

CHOLECYSTECTOMY-related BILE DUCT INJURY

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REIMS : 11-13/02/2021

Bile Duct Injury during Lap.Chole.

PERSONAL PUBLICATIONS

National surveys in Belgium

- ✓ **Gigot et al. Surg Endosc 1997; 11: 1171-1178**

The dramatic reality of biliary tract injury during laparoscopic cholecystectomy
An anonymous multicenter Belgian survey of 65 patients

- ✓ **Van de Sande et al. Act Chir Belg 2003; 103: 168-180**

National survey on cholecystectomy related bile duct injury – Public health and financial aspects in Belgian hospitals - 1997

- ✓ **Navez et al. Surg Endosc 2012; 26: 2436-2445**

Surgical management of acute cholecystitis: results of a 2-year prospective
Multicenter survey in Belgium (prospective study 2001-2002)

Review article

- ✓ **Gigot. Acta Chir Belg 2003; 103: 154-160**

Bile duct injury during laparoscopic cholecystectomy: risk factors, mechanisms, type, severity and immediate detection.

Technical article

- ✓ **Hubert et al. Surg Endosc 2010; 24: 2626-2632**

The “inside approach of the gallbladder” is an alternative to the classic Calot’s triangle dissection for a safe operation in severe cholecystitis.

AGENDA

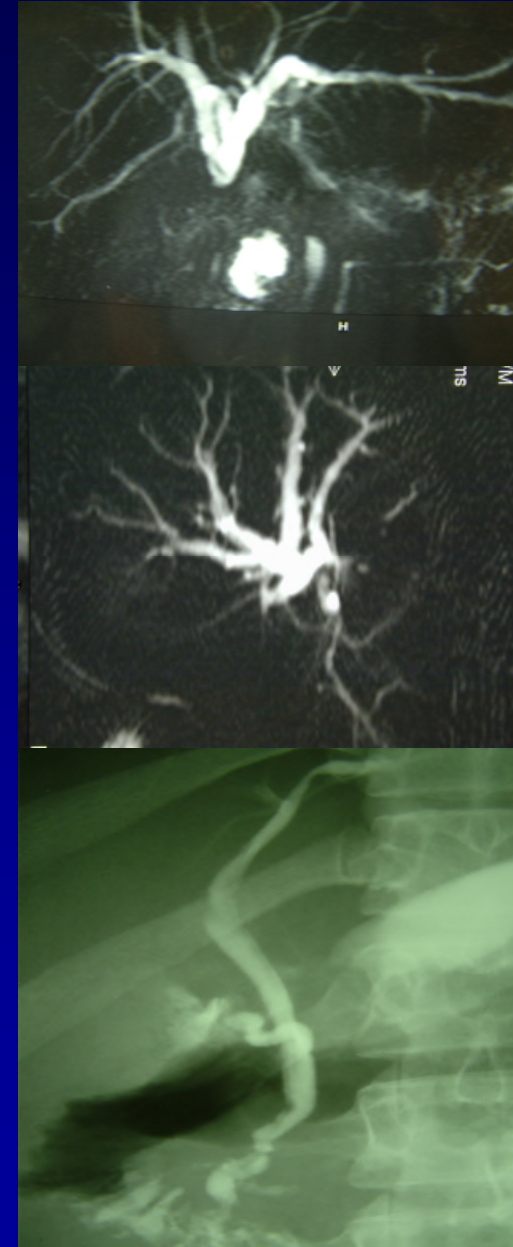
- Definition, characteristics and prevalence
- Risk factors for BDI
- Rules for a safe dissection
- Diagnosis (and the role of IOC)
- Alternatives approach for difficult cholecystectomy
- Management of BDI
 - Peroperative management
 - Postoperative fistula
 - Postoperative bile peritonitis
 - Postoperative bile duct stricture
- Conclusions

Bile Duct Injury during Lap.Chole.

DEFINITION

Any injury of the **main bile duct** and **bifurcation**
including **biliary anomalies**

*By exclusion of the **cystic duct injury***



LAPAROSCOPIC CHOLECYSTECTOMY

" The gold standard for elective treatment of symptomatic gallstone "

Consensus conferences :

- . Strasbourg - december 1991 - ANDEM
- . Bethesda - september 1992 - NIH
- . Madrid - september 1994 - EAES

Advantage : minimally-invasive approach

Bile duct Injury during Lap.Chole.

PARTICULARITIES

- * *more frequent*
- * *more severe injury*
- * *specific mechanisms of injury*
- * *lower peroperative detection*
- * *increased number of litigation !!!*

!!! PREVENTION is the KEY !!!



Bile duct Injury during Lap.Chole.

NEED to be included in the INFORMED CONSENT

Law in Belgium : inform about complication

- with an incidence of $\geq 1\%$
- But ALSO **severe** complication

**Discrepancy between announced MIS
>< BDI and consequences**

!!! INFORMATION is the KEY !!!



BDI during LC : the Belgian Registry

THE BELGIAN EXPERIENCE

Prevalence BDI in Belgium

1990 to 1997 (National survey) : **0.50 %**

Year 1997 (Belgian Health System) : **0.49 %**

Year 2000 (Belgian Health System) : **0.54 %**

→ *unchanged !!!*

Gigot et al. 1997 : 9959 patients - all presentation **0.5 %**

Navez et al. 2012 : 1089 patients - acute cholecystitis **1 %**

x 2 !!!

NOT A VANISHING PROBLEM in BELGIUM

BDI during LC : the Swedish Registry

GallRiks

Type of Injury (n=747)	Hannover Grade	N (%)
Cystic duct leak	A1	265 (35.5)
Peripheral duct injury gallbladder bed	A2	106 (14.2)
Tangential lesion common bile duct	C1, C2, C3	130 (17.4)
Transected bile duct (below hepatic bifurcation)	D1, D2, D3	16 (2.1)
Obstructive Injuries	B1, B2	7 (0.9)
Lesions above the hepatic bifurcation	C4, D4	32 (4.3)
Injuries with insufficient information		191 (25.6)

National Swedish Registry for Gallstone Surgery and ERCP

- National registry since 2005¹
 - Captures ~90% of all cholecystectomies in Sweden
 - **1.5%** of patients had bile duct complications including bile leaks.
 - **0.4%** of major bile duct injuries requiring reconstruction was.
- Such registry has improved health care ²

1. <http://kvalitetsregister.se/englishpages/findaregistry/registerarkivenglish/nationalqualityregistryforgallstonesurgeryandendoscopicretrogradecholangiopancreatographygallriks.2115.html>

2. ENOCHSSON Lakartidningen 2015;112:DCE6

Bile duct Injury during Lap.Chole.

