



Beth Israel Deaconess
Medical Center

Kyle Checchi, 2015
Gillian Lieberman, MD

January 2015

Imaging For Suspected Bile Leak Following Cholecystectomy

Kyle Checchi, Harvard Medical School Year IV

Gillian Lieberman, MD

Our Patient: Presentation

- Middle aged male with h/o chronic cholecystitis s/p CCY 2 weeks prior transferred from OSH immediately following aborted endoscopic CBD stone removal with impacted stone grasper
- Patient arrives at BIDMC with endoscopic stone grasper wire secured to himself with a Kelly clamp



Our Patient: Recent History

- Additional prior intervention details:
 - 2 weeks prior:
 - CCY: Standard procedure aborted, Thorek cholecystectomy completed, stones suspected in CBD
 - In the Thorek procedure, the gallbladder wall is divided at the border with the liver
 - ERCP: Failed CBD stone extraction, temporary CBD stent placed to bypass stone
 - Day of presentation:
 - ERCP: Failed repeat CBD stone extraction, impacted stone grasper, ? CBD leak below cystic duct stump



Imaging Guidelines

- ACR has published intervention guidelines:

<u>Clinical Condition:</u> Radiologic Management of Benign and Malignant Biliary Obstruction		
<u>Variant 10:</u> Initial therapeutic procedure for a patient with bile leak and dilated bile ducts following laparoscopic cholecystectomy.		
Treatment/Procedure	Rating	Comments
Endoscopic internal biliary catheter	8	
Percutaneous internal/external biliary catheter	8	Most appropriate whenever endoscopic treatment is unsuccessful and after drainage of ascites.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

- While not scored, ACR recommends the following for imaging:
 - Preoperative identification of the location and extent is most beneficial in planning treatment
 - US, CT, and MRCP
 - CT imaging has achieved marked improvement in anatomic detail
- CT will generally provide more useful data and will be necessary to plan management if a leak is observed (Sabiston)



Our Patient: Iatrogenic Bile Duct Injury on CT

- Axial O+/C+ abdominal CT
- Pause to review image, then continue to see findings

Warning: Not for diagnostic use

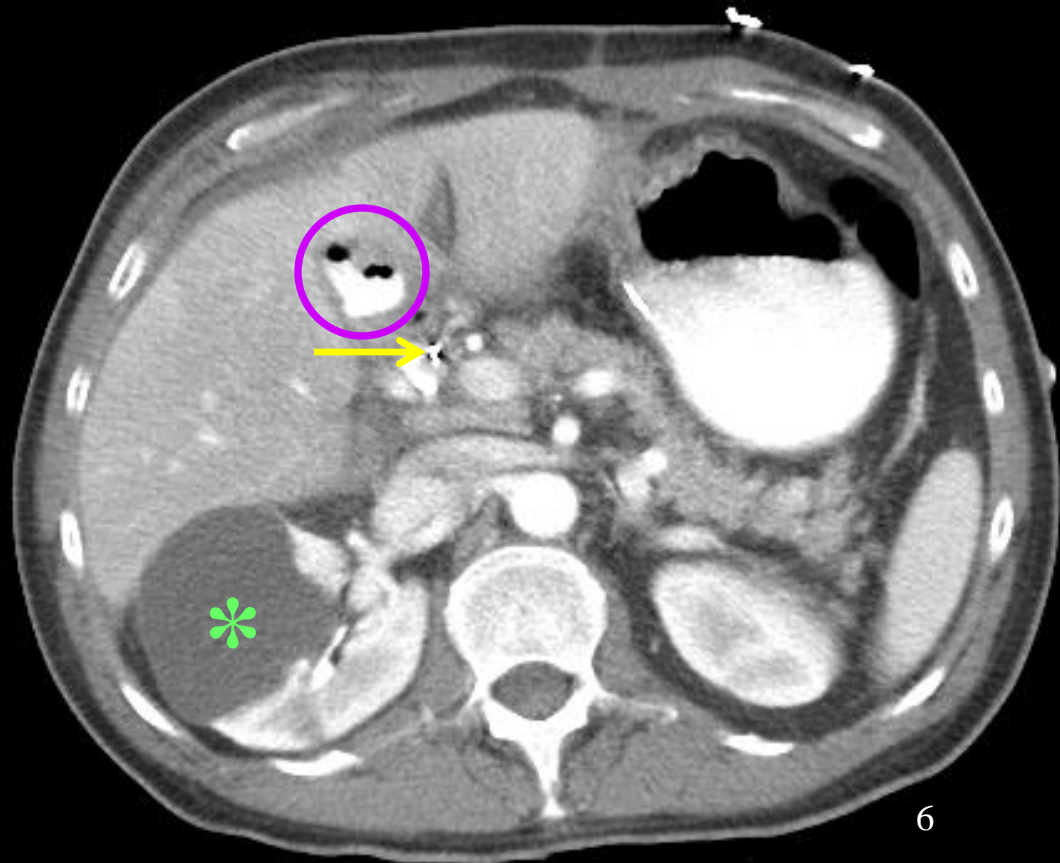




Our Patient: Iatrogenic Bile Duct Injury on CT

- Axial O+/C+ abdominal CT
- Key findings:
 - **Extraluminal air and oral contrast** collecting around the gallbladder fossa
 - **Biliary air and metallic foreign body** (stone grasper wire)
 - Incidentally discovered **simple renal cyst**

