



# Iatrogenic Biliary Lesions

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## IATROGENIC BILIARY LESIONS

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**Abstract**

Iatrogenic bile duct injury carries a high rate of morbidity. After the introduction of laparoscopic cholecystectomy the incidence of these injuries has at least doubled, and even after the learning curve, the incidence has remained of about 0.5%. Etiology of the iatrogenic biliary injuries is the result of the anatomical conditions (biliary or vascular anomalies), pathology (acute cholecystitis, adhesions), technical equipment, surgeon (the learning curve). The type of the injuries, the diagnostic procedures and therapeutic approach are discussed. Most of the minor bile duct injuries, including cystic duct leaks and bile duct strictures, are well treatable with endoscopic techniques, whereas most of the major injuries require operative treatment, which at optimal circumstances gives good results. Interdisciplinary cooperation and early referral to an experienced center is crucial in the management of these iatrogenic lesions. The best „treatment” for this iatrogenic pathology is prevention: surgical access adapted to morphology, good exposure of the hepato-duodenal space, good identification of structures before tying, appropriate dissection, selective cholangiography, great care with the use of electrosurgery.

**KEY WORDS:** BILE DUCTS, IATROGENIC INJURIES, LAPAROSCOPIC CHOLECYSTECTOMY\*

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## Iatrogenic Lesions of the Biliary Tract

“**CBD lesions** are, almost always, a result of an accident during surgery and, therefore, **it can only be attributed to the surgical profession**”.

“These lesions cannot be seen as a normal operative risk...”

Grey-Turner (1944)  
in "Lancet"

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## Cholecystectomy Morbidity and Mortality

- Morgenstein and Berci (92)
- 1200 patients – laparotomy
- Morbidity – 4.9%
- Mortality - 1.8%
- Bicha Castelo et al. (SPC – 98)
- 14.455 patients – laparoscopy
- Morbidity – 3.8%
- Mortality – 0.08%
- Blumgart (95)
- Mortality – 0 to 0.1%
- Below 65 years

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## Biliary lesions: the “3 dangers”

- 1.- Dangerous disease  
(late acute cholecystitis, portal hypertension, ...)
- 2.- Dangerous anatomy  
(anomalies in 10 to 15% of cases)
- 3.- Dangerous surgery  
(technical deficiencies, ...)

(A.R.Moossa)

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## Ethiology of Complications

Variable issues

- Patient
- Pathological condition
- Surgeon
- Equipment
- Environment
- “Learning Curve”

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### Ethiology of Complications

Local Factors

- Inflammation
- Fibrosis
- Reoperations (changed anatomy)
- Urgent Operations
- *(Inevitable??)*

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### Ethiology of Complications

General Factors

- Inadequate Incision
- Bad field exposition
- Bad light
- Bad anaesthesia
- Surgeon (or team's) Inexperience
- Surgeon (or team's) Tiredness
- Misknowledge of eventual anomalies

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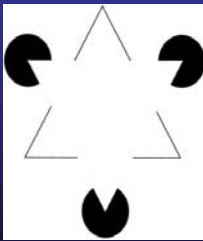
### Ethiology of Complications

Technical Failures


- Inappropriate traction
- Undue use of diathermia
- Inappropriate sutures
- Badly executed sutures
- Prolonged use of the T tube
- Instrumental mishaps
- ...

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### « Heuristic » Processes



Kanizsa's Triangle



(Way Ann Surg 2003)

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### Biliary Complications

3.- Lesions of the Biliary Tract

#### Prevention

- Surgical access adapted to morphology
- Good exposure of the hepato/duodenal space
- Good identification of structures, before tying
- Appropriate dissection
- If necessary, Direct Cholecystectomy
- Selective Cholangiography
- Clamping of the pedicle if big haemorrhage
- Great care with the use of electrosurgery

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### Biliary Complications

3.- Lesions of the Biliary Tract

#### Predicting Problems and Conversion

- Laboratory Parameters
  - Elevated white blood cell count
  - Neutrophilia
  - Elevated RC Protein and Sedimentation rate
  - Elevated Liver function tests

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## Biliary Complications

### 3.- Lesions of the Biliary Tract

### Predicting Problems and Conversion

- Radiological Parameters
  - Thickened gallbladder wall in US
  - Porcelain or calcified gallbladder
  - Signs of acute cholecystitis
  - Gas in the gallbladder wall
  - Pericholecystic fluid
  - Pericholecystic abscess
  - Irregularities or intraluminal mass