ACTUAL TREND

- All surgeons are trained
- Lap chole is a part of all surgical training programs
- The technique has been revisited
(*Critical View Safety technique*)
- Decreased incidence of BDI (from 0.5% to around 0.2 %)
- IOC is still not the rule !!!
- Multidisciplinary management is the key of success
- Many less severe BDI are successfully treated by endoscopy
- increased number of litigation !!!

PITT et al. Ann Surg 2013; 258(3): 490
SICKLICK et al. Ann Surg 2005; 241(5): 786



LC-related BDI : the literature

and WHAT ABOUT TODAY ?

Prevalence BDI

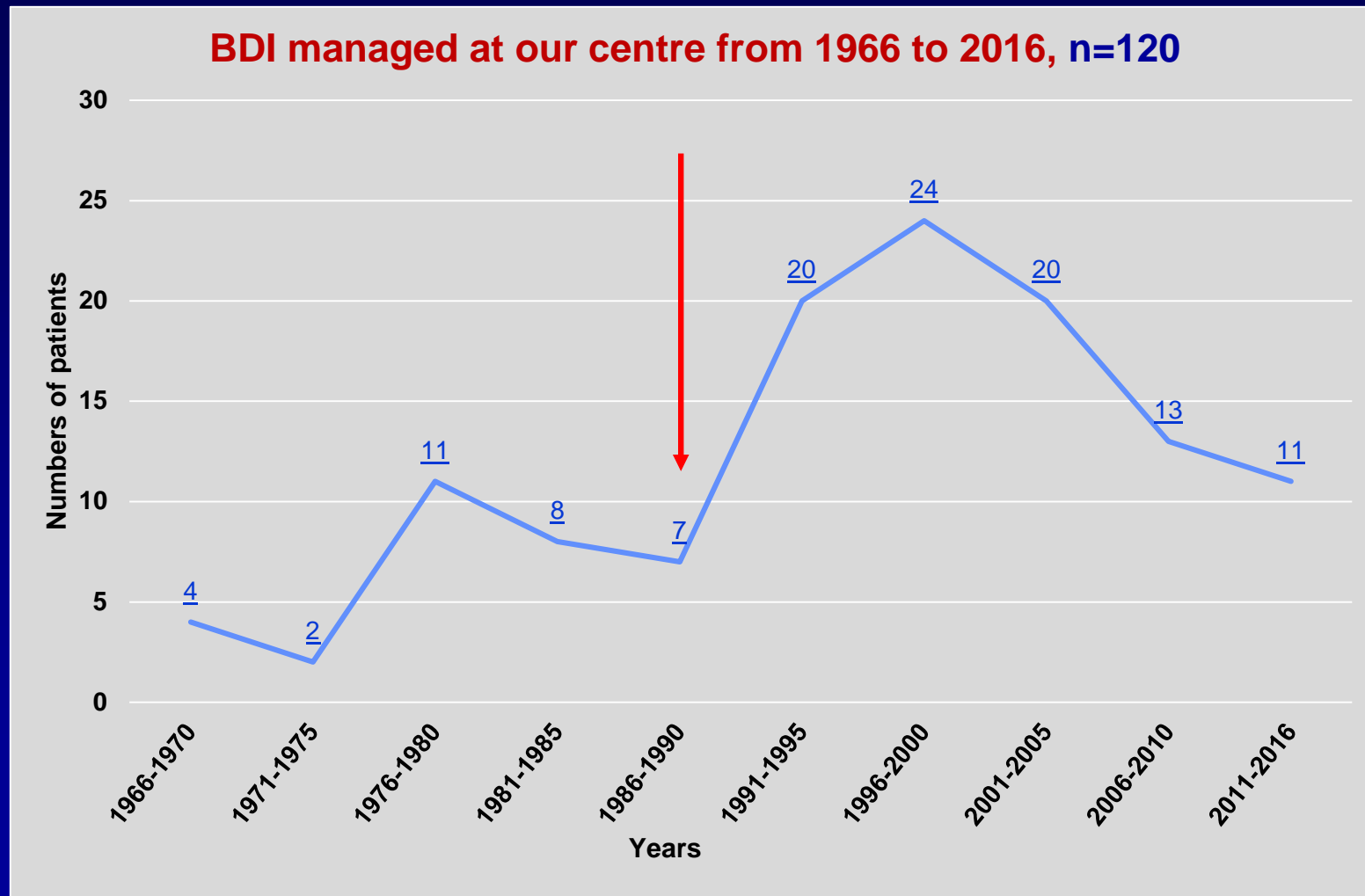
No recent survey in Belgium

Authors	Year	Type of study	Period	Patients	BDI rate
HARBOE et al.	2011	Danish cholecystectomy database	2006-2009	20.307	0.2 %
CHUANG et al.	2012	USA: Kaiser Permanente North California system	1995-2008	83.449	0.1 %
AFTHINOS et al.	2014	USA: Nationwide Inpatient Sample (NIS)	2005-2010	312.521	0.2 %
VISTE et al.	2015	Norwegian Patients registry	1999-2013	5013	0.4 %
RYSTEDT et al.	2016	Swedish Quality Register	2007-2011	55.134	0.3 %

NAVEZ et al. Surg Endosc 2012;26:2436
HARBOE et al. Surg Endosc 2011; 25:1630
CHUANG et al. Am J Surg 2012; 203(4): 480

AFTHINOS et al. JACS 2014; 219(4): 91.
VISTE et al. Scand J Surg 2015; 104(4): 233
RYSTEDT et al. World J Surg 2016; 40(1): 73

LC-related BDI : the UCL experience with secondary biliary repair



BDI during LAP CHOLE : Belgian Health Care System Study (INAMI / RIZIV)

SIGNIFICANT INCREASE in MORTALITY / COSTS

	1997 *		2000 *	
	Mortality	Costs (euros)	Mortality	Costs (euros)
Lap Chole	-	1800 (x1)	0.05 %	2000 (x1)
Open chole	-	2980 (x 1.7)	0.7 %	2800 (x 1.4)
Primary repair	3.3 %	7500 (x 4)	4.7 %	10.500 (x 5.8)
Primary delayed repair	13 %	12.400 (x 7)	-	-
Secondary repair	2.2 %	8000 (x 4.5)	1.3 %	7500 (x 3.8)
1° + 2 ^d BDI repair	-	-	-	(x 9.6)

BDI during LC : the Belgian Registry

POSTOPERATIVE OUTCOME

SIGNIFICANT MORBIDITY !!!