Warning: Not for diagnostic use





Our Patient: Iatrogenic Bile Duct Injury on CT

- Coronal O+/C+ abdominal CT
- Pause to review image, then continue to see findings

Warning: Not for diagnostic use





Our Patient: Iatrogenic Bile Duct Injury on CT

- Coronal O+/C+ abdominal CT
- Key findings:
 - Proximal CBD stent with oral contrast
 - Reflux of contrast into cystic duct stump
 - Distal CBD stent with oral contrast and air

Warning: Not for diagnostic use





Our Patient: Iatrogenic Bile Duct Injury on CT

- Coronal O+/C+ abdominal CT
- Pause to review image, then continue to see findings

Warning: Not for diagnostic use

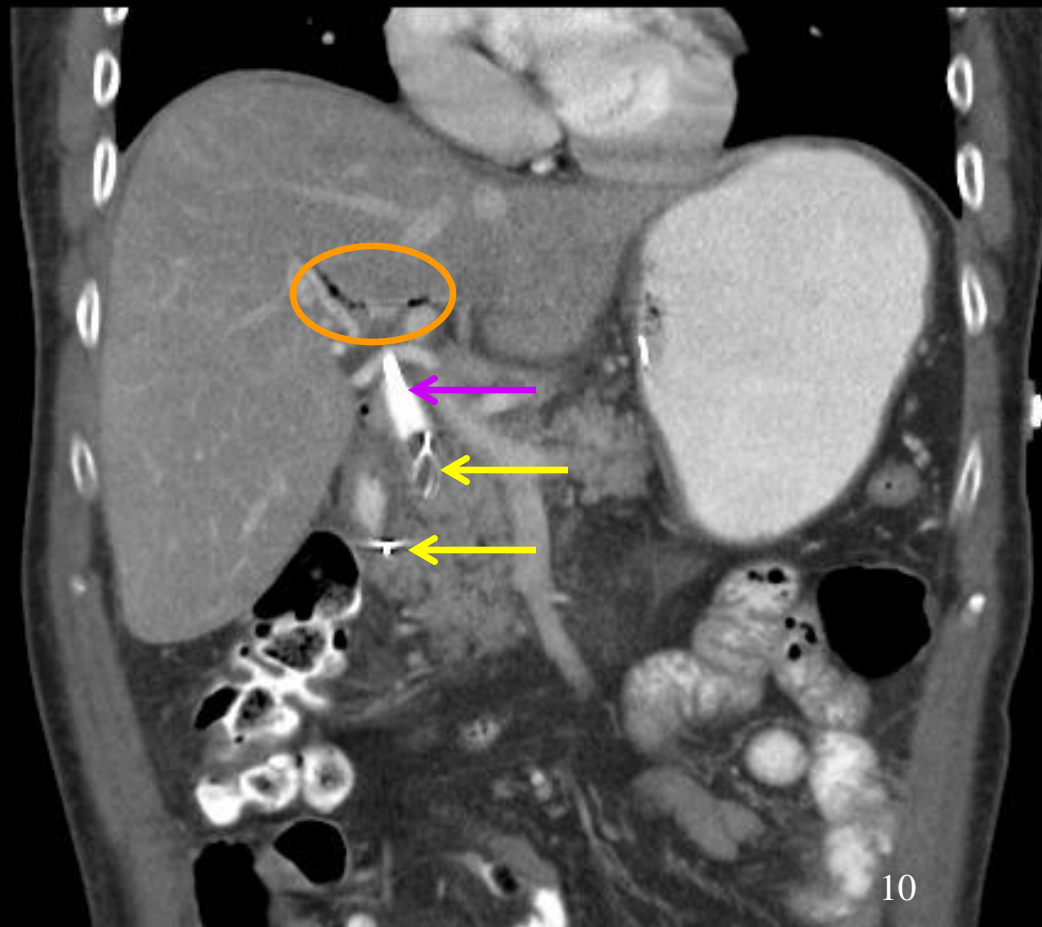




Our Patient: Iatrogenic Bile Duct Injury on CT

- Coronal O+/C+ abdominal CT
- Key findings:
 - **Biliary air**
 - **Proximal CBD with oral contrast**
 - Stone grasper **basket** (around stone) and **wire** (in duodenum)

Warning: Not for diagnostic use





Our Patient: Course and Outcome

- Prior to CT, patient underwent CCY and 2 ERCPs complicated by cystic duct stump leak
- CT used appropriately to define anatomy and characterize the iatrogenic bile duct injury
 - Facilitated choice and planning of appropriate intervention (in this case ERCP)
- Patient's cystic bile duct leak was successfully bypassed via endoscopic CBD stenting
- Patient is recovering well