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## Iatrogenic Lesions of the Biliary Tract

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## Lesions of the Biliary Tract

### Incidence – 2

• In "classic" cholecystectomy	0.2%
(Davidoff et al.1993)	
• In laparoscopic cholecystectomy	2%
(Strasberg et al.1995)	
• Laparoscopic x "classic"	>0.5%
(McMahon et al.1995)	
• Laparoscopic x "classic"	5 to 10 x >
(Davidoff et al.1992)	
• Diminished in the last years	0.4 to 0.8%
(Richardson et al.1996)	

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## Lesions of the Biliary Tract

### Incidence - 1

• Laparoscopy	France	(24 300 p.) – 0.27%
•	USA	(77 600 p.) – 0.6%
•	Portugal	(14 455 p.) – 0.25%
•	Italy	(13 718 p.) - 0.24%
•	Metanalyses	0.8 to 1%
<hr/>		
• Laparotomy	Johns Hopkins (H.Pitt)	0.1 to 0.2%
•	San Diego (A.R.Moossa)	0.5%
•	Paul-Brousse (H.Bismuth)	0.2%
•	Cornell Univ. (L.Blumgart)	0.2%
•	Portug.Soc.Surg. (B.Castelo)	0.55%

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## Lesions of the Biliary Tract

### Incidence – 2 (personal series)

- In laparoscopic cholecystectomy
- Personal                   0,2%
  - (About 1.000 laparoscopic cholecystectomies:  
2 iatrogenic lesions of the CBD)
- Group                       0,2%
  - (About 3.000 laparoscopic cholecystectomies:  
6 iatrogenic lesions of the CBD)

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## Causes for Biliary stenosis

- 1.- Tying, cutting or resecting the CBD
- 2.- Luminal occlusion (tying of cystic duct)
- 3.- Ischemia of CBD
- 4.- Periductal ischemia
- 5.- Luminal trauma while exploring
- 6.- (Pre-existing benign stenosis)

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### Biliary Complications

#### 3.- Lesions of the Biliary Tract

#### Diagnostic Signs

- Excessive drainage through the wound or drains
- Post-op drainage + Fever + Sub-phrenic abscess
- Some months well and -> Fever, Shivering and Jaundice
- Progressive obstructive jaundice (days, weeks, months)
- Fever without Jaundice (sectorial lesion)
- Intermittent Jaundice (partial occlusion)

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### Signs, Symptoms and Causes

Signs or symptoms	Causes
<ul style="list-style-type: none"> <li>• Abdominal pain</li> <li>• Fever</li> <li>• Nausea/vomiting</li> <li>• Abdominal distension</li> <li>• Jaundice</li> <li>• Anorexia</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical/Bacterial peritonitis</li> <li>• Cholangitis/peritonitis</li> <li>• Peritonitis/ileus</li> <li>• Ileus/biloma</li> <li>• Bile duct obstruction</li> <li>• Ileus/biloma or obstruction</li> </ul>

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### Treatment options

Injury	Therapy
<ul style="list-style-type: none"> <li>• Ductal disruption</li> <li>• Stricture</li> <li>• Bile leak                             <ul style="list-style-type: none"> <li>– Disruption</li> <li>– Duct laceration</li> <li>– Accessory duct</li> <li>– Cystic duct stump</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Hepatico-jejunostomy</li> <li>• Hepatico-jejunostomy – balloon/stent</li> <li>• Hepatico-jejunostomy</li> <li>• Repair, stent/sphinct.</li> <li>• Hep.jej., stent/sphinct., ligate</li> <li>• Stent/sphinct., repair, octreotide</li> </ul>

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### Biliary tract lesions (Bismuth's classification)

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### Biliary tract lesions (Strasberg's classification)

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### Data from referral centers (270 pts)

Type	No	%	Source
<b>A</b>	<b>62</b>	<b>22.9</b>	85% cystic duct leak
B	1	0.37	Radiological & Endoscopic lit.
C	8	3	
D	24	8.8	Surgical literat.
<b>E</b>	<b>175</b>	<b>64.8</b>	

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### Endoscopic Classification

- Type A – Small leaks from accessory ducts
- Type B – Strictures
- Type C – Lateral Fistulae
- Type D – Cut with complete separation

(Neuhaus et al.)

