Professor Colin Johnson
University of Southampton

- Commonest abdominal operation
- Potential for significant injury
- Variable quality of training/surgical skills

cdj1@cantab.net

What will we cover?

- What is cholecystectomy?
- How is it done?
- Why is cholecystectomy such a problem?
  - Dangerous anatomy
  - Dangerous surgeon
  - Dangerous aftercare
- What is the significance of 'bile leak'?
- What should the surgeon do?
- Consequences of bile duct injury
- Review some cases

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What is cholecystectomy? Why is it done?

- **Removal of the gallbladder** and the stones that have formed within it
- Relief of symptoms
  - **Biliary colic**: pain below right ribs, going through to back; pain lasts 2-6 hours, often after eating; vomiting;
  - **Other less specific symptoms**: non-specific pain, epigastric or left upper pain, 'indigestion'
- Treatment of **complications of gallstones**
  - Cholecystitis and empyema
  - Jaundice (stones in the bile duct)
  - Acute pancreatitis (stones passing through the bile duct)

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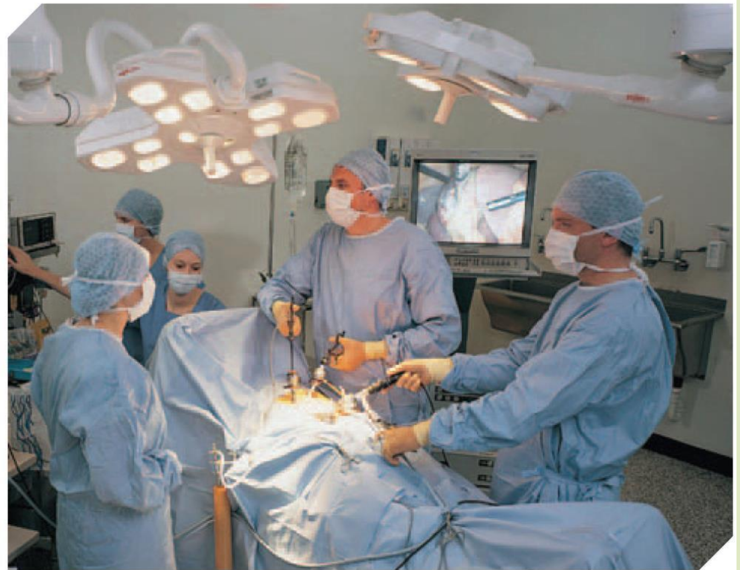
How is it done?



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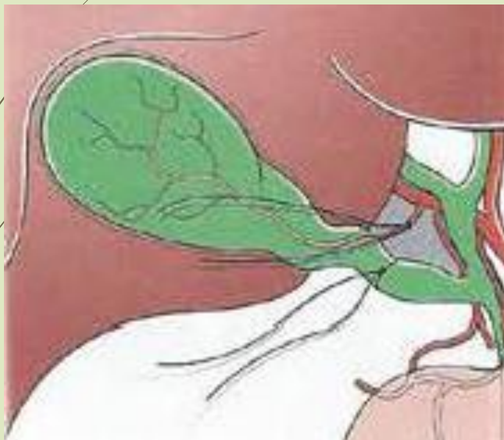
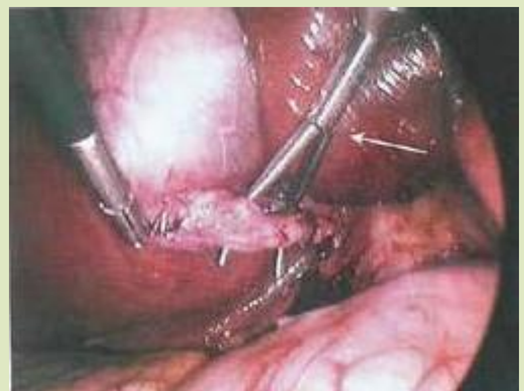
https://www.youtube.com/watch?v=Ng_ThVmaY6Q

How is it done?





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Video of operation

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Why is it such a problem?