Outline

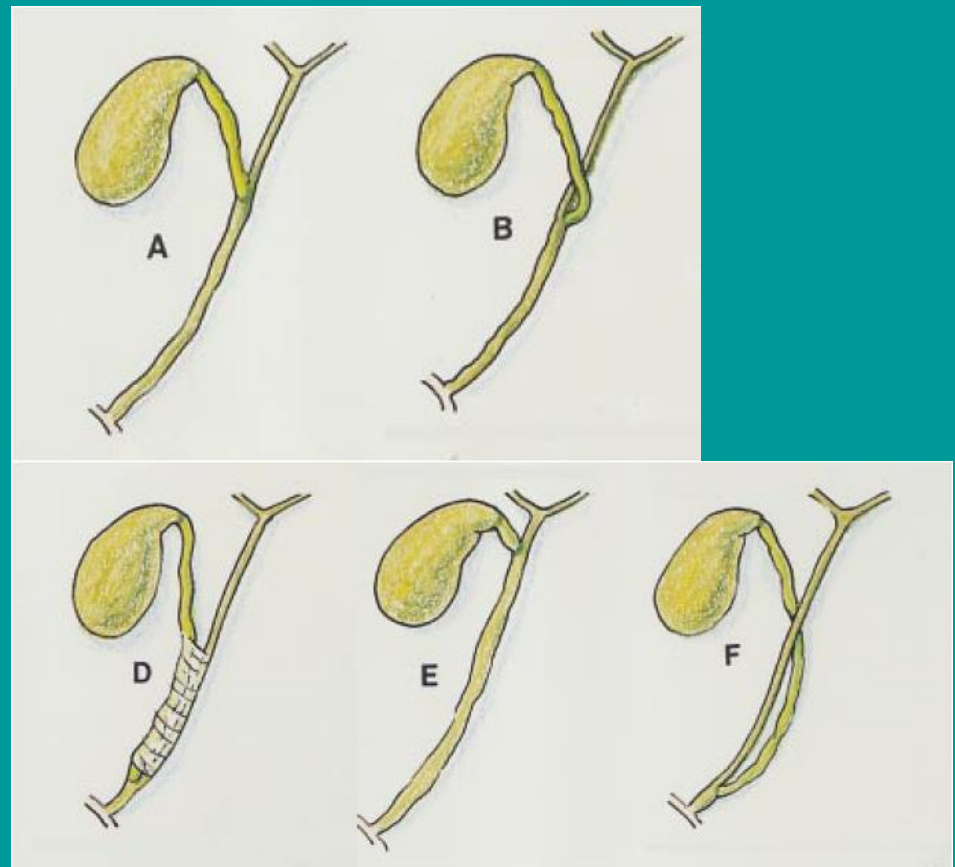
✓ Our patient

- Using imaging to inform therapeutic interventions following iatrogenic bile duct injury:
 - Defining bile duct system anatomy
 - Radiographic classification of iatrogenic bile duct leaks
- Summary



Advanced Biliary Anatomy

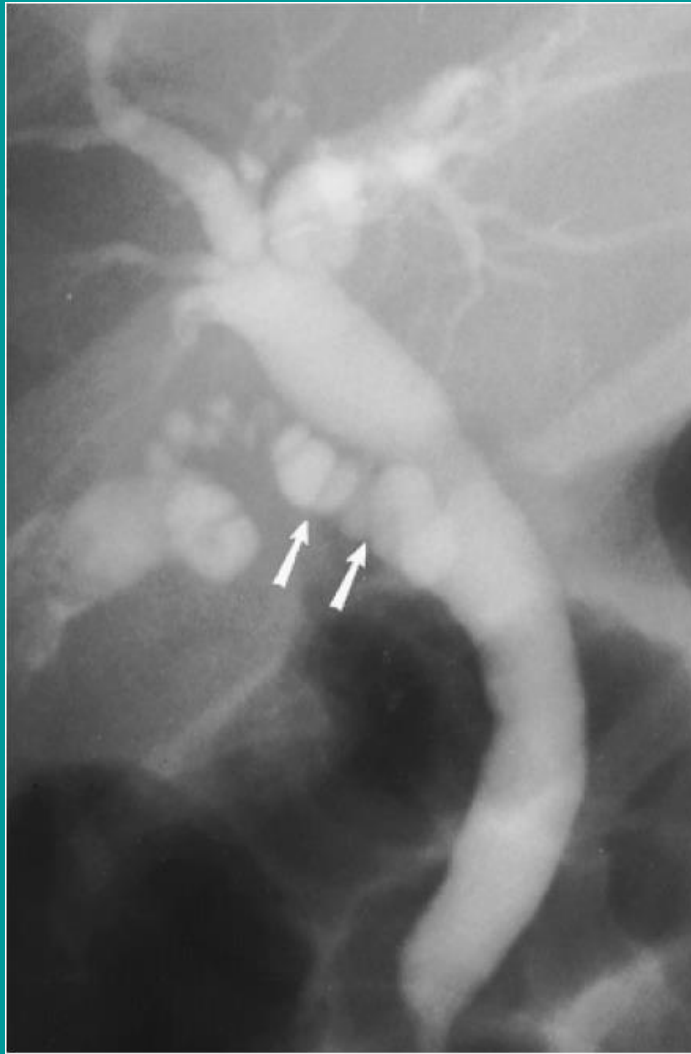
- Cystic to CBD insertion anomalies
 - A: right lateral insertion
 - B: anterior spiral with medial insertion
 - D: low lateral insertion with common sheath
 - E: proximal insertion
 - F: low medial insertion with long parallel course





Cystic to CBD Insertion Anatomy on ERCP

- Index Case 1: Classic anatomic right lateral insertion
 - Cystic duct (2 arrows)