**IMMEDIATE DETECTION
is the key for OUTCOME**

mortality rate : 9 %
complications : 31 %
14 %
%

Patients

Mortality

comp.

. Perop. detect. :

7 %

24 %

14 %

45 %

. Peritonitis :

34 %

20 %

50 %

23 %

53

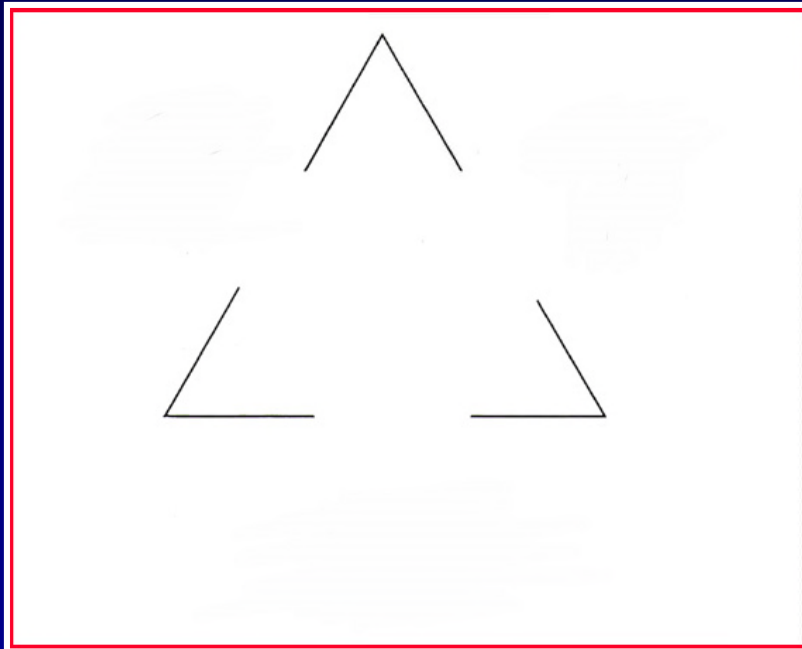
47 %

THE *RISK FACTORS* for BDI during LAP. CHOLE are *MULTIFACTORIAL*

THE FIELDS of PREVENTION

1. Factors **inherent** to the laparoscopic approach
2. Inadequate **training** of the surgeon
3. Presence of **local risk factors**
4. **Technical factors**
 - Inappropriate surgical technique
 - Absence of IOC
 - Lack of adequate conversion in difficult cases

RISK FACTORS *INHERENT* TO THE LAPAROSCOPIC APPROACH



Kanizsa triangle : the white triangle is a creation of visual heuristics



An illusory dog assembled automatically by subconscious process

MISPERCEPTION = major factor for BDI (cognitive psychology perspective)
HUMAN ERROR AND OPTICAL ELUSION (visual errors)

RISK FACTORS *INHERENT* TO THE LAPAROSCOPIC APPROACH

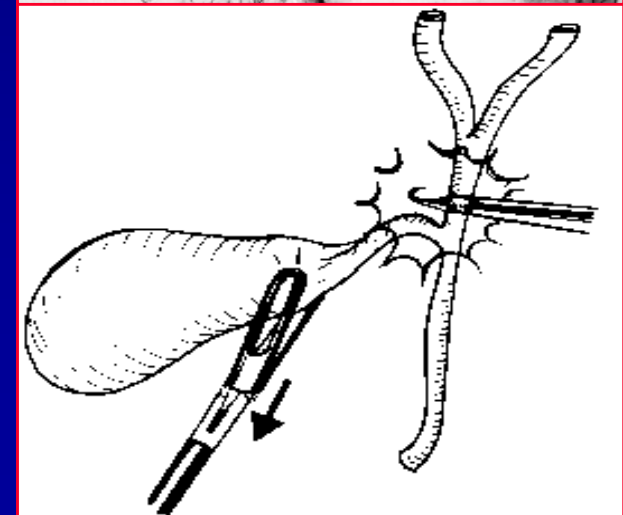
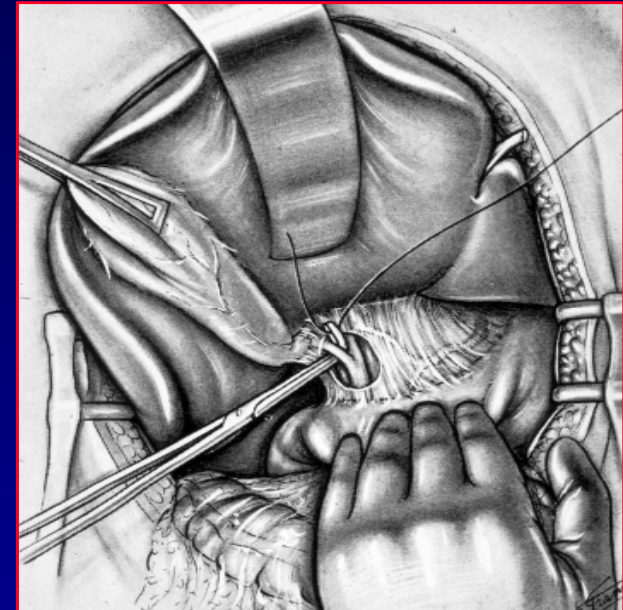
due to the *concept* of laparoscopy

- Loss of depth perception (**2-D vision**)
- **Loss of manual palpation** of the porta hepatis
- **Surgeon's dependance**
 - to the equipment (light, pneumoperitoneum, ...)
 - to the camera holding assistant
- **Loss of vision** when the limited field is obscured by bile or blood
- **Blind manipulation** of instruments.