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### Biliary Complications

#### 3.- Lesions of the Biliary Tract

#### General Principles of Biliary Reconstruction

- 1.- Excision of scar tissue in proximal duct
- 2. – Construction of the widest possible stoma
- 3. – Good mucosa to mucosa apposition in 360°
- 4. – Good blood irrigation at suture line
- 5. – Tension less anastomosis

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### Lesions of the Biliary Tract

#### Incidence and Seriousness

- 1.- Is the incidence still the same after the explosion of Laparoscopy?
- 2.- Are the lesions from laparoscopic surgery more serious?

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### Lesions of the Biliary Tract

#### What to do when...

- 3.- A lesion is recognised at surgery?
- 4.- The lesion is diagnosed at immediate post-operative period?
- 5.- The lesion is diagnosed at early post-operative period?

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### Lesions of the Biliary Tract

#### Lesion recognised at surgery

- Which attitude? (*surgical*)
  - a. – End-to-end anastomosis?
  - b. – Hepatico-jejunostomy?
  - c. – Choledoco-jejunostomy?
  - d. – Control and reference?
- With:
  - e. – “Mapping” cholangiograms?
  - f. – T tube (end-to-end)?
  - g. – Stent (anastomotic “support”)?
  - h. – Peri-anastomotic drainage?
- or *endoscopic*? When?

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### Lesions of biliary tract

#### Intraoperative diagnosis

<ul style="list-style-type: none"> <li>• Attitudes                             <ul style="list-style-type: none"> <li>• End to end Anastomosis</li> <li>• Hepatico-jejunostomy</li> <li>• Choledoco-duodenostomy</li> <li>• Control and referral</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Technical details                             <ul style="list-style-type: none"> <li>• Get clean, regular edges</li> <li>• Save duct</li> <li>• Check blood supply</li> <li>• If necessary, “ovalise” the end of the duct</li> <li>• Mapping cholangiography</li> <li>• T tube (end to end)</li> <li>• Good peri-anastomotic drainage</li> </ul> </li> </ul>
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### Lesions of the Biliary Tract

What to do if there are...

Contra-indications for immediate repair?

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<ul style="list-style-type: none"> <li>• <b>Reasons</b></li> <li>• Bad local conditions                     <ul style="list-style-type: none"> <li>– Major inflammation</li> <li>– Narrow bile ducts</li> </ul> </li> <li>• (in) Experience of the surgeon</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Attitudes</b></li> <li>• Sub-hepatic drainage, close to the bile duct lesion</li> <li>• Tying of the main bile ducts, immediately above the lesion</li> <li>• Intubation or drainage of the damaged duct and referral</li> </ul>
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### Lesions of the Biliary Tract

What to do when...

~~3.-~~  
A lesion is recognised at surgery?—

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4.-  
The lesion is diagnosed at immediate post-operative period?

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5.-  
The lesion is diagnosed at early post-operative period?

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### Lesions of the Biliary Tract

Lesion recognised at immediate post-op.

- **Recognised by finding:**
  - a. – Localised peritonitis / “Biloma”?
  - b. – Biliary peritonitis?
  - c. – Major fistula and/or Identified lesion?
- **What to do?**
- **Why?**

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### Lesions of biliary tract

Immediate post-operative

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<ul style="list-style-type: none"> <li>• <b>Diagnosis</b></li> <li>• Localised peritonitis /Biloma</li> <li>• Biliary peritonitis</li> <li>• Major fistula and/or Identified lesion</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Attitude</b></li> <li>• Surgical or percutaneous drainage</li> <li>• Immediate surgery</li> <li>• Drain bile and ducts (repair?)</li> <li>• Do not sacrifice any length</li> <li>• Wait, as much as possible: if necessary drain</li> </ul>
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### Lesions of the Biliary Tract

What to do when...

~~3.-~~  
A lesion is recognised at surgery?—

---

~~4.-~~  
The lesion is diagnosed at immediate post-operative period?—

---

5.-  
The lesion is diagnosed at early post-operative period?

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### Lesions of biliary tract

Early post operative

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- 1.- Fistulography (bilio-enteric continuity?)
- 2.- **Wait (the fistula may close)**
- 3.- Control infection
- 4.- Correct imbalances and nutrition
- 5.- Fistulo-jejunostomy (control losses?)
- 6.- **WAIT !!**

(Blumgart)

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### Lesions of the Biliary Tract

What to do when...

