergent case):** Argatroban hold for 4 hours; bivalirudin (Angiomax) hold for 2 to 3 hours (3–5 hours if creatinine clearance (CrCl) ≤ 50 mL/min); dabigatran (Pradaxa) hold for 2 to 3 days (3–5 days if CrCl ≤ 50 mL/min).
  - **Fondaparinux (Arixtra):** Withhold 2 to 3 days (3–5 days if CrCl ≤ 50 mL/min).

Diagnosis

Solitary hepatocellular carcinoma for focal tissue ablation, which is a high risk of bleeding procedure. Screening parameters were normal, and the patient was not on any coagulation altering medications. Nonetheless, he still experienced a significant bleed. Fortunately, this was able to be managed without open surgery.

✓ Pearls

- A time lapse of 5 half-lives for a particular agent leaves about 3% residual drug activity and is frequently used as a means of normalizing a patient's bleeding risk.
- These are consensus guidelines. The risk of cardiovascular or thromboembolic events must weigh in on the complex decision to withhold certain pharmacologic agents versus the risk of bleeding and managing periprocedural bleeding.

Suggested Readings

Patel IJ, Davidson JC, Nikolic B, et al; Standards of Practice Committee, with Cardiovascular and Interventional Radiological Society of Europe (CIRSE) Endorsement. Consensus guidelines for periprocedural management of coagulation status and hemostasis risk in percutaneous image-guided interventions. J Vasc Interv Radiol 2012;23(6):727–736

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Case 3

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Ordered panel/Test: Complete blood count		
WBC	5.5	
HGB	8.3	L
MCV	96.2	
MCH	31.9	
MCHC	33.2	
PLATELETS	59	L
RDW	17.0	H
MPV	12.6	H

a (i)

Ordered panel/Test: PT/PTT/INR		
PT	26.2	H
PTT	66.7	H
INR	2.56	H

a (ii)

Fig. 3.1 Hospital information system with abnormal coagulation parameters **(a)**, and other findings commonly seen in end-stage liver disease. Coronal image from a contrast CT of the head and neck demonstrates a right jaw soft tissue fluid collection consistent with an abscess **(b)**. The patient is unable to tolerate oral intake. Ultimately, a percutaneous gastrostomy tube is placed **(c)**.

Clinical History

Patient with history of hepatitis C liver failure presents with new right mandibular pain and swelling. The patient's inpatient care team is requesting gastrostomy tube placement (▶ Fig. 3.1).