RISK FACTORS *INHERENT* TO THE LAPAROSCOPIC APPROACH

due to the *laparoscopic approach*

- **Different exposure compared to OC**
of the hepatoduodenal ligament
(vertical *versus* oblique and tangential)
- **Different surgical technique**
 - the junction Cd/CBD/CHD is usually not visualized
 - (ab)use of electrocautery !!!
- **Bleeding is more difficult to control laparoscopically**



RISK FACTORS *INHERENT* TO THE LAPAROSCOPIC APPROACH

du

laparoscopic approach

YOU SHOULD BE AWARE OF THESE SPECIFIC PARTICULARITIES OF THE LAPAROSCOPIC APPROACH

- **Different anatomy**
 - of the hepatocolic junction (vertical *versus* oblique anastomosis)
- **Different surgical technique**
 - the junction Cd/CBD/CHD is usually not visible
 - (ab)use of electrocautery !!!
- **Bleeding is more difficult to control laparoscopically**



THE *RISK FACTORS* for BDI during LAP. CHOLE are *MULTIFACTORIAL*

THE FIELDS FOR PREVENTION

1. factors **inherent** to the laparoscopic approach
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BDI during Lap. Chole : the BELGIAN REGISTRY

Surgeon's
experience

BDI
rate

INCIDENCE

0.5 %

< 50 cases :
> 50 cases :

1.3 %

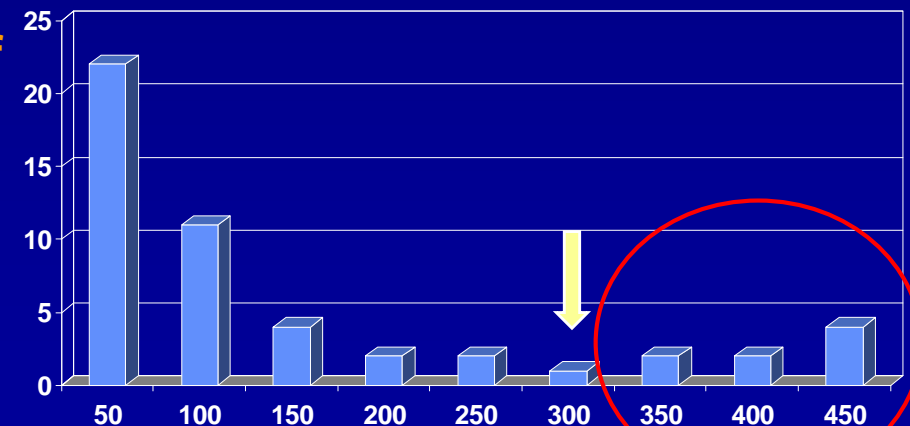
0.35 % $p < 0.0001$

DISTRIBUTION

(50 primary BDI)

< 50 cases : 44 %
50-100 cases : 22 %
> 100 cases : **34 %**

Nb of
BDI



Surgical Experience (Nb of LC)

**THUS, ADEQUATE SURGICAL TRAINING
ALONE DOES NOT PROTECT THE
PATIENT AGAINST THE OCCURRENCE
OF BDI DURING LAPAROSCOPIC
CHOLECYSTECTOMY**



JUST A QUESTION

**IS THE CONCEPT OF SURGICAL
LEARNING CURVE ETHICALLY
ACCEPTABLE FOR THE PATIENT?**



THE *RISK FACTORS* for BDI during LAP. CHOLE are *MULTIFACTORIAL*

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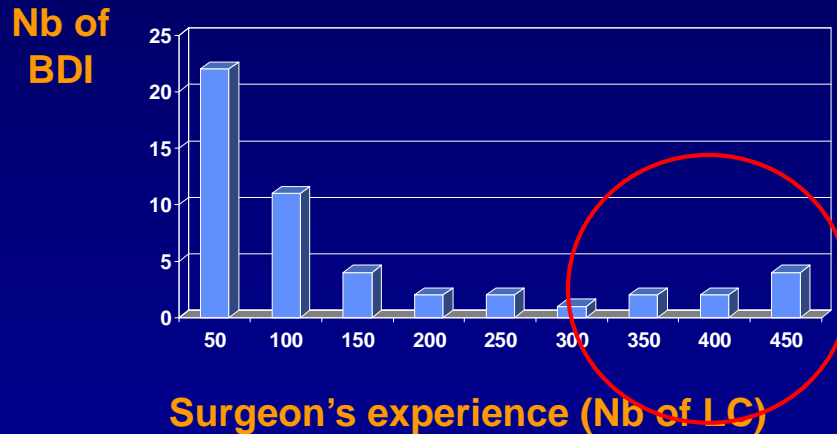
The relation between *LOCAL RISK FACTORS* and *SURGEON'S EXPERIENCE*

% BDI

Gigot et al. 1997 : 9959 patients - all presentation
Navez et al. 2012 : 1089 patients - acute cholecystitis

0.5 %
1 %

X 2



SURGEON EXPERIENCE and LOCAL RISK FACTORS

	absent	present
< 50 cases :	55 %	45 %
> 50 cases :	24 %	76 %

p = 0.03

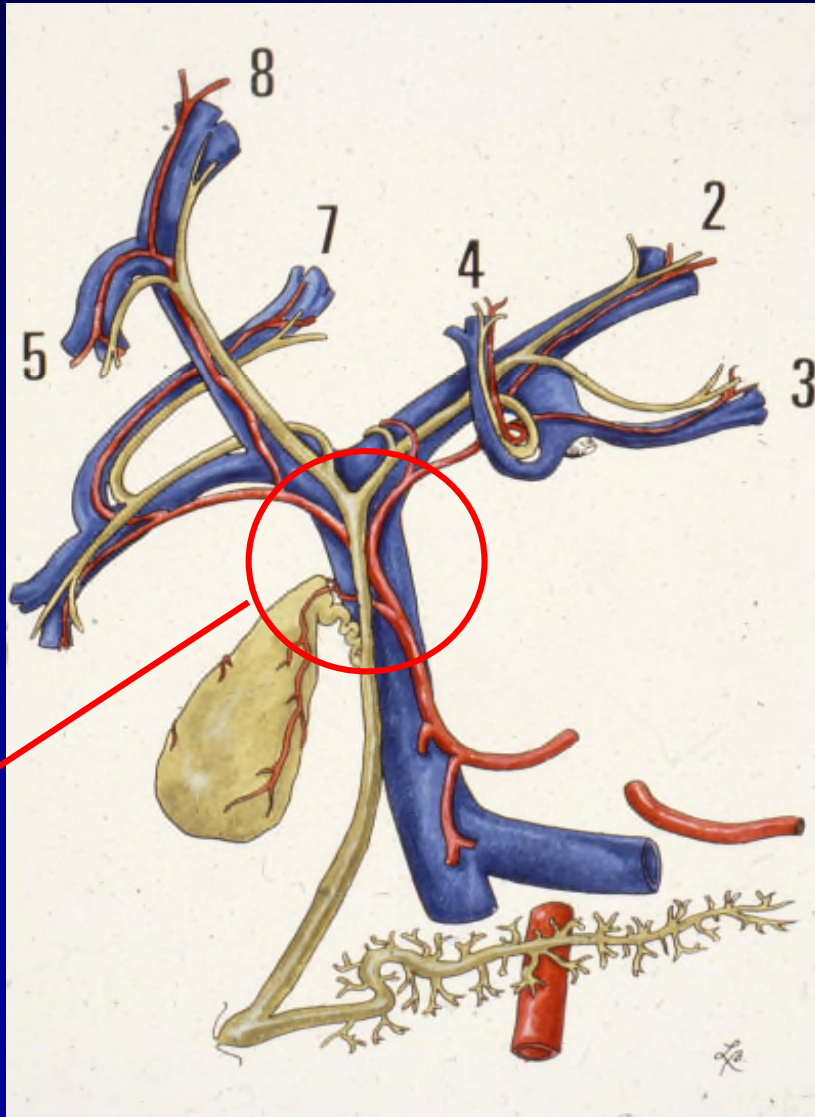
Increased BDI rate in acute cholecystitis :