- First widely practised laparoscopic operation
- Many self-taught practitioners
- 2D image of 3D anatomy
- MAJOR STRUCTURES AT RISK

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Dangerous anatomy

- Variations in the bile ducts
- 'Accessory' ducts from posterior sector
- Inflammation of GB obscures the bile duct – Mirrizzi syndrome
- Artery to the liver

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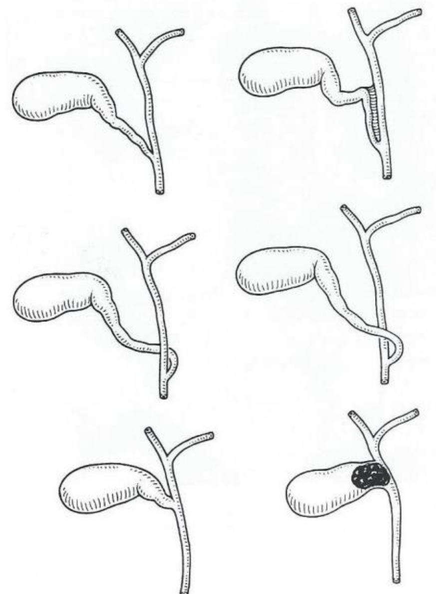
Variation in anatomy

- Many ways the GB can attach to the bile duct
- Some of these are dangerous



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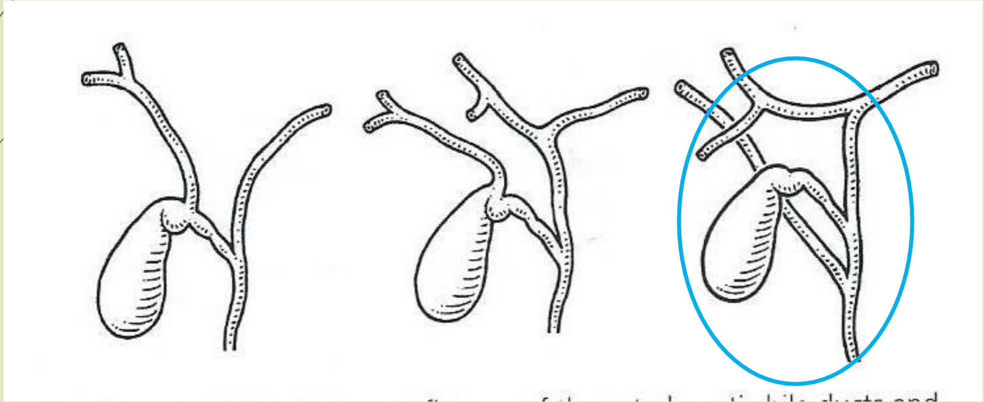
Posterior sector duct

- UNEXPECTED danger



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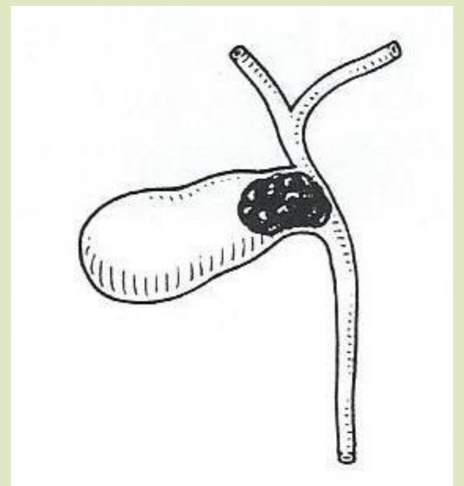
Mirrizzi syndrome

- Bile duct obstruction
- No stone in bile duct
- Compression by GB stone/inflammation



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Dangerous surgeon

The dangerous surgeon FAILS to

- Achieve correct retraction,
- Display important structures
- Dissect down from GB
- Demonstrate the **'critical view of safety'**
- Recognise difficulty and change strategy