Cystic to CBD Insertion Anatomy on ERCP

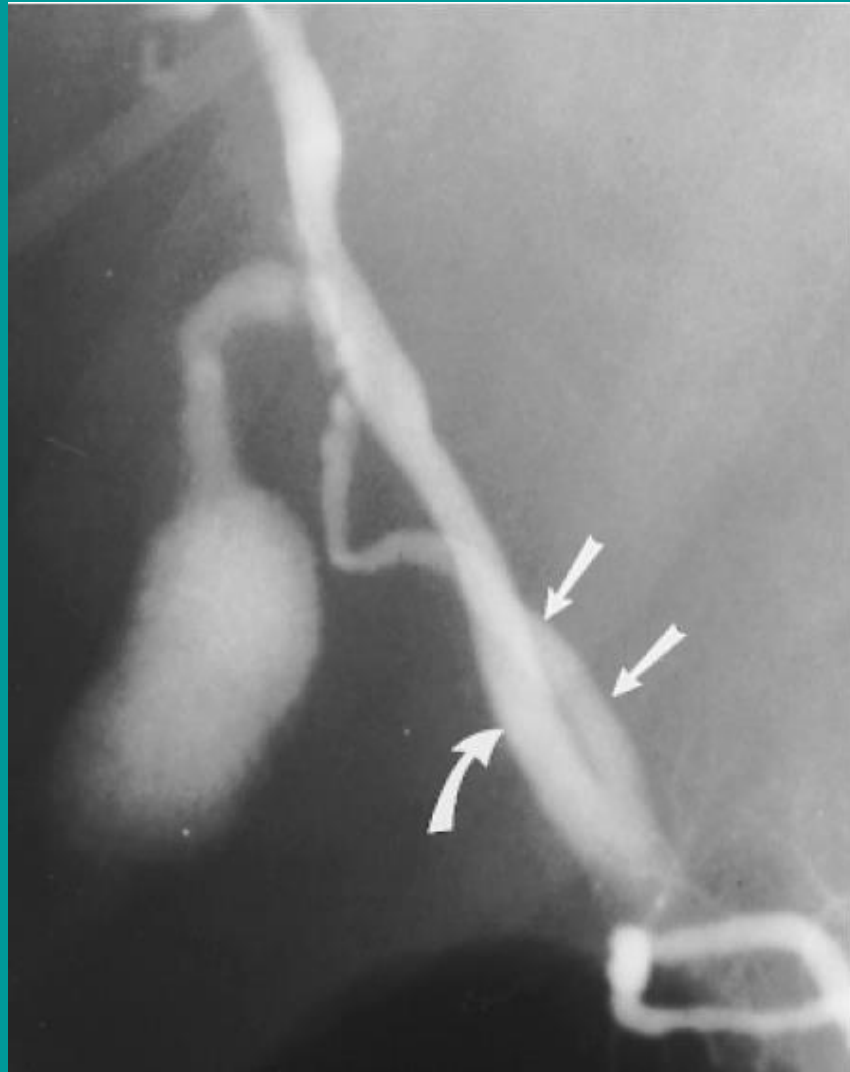
- Index Case 2: Anterior spiral with medial insertion
 - Cystic duct (3 arrows)





Cystic to CBD Insertion Anatomy on ERCP

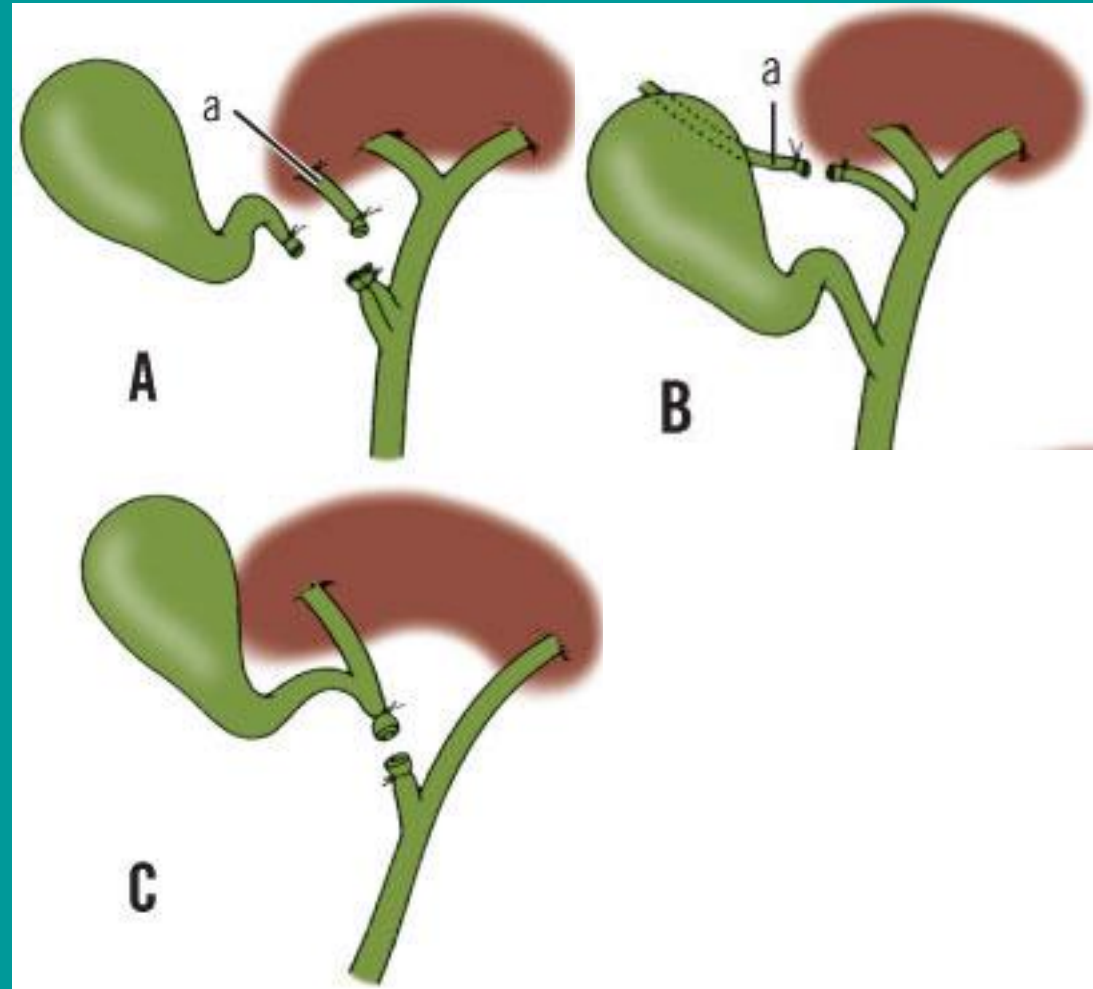
- Index Case 3:
Posterior spiral with
long parallel course
and low insertion
 - Cystic duct (2 straight
arrows)
 - CBD (single curved
arrow)