KUM et al. 5.5% vs 0.2%; $p < 0.005$
TÖRNQVIST et al. Mild cholecystitis: OR 0.96
x2 Moderate cholecystitis: OR 2.41
 Severe cholecystitis: OR: 8.43

Direct relationship between risk of BDI and severity of AC !!!

Intention IOC reduced the risk by 52 %

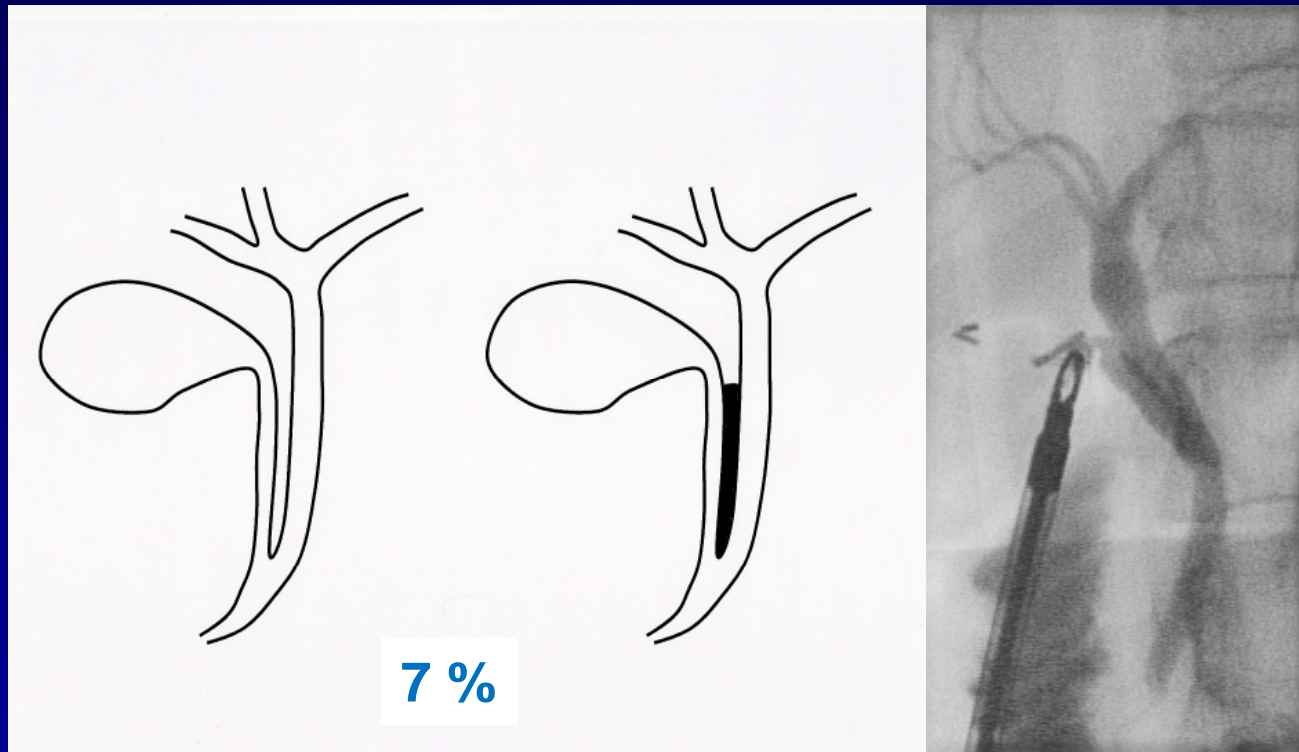
NORMAL BILIARY / ARTERIAL ANATOMY



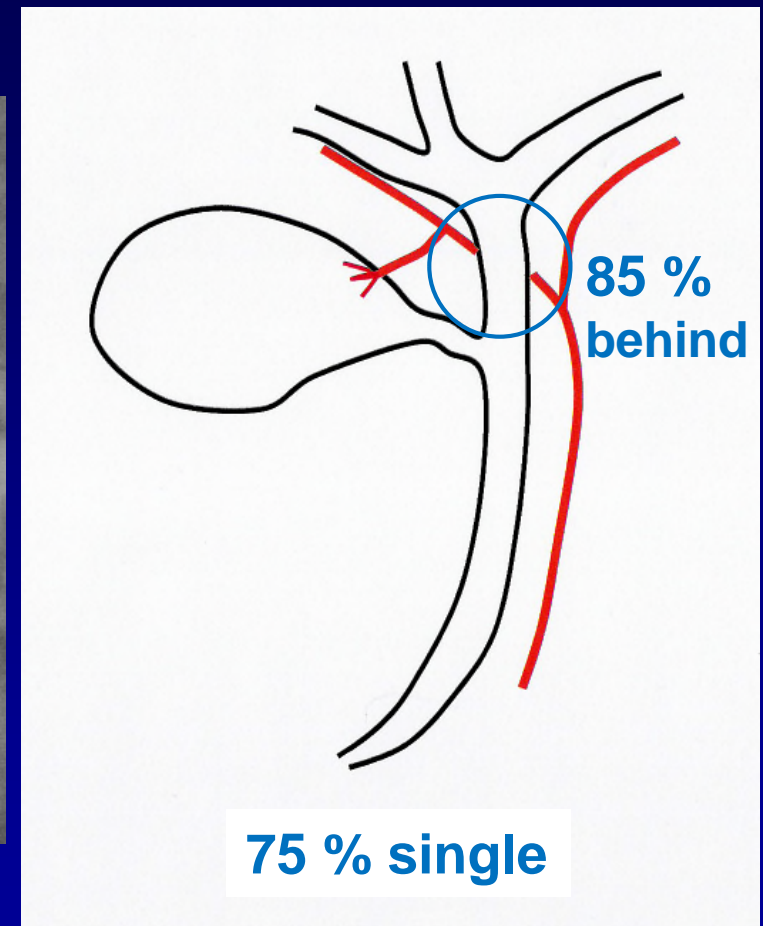
Zone of danger



ANATOMICAL VARIATIONS of CYSTIC DUCT / ARTERY



Parallel or fused cystic duct



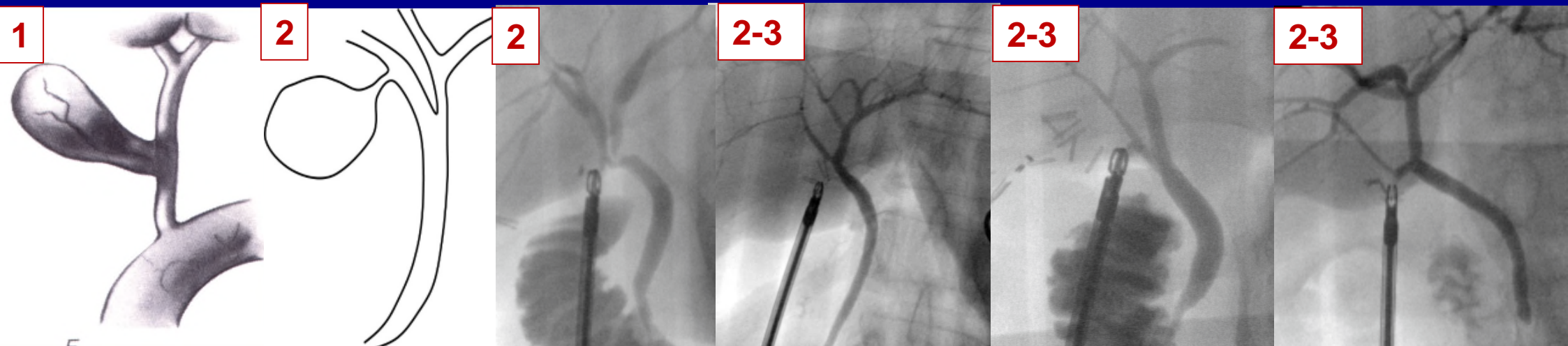
Multiple cystic arteries in 25%
From single or multiple origin

ANATOMICAL LOCAL RISK FACTORS

Be aware of biliary anomalies

The most common being ...

1. a short or inexistant cystic duct
2. a cystic duct draining in the RHD or ARHD