6.-  
The lesion is diagnosed late, post-operatively?

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7.-  
The lesion is diagnosed late, post-operatively, and the patient already has an established portal hypertension?

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### Lesions of biliary tract

Late post-operative

- 1.- Necessary to get to healthy ducts draining the **WHOLE** liver
- 2.- If abscess – drain (can be percutaneous)
- 3.- If portal hypertension:
  - 1st step – biliary drainage (Interv.Rad.)
  - 2nd step – Shunt or sclerosis
  - 3rd step – Definite repair

(Blumgart)

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### Biliary Complications

iatrogenic lesions

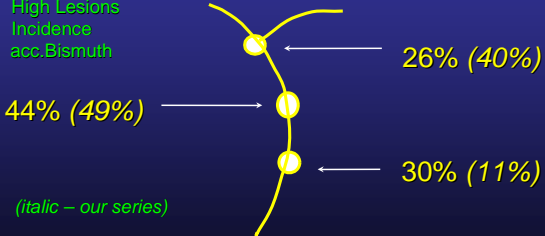
#### Unsuccessful Therapy

- **Causes**
  - Late Diagnosis
  - Prolonged Treatment
  - Unsuccessful Treatment
  - Inadequate Treatment
  - Incomplete Mapping
  - After laparoscopic surgery (??)
- **Attitudes**
  - PTC AND ERCP
  - Preferably by experimented surgeon
  - Anastomosis in one layer only
  - Reabsorbable suture material
  - Drainage (efficacy)
  - Infection Control
  - Care with electrosurgery
  - Excision of all scare tissue

(Lawrence e Way – 1997)

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### Iatrogenic Lesions of Biliary Tract



High Lesions  
Incidence  
acc. Bismuth

26% (40%)

44% (49%)

30% (11%)

*(italic – our series)*

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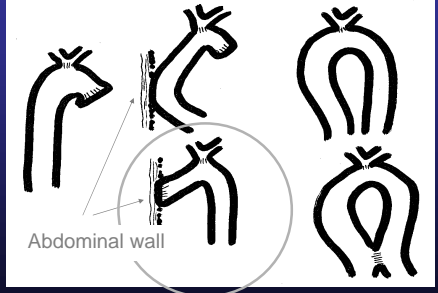
### Lesions of the Biliary Tract

Patients and Surgeries performed

	Immediate	Early	Reoperation	Reconstruction	Total
Cholangiojej.		3	1		4
Hepaticojej.	1	18	6	2 (1 from R.Smith)	27
Segm.III		3		1 (from R.Smith)	4
Choledocojej.		3		1 (from R.Smith)	4
"Mucosal graft"		4	4	1 (from R.Smith)	9
Hepato-jej.		1			1
End-to-end	2				2
					43 patients
<b>Total</b>	<b>3</b>	<b>32</b>	<b>11</b>	<b>5</b>	<b>51 surgeries</b>

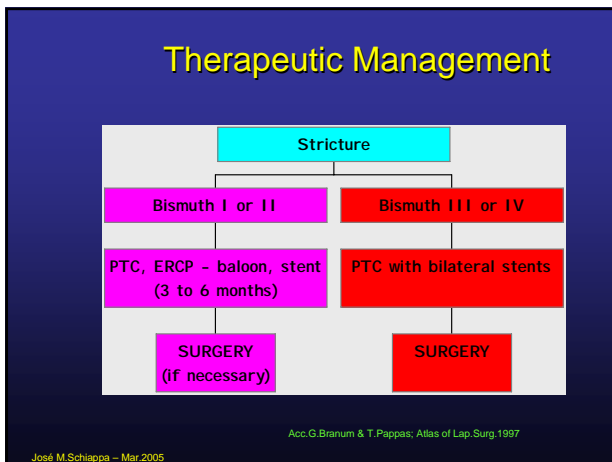
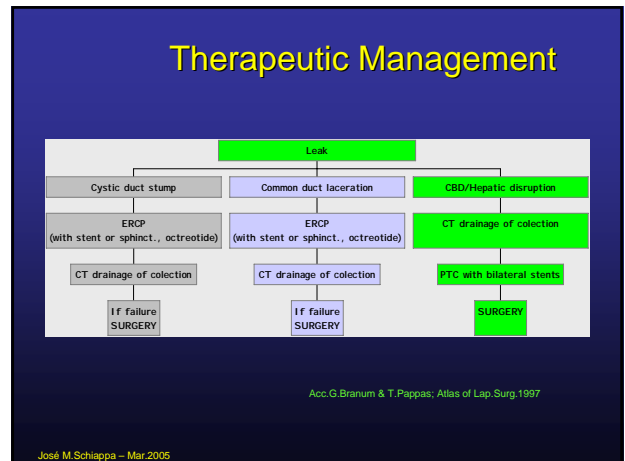
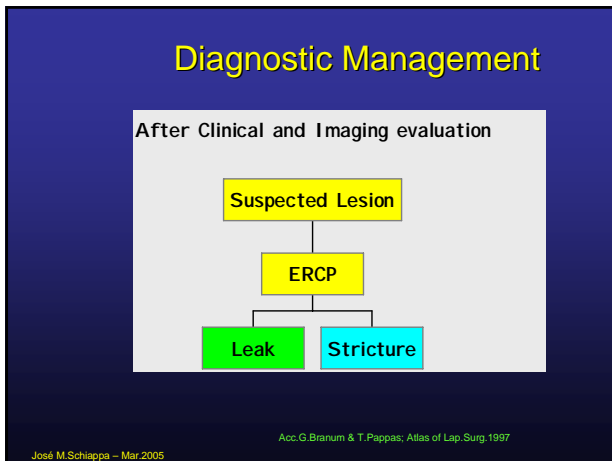
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### Installation of the jejunal limb