Anatomy: R Posterior Bile Duct Variances

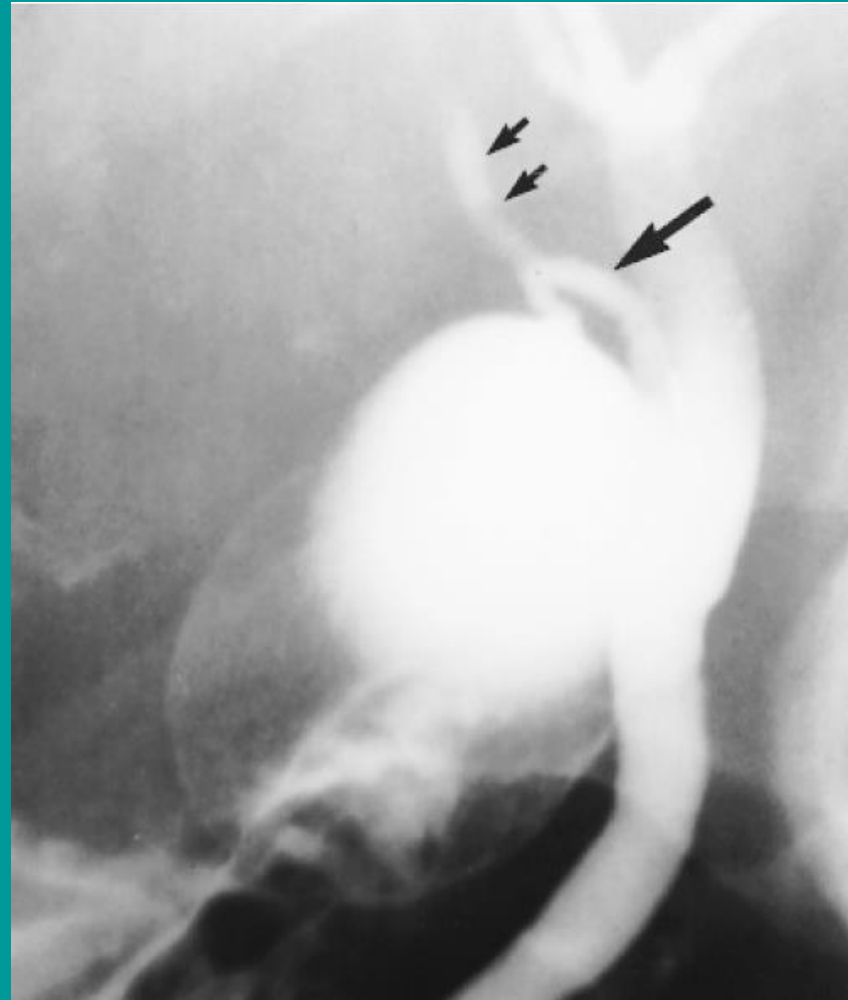
- A: Right posterior duct paralleling and joining the CBD adjacent to the cystic duct
- B: Right posterior duct joining distal to right and left hepatic duct junction
- C: Right posterior duct joining cystic duct