3. an anomalous RHD



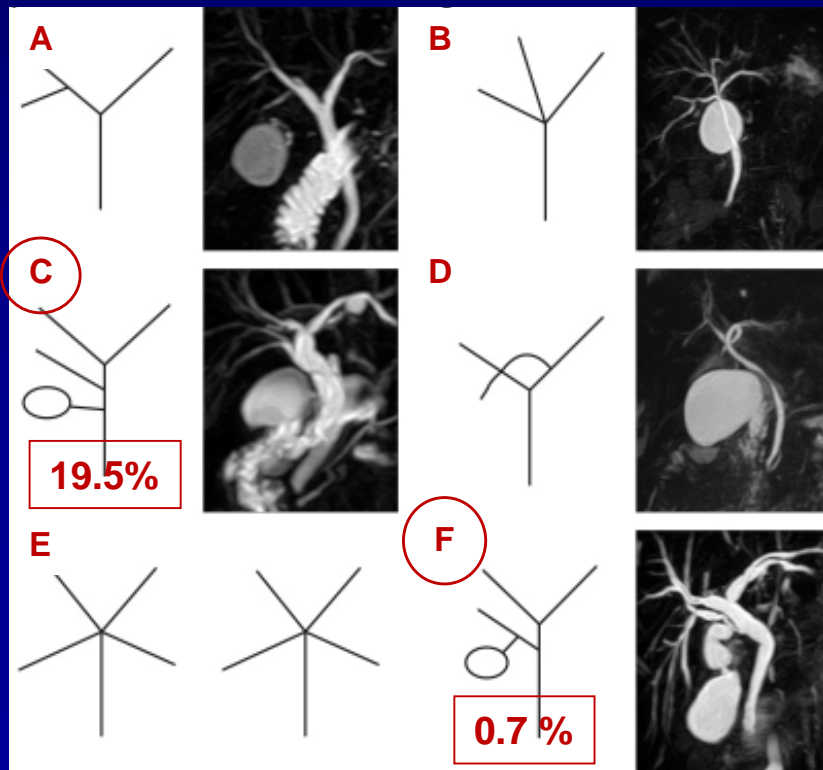
ANATOMICAL LOCAL RISK FACTORS

Be aware of biliary anomalies

1. Short or inexistant cystic duct
2. Cystic duct draining in the RHD or ARHD
3. Anomalous RHD

High-risk group : Anomalous extrahepatic confluence (type C and F)

20 %



FREQUENCE	COUINAUD	CHUNG
Type C	20 %	19.5 %
Type F	2 %	0.7 %

CLINICAL IMPACT	Low-risk group	High-risk group	p
Patients	221	56	NS
Age	54.4	55.6	NS
BDI rate	0.46 %	5.17 %	0.03
Conversion	4.6 %	6.9 %	NS
Complications	5.9 %	8.6 %	NS
Acute cholecystitis	46.6 %	37.9 %	NS

Anomalous extrahepatic confluence increase the risk of BDI by OR 11.89

COUINAUD Etudes anatomiques du Foie. 1957
CHUNG et al. J Hep Pancr Surg 2012; 16:17