Abdominal wall

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- ### Lesions of biliary tract
- #### Non Surgical therapeutic options
- **Endoscopic or Percutaneous**
    - Balloon Dilatation
    - Use of prosthesis
  - **Situations**
    - Small lateral lesions of Bile tract
    - Cystic duct leaks
    - High risk patients
    - Refusal of Surgery
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- ### Biliary Complications
- #### 3.- Lesions of the Biliary Tract
- #### Increased Risk (of repair surgery)
- Age
  - Co-morbidity (hepato-cellular dis., fibrosis, portal hip., ...)
  - High lesions or strictures (Bismuth III e IV)
  - Number of previous repairs
  - Cholangitis or Liver Abscess
  - Intraabdominal Abscess or Collection
  - Biliary Fistula (external or internal)
  - Intrahepatic or multiple Strictures and Lithiasis
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- ### Success rates for treatment
- |  |        |
|--|--------|
| Surgery  |        |
| • Repair by primary surgeon  | 11-17% |
| • Second repair by 1ry surgeon   | =      |
| • Repair by 3ry care surgeon   | > 90%  |
| <small>(Stewart and Way, Arch Surg 1995, Lillemoe et al., Ann Surg 2000)</small> |        |
| • Percutaneous management  | ~60%   |
| <small>(Lillemoe et al., Ann Surg 1997)</small>                                  |        |
| • Endoscopic management  | 40-60% |
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## Iatrogenic Lesions of the Biliary Tract

Surgery *or* Endoscopy?

X

Surgery *and* Endoscopy?

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## “Combined non-surgical” Approach

- Transhepatic Interventional radiology approach till the guide wire goes beyond the severed duct
- ERCP and introduction of a grasper beyond the severed duct
- The grasper grasps the guide wire and pulls it to the mouth
- A prosthesis is passed to occupy the gap of the duct

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## Endoscopic Treatment

### Strictures

- Follow-up time for “cure” – 10 years!
- Endoscopists suggest good results with progressive dilation and placement of multiple plastic prosthesis for 6 to 18 months

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## Conclusions

- These are serious lesions but can be avoided (or, at least, minimised) by:
  - A cautious approach when dealing with bile tract surgery.
  - A policy of conversion or asking for specialised help when facing any unexpected intra-operative problems.
- By its specificity they should always be dealt with by experienced teams in reference centres.

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## Conclusions

### Always use Prevention measures

- Surgical access adapted to morphology
- Good exposure of the hepato-duodenal space
- Good identification of structures, before tying
- Appropriate dissection
- If necessary, Direct Cholecistectomy
- Selective Cholangiography
- Clamping of the pedicle if big haemorrhage
- Great care with the use of electrosurgery

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## Conclusions

- Always use the highest human and surgical good sense
- Have adequate knowledge of the anatomy and of the anomalies
- When in doubt, stop and re-evaluate
- Always keep a humble attitude:
  - Awareness of situations and capacities
  - Every time it is advisable, ask for help...

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