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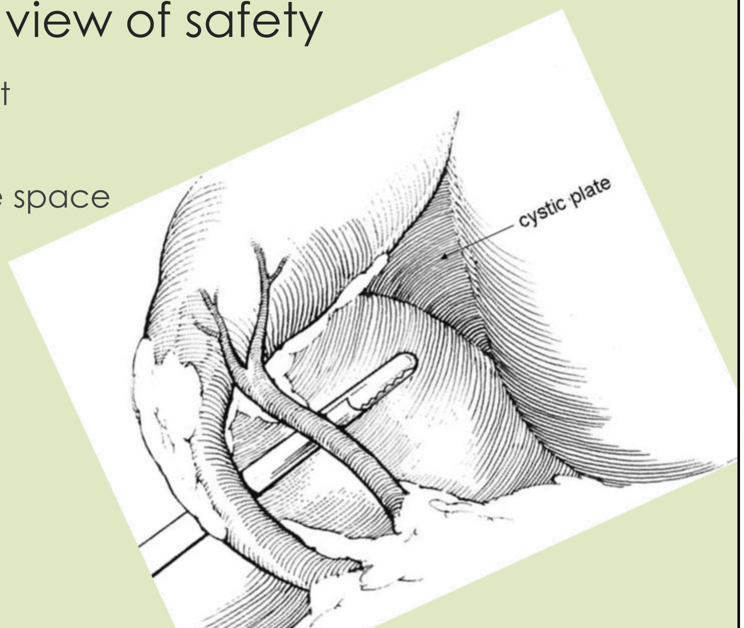
The critical view of safety

- Gallbladder/cystic duct
- Clear gallbladder bed
- No structure crosses the space



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The critical view of safety

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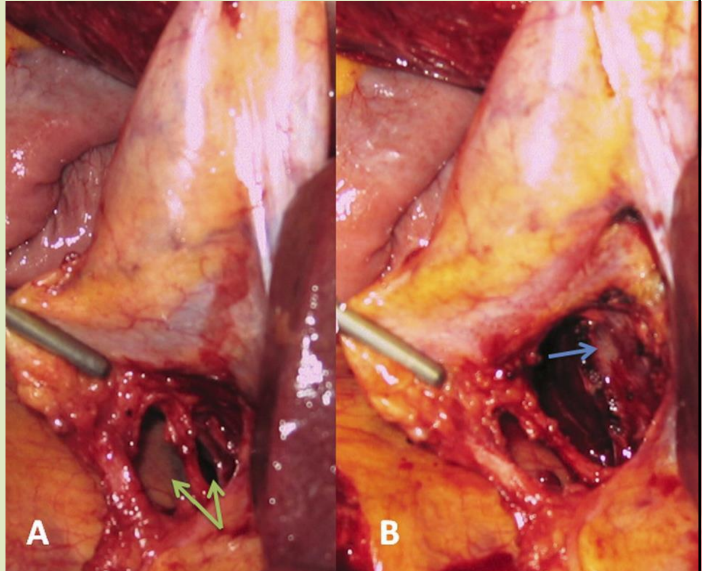

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Essential safety manoeuvres

- **Obtain the Critical View**, or, if that is not possible:
- Convert to open surgery
  - See and feel
- Subtotal cholecystectomy
- Cholecystostomy
- Stop and refer

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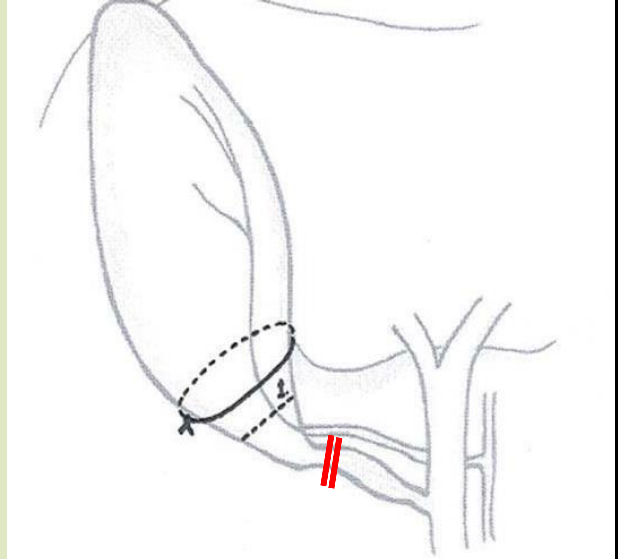
Subtotal cholecystectomy