Aberrant R Posterior Bile Duct on ERCP

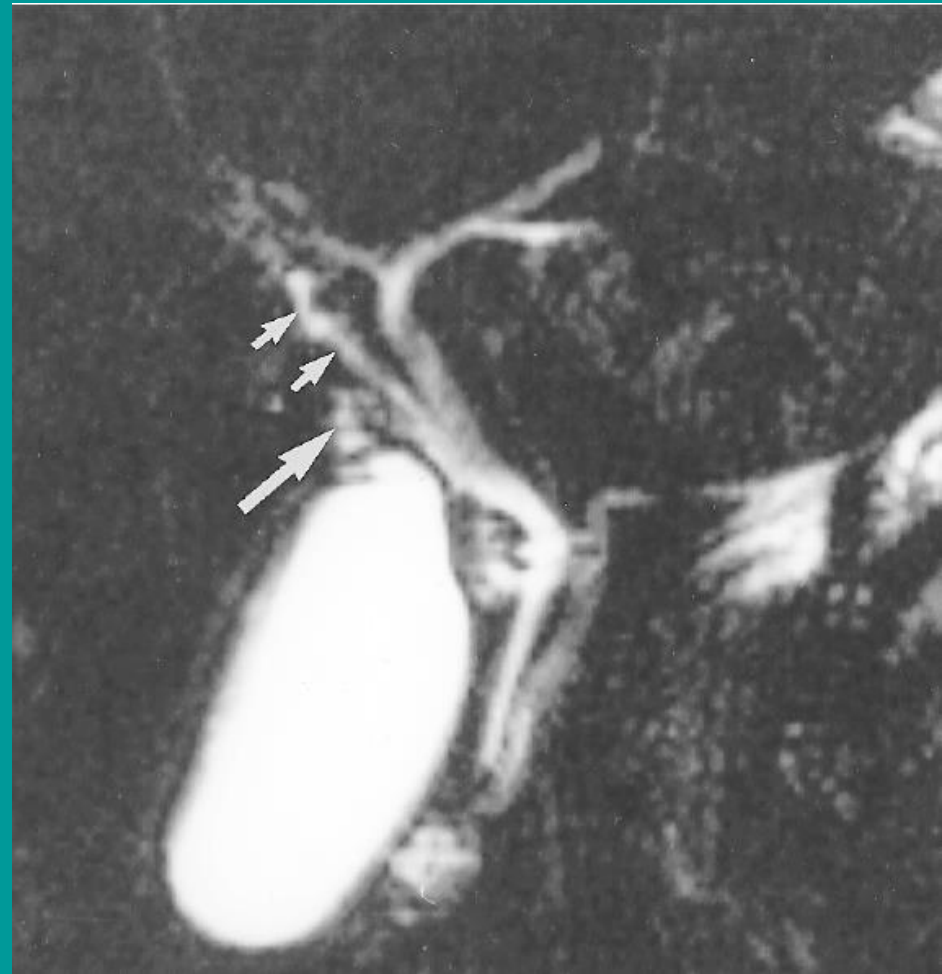
- Index Case 4: Right posterior duct joining cystic duct
 - R posterior duct (2 smaller arrows)
 - Cystic duct distal to intake of R posterior duct (larger single arrow)





Aberrant R Posterior Bile Duct on MRCP

- Index Case 5: Aberrant right posterior duct paralleling and inserting into the CBD adjacent to the cystic duct
 - R posterior duct (2 smaller arrows)
 - Cystic duct (larger single arrow)





Outline

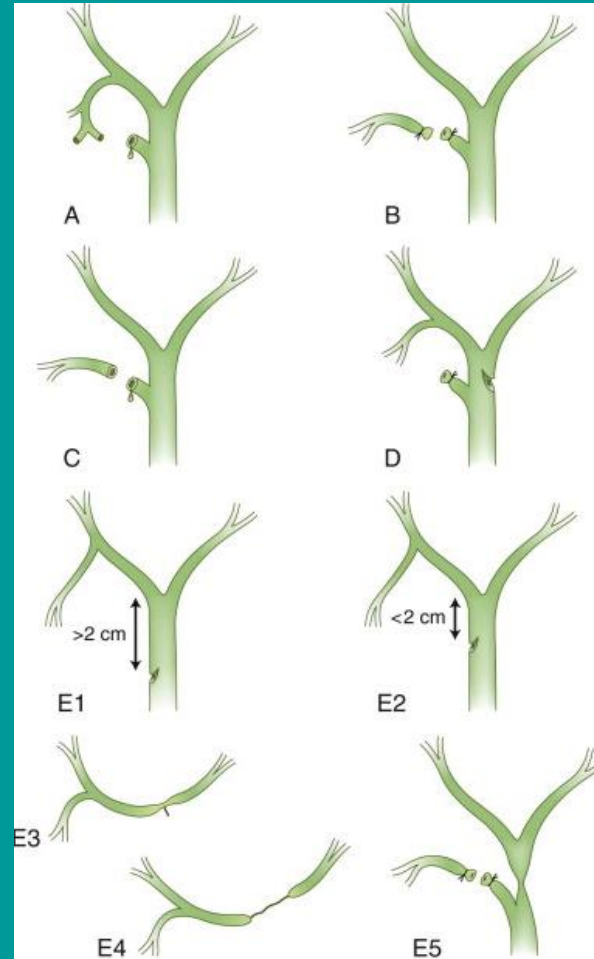
✓ Our patient

- Using imaging to inform therapeutic interventions following iatrogenic bile duct injury:
 - ✓ Defining bile duct system anatomy
 - Radiographic classification of iatrogenic bile duct leaks
- Summary