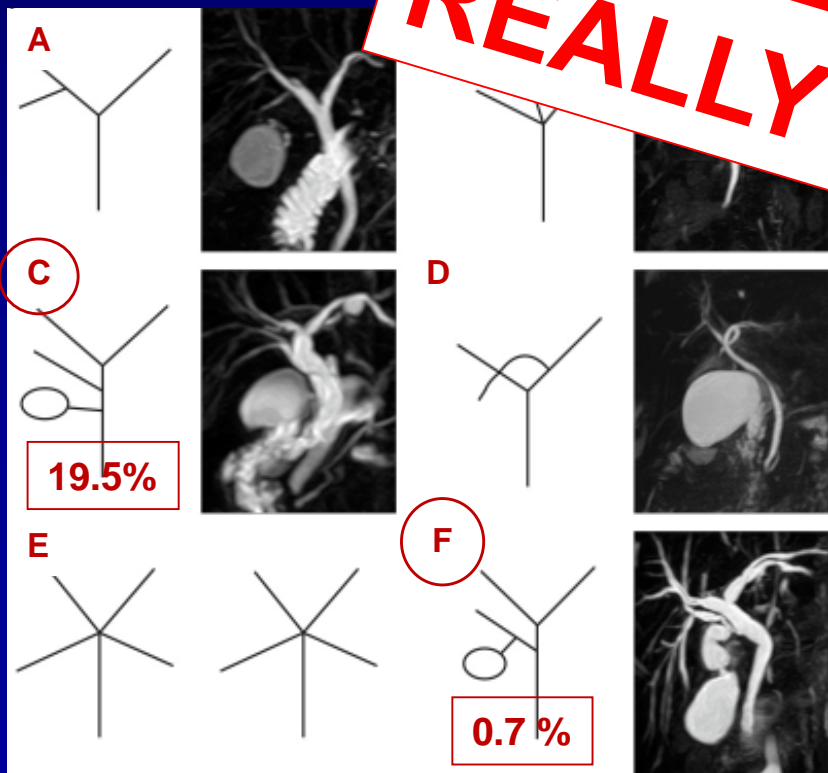
ANATOMICAL LOCAL RISK FACTORS

Be aware of biliary anomalies

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High-risk group: Anomalous extrahepatic confluence (type C and F)

20 %



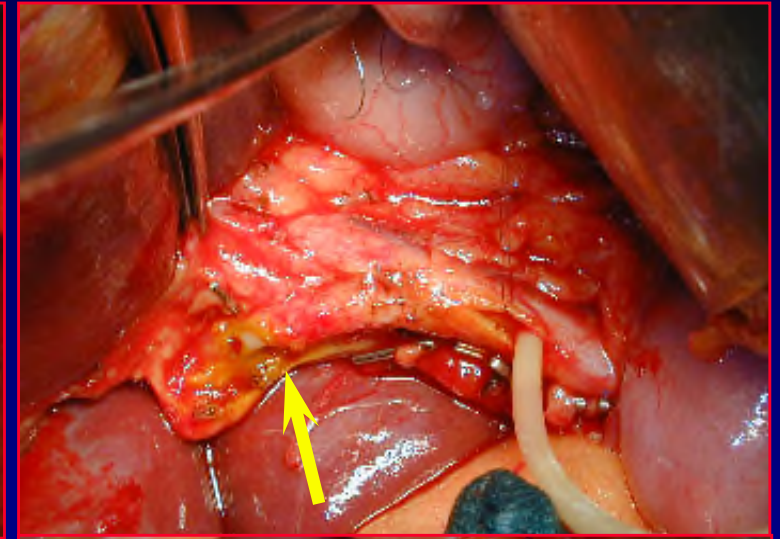
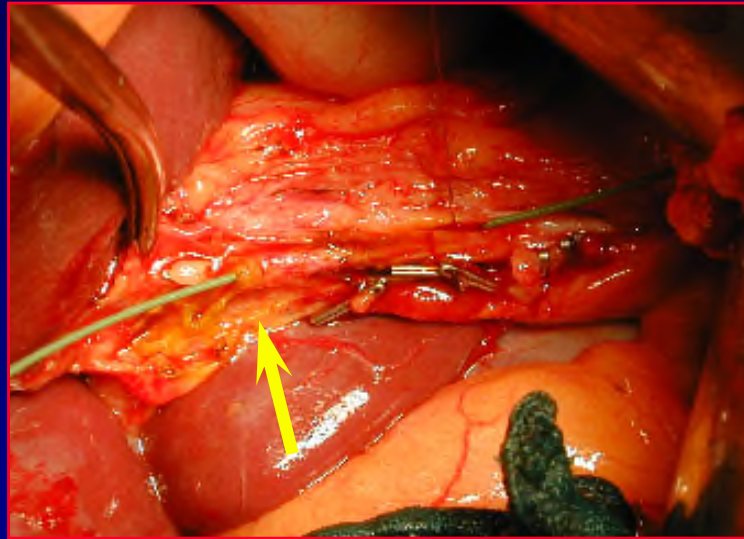
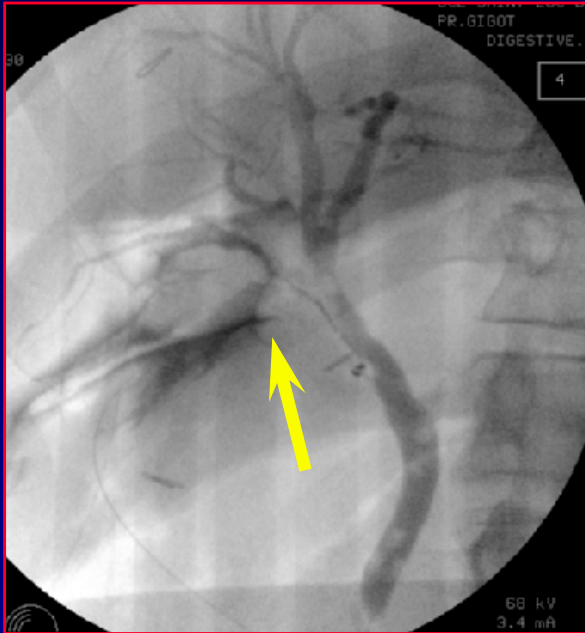
THESE PATIENTS ARE REALLY AT RISK OF BDI

FREQUENCE	COUINAUD	CHUNG
Type C	20 %	19.5 %
Type F	2 %	0.7 %

	High-risk	High-risk group	p
Age		56	NS
Age		55.6	NS
BDI rate		5.17 %	0.03
Conversion		6.9 %	NS
Complications	5.9 %	8.6 %	NS
Acute cholecystitis	46.6 %	37.9 %	NS