- Part of GB left in place
  to protect the bile duct



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Dangerous aftercare

- When a complication occurs the surgeon should:
  - Identify the problem
    - Be aware of the possibility
    - Review the patient before discharge
    - Consider unusual symptoms
    - Be available to review later
  - Diagnose the cause
  - Provide timely treatment

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Complications

- **Bleeding**/haemorrhage
- **Bile leak** from Bile Duct Injury and other causes
  - Internal: abscess, bile peritonitis
  - External through a drain
- **Bile duct obstruction**
  - Stricture
  - occlusion by surgical clip (BDI)
- **Bowel injury**

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Bleeding – types and times

- During operation – **Primary**
  - Injury by the surgeon
  - Should be visible, and should be stopped
  - Complete haemostasis before closure
- Within hours of operation – **Reactionary**
  - ?missed primary haemorrhage
  - Vascular spasm
  - Low blood pressure
- Within days of operation – **Secondary**
  - Surgical site infection

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Bleeding - signs

- Fast or rising pulse rate
- Falling blood pressure
- Pale skin/eyes/mouth
- Cold hands/arms

- Low urine output
- Response of all features to rapid IV fluid

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Bleeding – causes at cholecystectomy

- Cystic artery
  - Usually primary/reactionary
  - Diathermy/heat instead of clips
  - Clips poorly applied
- Gallbladder bed
  - Common problem, immediately obvious
  - Inadequate haemostasis is substandard
- Liver
  - Traction from adhesions, ligaments
  - Injury by instruments
  - May be inconspicuous at operation
  - Small amounts of bleeding usually stop
- Division of adhesions – poor technique

cdj1@cantab.net

Bleeding - treatment

- **PROMPT** intervention to control the bleeding

cdj1@cantab.net

Bile Leak
Bile duct injury and other causes

- About HALF of bile leaks arise from main BDI
- Significant bile leak may result from Bowel Injury
- Non-negligent bile leak can occur
  - From the gallbladder bed (duct of Luschke)
  - From the cystic duct (displaced clips; duct necrosis)

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Bile duct injury

- Classify A-E e1-E5
- CHD
- RHD +/- RHA
- Posterior sector

A B C D > 2 cm E1 < 2 cm E2 E3 E4 E5 E6

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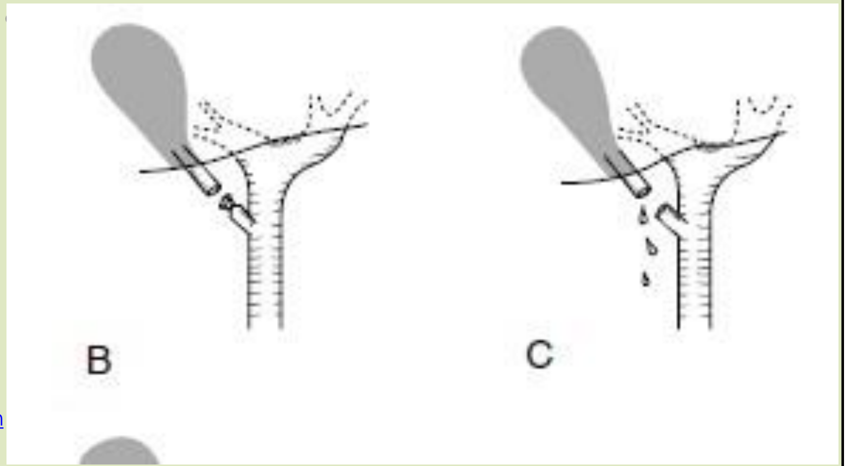
Strasberg A

- Usually Non-negligent
- Postoperative management?
- Treat by ERCP and stent or reoperation

A

Strasberg B, C

- May be Non-negligent – safety manoeuvres?
- Postoperative management?