Strasburg Classification of Iatrogenic Bile Duct Injuries

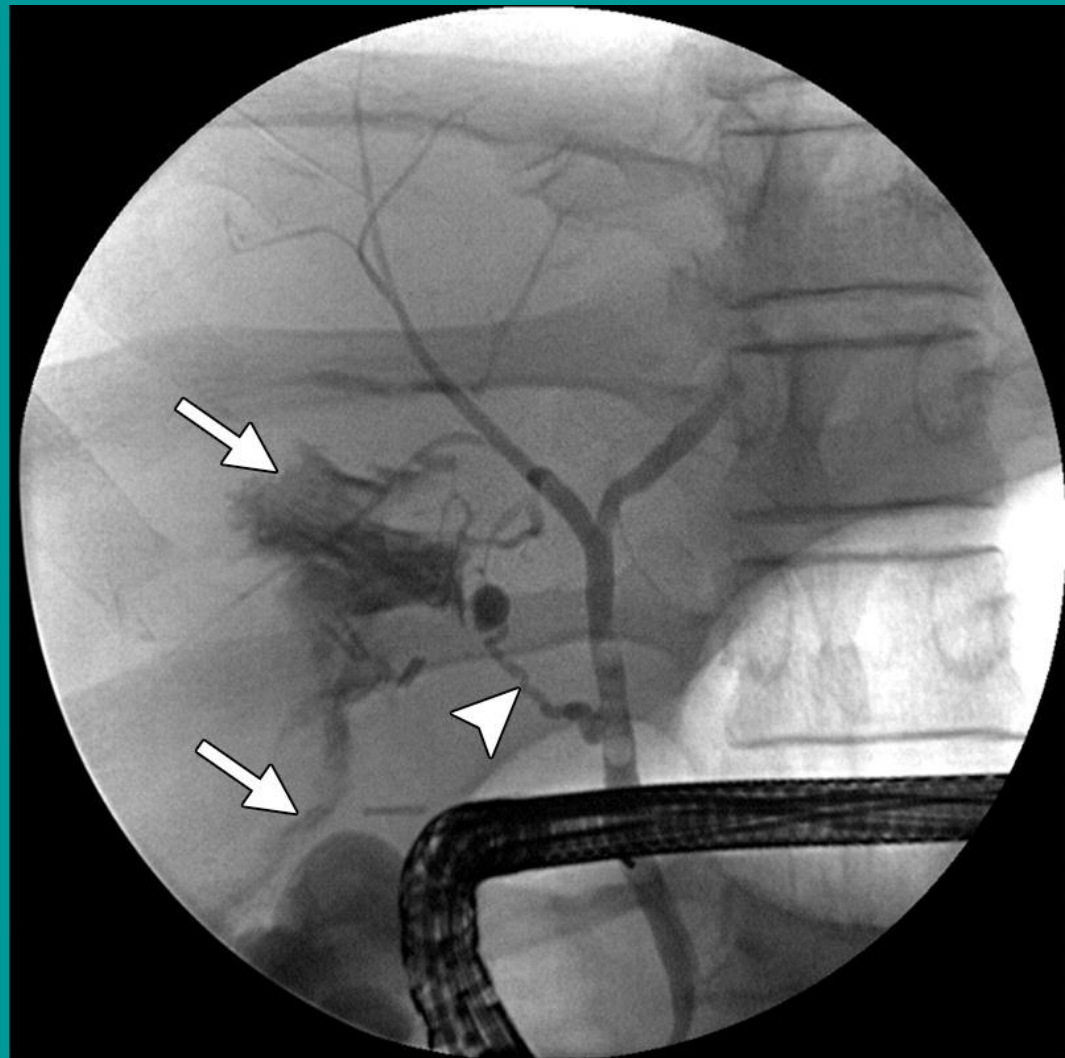
- Classification system for iatrogenic bile duct injuries
 - A: cystic duct leak
 - B: right aberrant duct ligation
 - C: right aberrant duct leak
 - D: CBD injury (<50%)
 - E1: CBD injury (>50%, <2cm from junction)
 - E2: CBD injury (>50%, <2cm from junction)
 - E3: CBD injury (high)
 - E4: CBD injury (dividing left and right hepatic ducts)
 - E5: CBD and right aberrant injury