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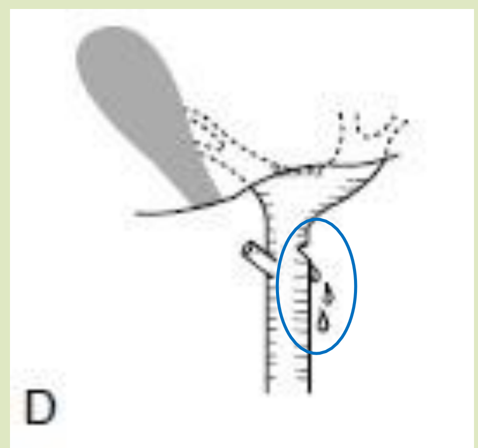
Strasberg D

- Side injury of bile duct
- Difficult to defend
- Was it noticed at operation?
- Treat like Strasberg A
- May need major surgery



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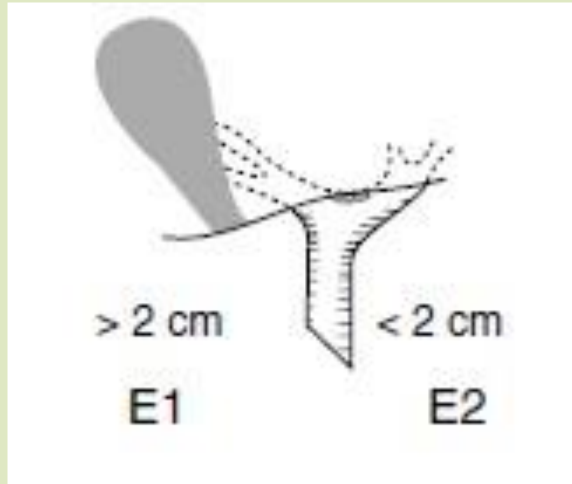
Strasberg E1, E2

- Difficult to defend
- Bile leak
- Needs major surgery (hepaticojejunostomy)



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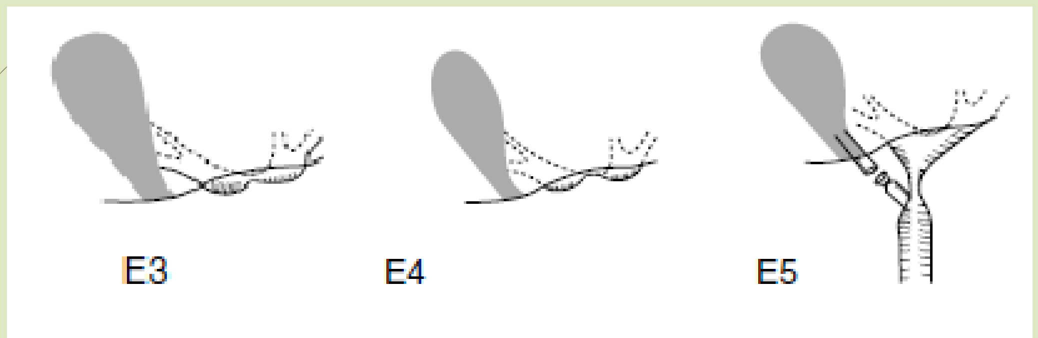
Strasberg E3, E4, E5

- Difficult to defend
- Stricture, no bile leak



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Strasberg E6

- Difficult to defend
- Excision of bile duct
- Open hepatic ducts

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Bile leak
Investigation and management

- Bile in drain – should be obvious!
- No drain: Patient has pain, vomiting, distension. What is going on?
- CT scan will show free fluid in abdomen: INVESTIGATE FURTHER
- MRCP/MRI demonstrates the bile ducts
  - Continuity?
  - Association with fluid collection
  - Better for obstructed ducts
- ERCP demonstrates leakage and where it leaks from from
  - Permits immediate intervention (stent)

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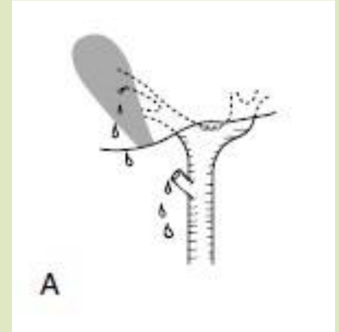
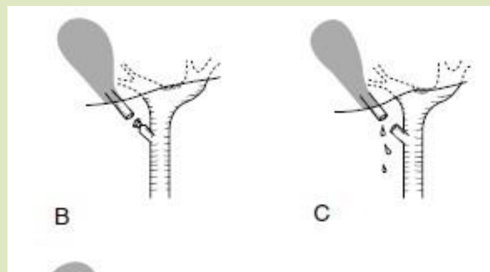
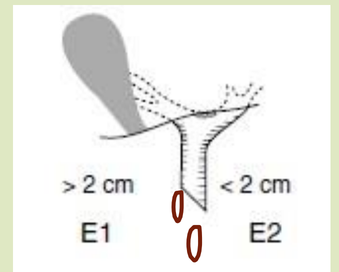
Non-negligent bile leak?

- Which case would you like to manage?







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Bile Duct Obstruction

In the absence of bile leak:

- Patient has upper abdominal pain/discomfort
- No distension
- Gradual onset JAUNDICE (5-7 days)

Causes

- BD injury – stricture or occlusion by clip
- injury to liver arteries
- Stone in bile duct

Call the specialist!

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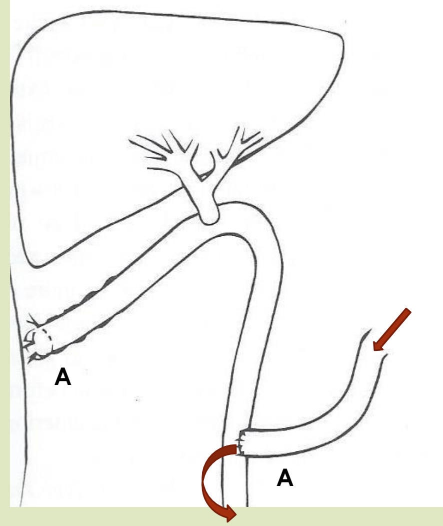
Hepatico-jejunostomy

- Divide small bowel
- Reconnect bile duct to bowel
- Reconnect upper bowel



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Hepatico-jejunostomy - Longterm outcomes

- Consequences of operation
  - Diarrhoea and malabsorption
    (Poor digestive function; Bacterial overgrowth)
  - Adhesions (intermittent colicky pain; bowel obstruction; **operation**)
  - Incisional hernia (pain; backache; swelling; **operation)**
- Stricture at anastomosis
  - Jaundice
  - Cholangitis

cdj1@cantab.net

Hepatico-jejunostomy - Longterm outcomes

- Stricture at anastomosis with recurrent Jaundice, or Cholangitis
  - Antibiotics (intermittent, daily)
  - Percutaneous dilatation **(£15000)**
  - major surgery
    - Redo hepaticojejunostomy **(£15-20K)**
    - Liver resection **(£25K)**
  - Biliary cirrhosis
  - Liver failure leading to Liver transplant **(>£100K)**

cdj1@cantab.net

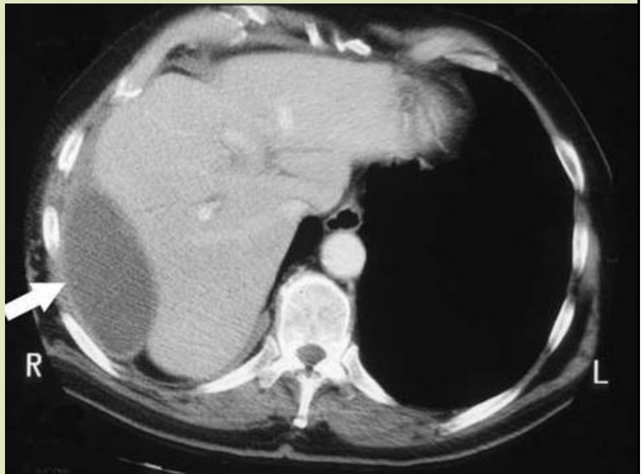
Bowel Injury

- Occurs during
  - insertion of ports
  - Division of adhesions
  - Careless use of diathermy
- DIFFICULT to defend
- Presentation
  - Bile in drain or through wound(s)
  - Peritonitis

cdj1@cantab.net

Lost stones
(dropped into the abdomen from the gallbladder)

- There may be many small stones in GB
- GB is accidentally opened in up to 10% of cases
- If stones are dropped, they may be impossible to retrieve
- Reasonable surgeons would **look carefully**, **remove** as many as possible, and **accept a small risk** of future problems
- **COMMUNICATION is essential**



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Case studies

- To be presented on the day

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