Iatrogenic Bile Duct Injuries on ERCP

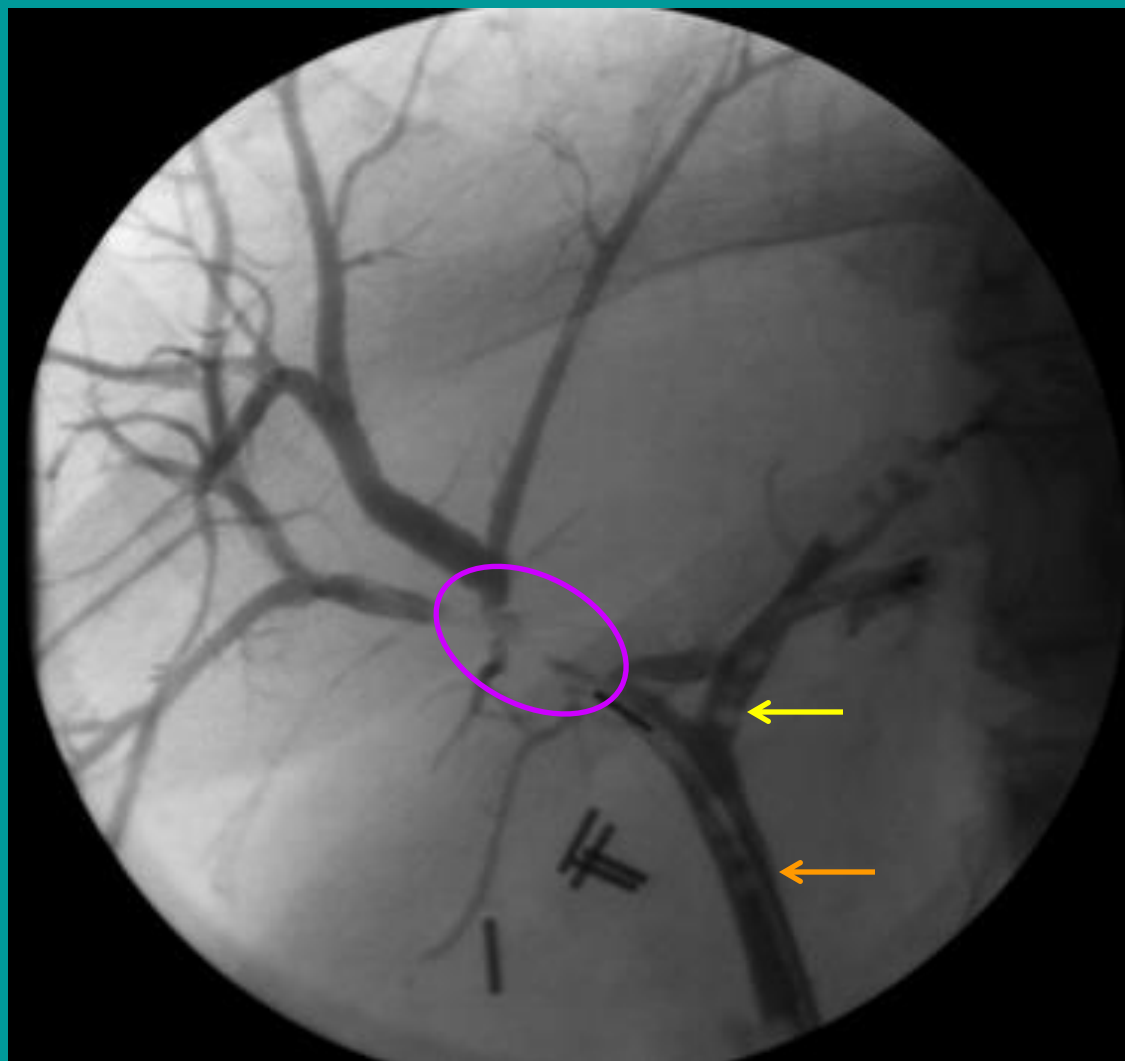
- Index Case 6: Cystic stump leak (Strasburg A)
 - Cystic duct (Arrowhead)
 - Extravasated contrast agent (Arrows)





Iatrogenic Bile Duct Injuries on ERCP

- Index Case 7: Strictures preventing union of right and left hepatic ducts (Strasburg E4)
 - **R hepatic duct stricture**
 - **L hepatic duct**
 - **CBD**





Outline

- ✓ Our patient
- ✓ Using imaging to inform therapeutic interventions following iatrogenic bile duct injury:
 - ✓ Defining bile duct system anatomy
 - ✓ Radiographic classification of iatrogenic bile duct leaks
- Summary



Summary

- Our patient
 - Cystic duct leak following CCY (also with CBD stone and retained endoscopic equipment)
 - CT is the imaging study of choice for iatrogenic bile duct injury (following or without US)
 - Patient recovered well after ERCP recovery of the stone grasper, CBD stone, and CBD stenting to bypass the cystic duct
- The utility of CT for defining anatomy and characterizing the iatrogenic injury
 - Advanced biliary anatomy
 - Cystic and CBD junction
 - Right posterior duct
 - Strasburg classification
 - A-D, E1-E5



References

- Litwin DE, Cahan MA. Laparoscopic cholecystectomy. *Surg Clin North Am*. 2008;88(6):1295-1313.
- Neel B. Patel; Aytakin Oto; Stephen Thomas; *RadioGraphics* 2013, 33, 1867-1888.
- Ray Jr, C. E., Lorenz, J. M., Burke, C. T., Darcy, M. D., Fidelman, N., Greene, F. L., ... & Vatakencherry, G. (2013). ACR Appropriateness Criteria radiologic management of benign and malignant biliary obstruction. *JACR*, 2013, 10(8), 567.
- Strasberg S, Hertl M, Soper N. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *J Am Coll Surg* 1995;180(1):101-2 .
- Townsend Jr, Courtney M., R. Daniel Beauchamp, B. Mark Evers, and Kenneth L. Mattox. *Sabiston textbook of surgery*. W.B. Saunders Company, 2004.
- Turner, M. A., & Fulcher, A. S. The cystic duct: normal anatomy and disease processes. *RadioGraphics* 2001, 21(1), 3.
- Weidman, Thomas A. *Skandalakis' Surgical Anatomy*. McGraw-Hill Companies, 2004. 26

Acknowledgements

I would like to thank Dr. Neda Sedora Roman for providing me with an index case and helping me with image selection and interpretation for this presentation. I would like to thank Dr. Gillian Lieberman for directing the fantastic PCE Core Radiology Rotation at BIDMC. I would like to thank Mr. Joseph Singer for providing formatting and technical guidance for the preparation of this presentation. And, lastly, I would also like to thank my fellow students for being splendid colleagues.