Anomalous extrahepatic confluence increase the risk of BDI by OR 11.89

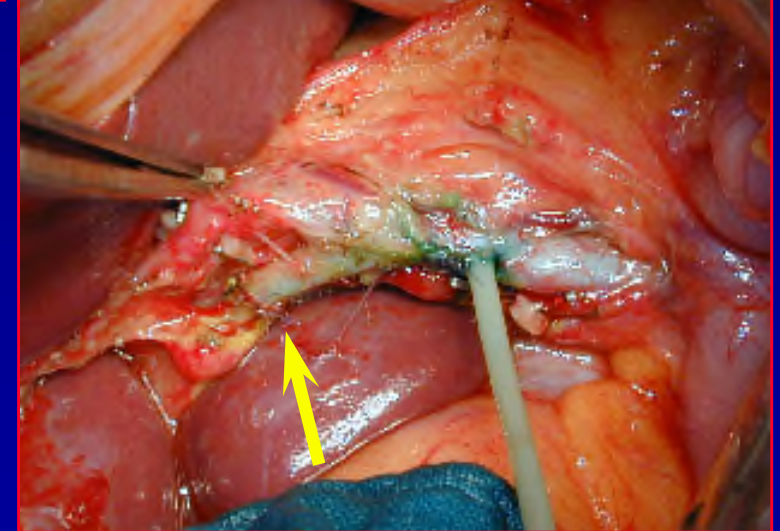
LAPAROSCOPIC BDI to an ANOMALOUS R. HEPATIC DUCT



lateral BDI to
anomalous RPLBD
during delayed LC
for severe cholecystitis



primary repair
by *direct suture*
with T-tube
insertion



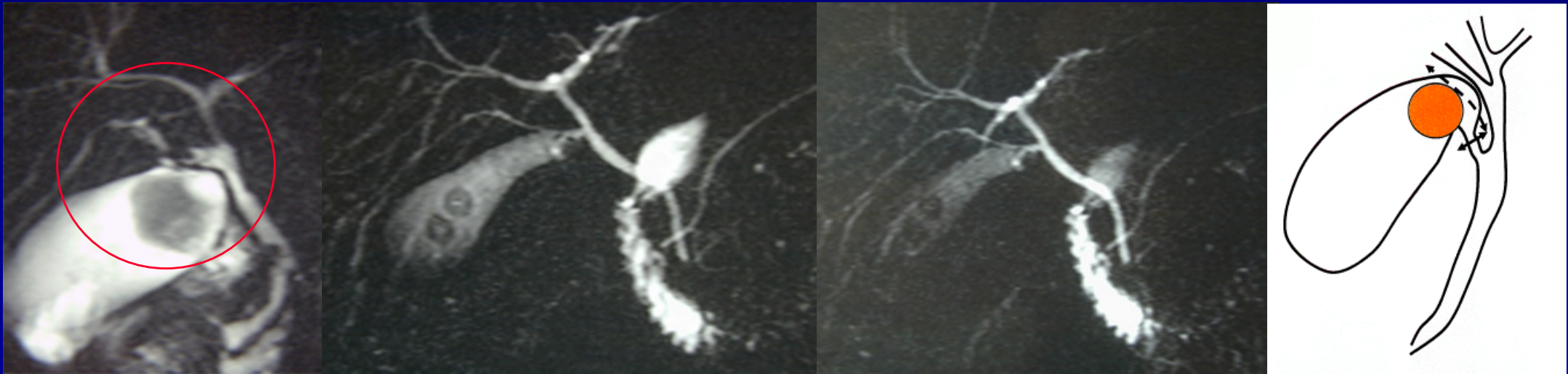
ANATOMICAL LOCAL RISK FACTORS

HIGH RISK of BDI in case of severe cholecystitis

We do routinely preop. MRCP in case of
delayed cholecystectomy for acute cholecystitis

→ preop identification of biliary anomalies

→ preop decision of potential alternative subtotal cholecystectomy



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THE FIELDS FOR PREVENTION

1. factors **inherent** to the laparoscopic approach
2. inadequate **training** of the surgeon
3. **local risk factors**
4. **technical factors** :
 - inappropriate surgical technique ++++++
 - absence of IOC
 - lack of adequate conversion in difficult cases

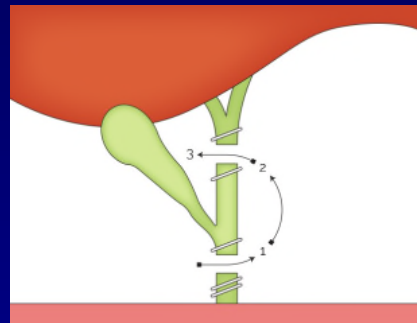
MECHANISMS of BDI during Chole

87 % during Calot triangle dissection

open	laparoscopic
French survey	Belgian survey

. misidentification of CBD : *the « classical » injury*

with cystic duct during IOC
 during dissection
 with cystic artery



29 %	} 42 %	6 %	} 43 %
8 %		35 %	
4 %		1.5 %	

. cystic duct avulsion

3 %	3 %
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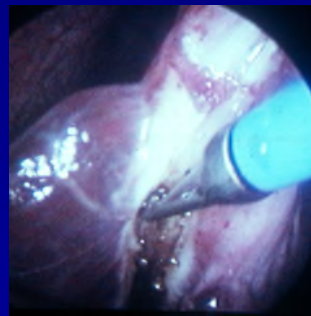
. CBD tenting

3 %	3 %
-----	-----

. during urgent haemostasis

1.5 %	1.5 %
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. instrumental
. thermal usually combined

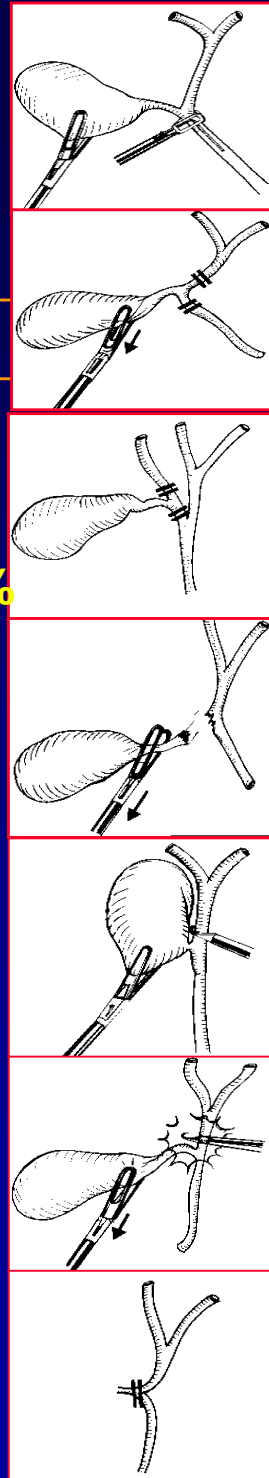


3 %	21 %
-	13 %

. lateral clipping

-	1.5 %
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Vasculo-biliary injuries in 25-35%



SARNO *et al.* Br J Surg 2012; 99: 1129
 STRASBERG *et al.* HPB 2011; 13: 1
 FRILLIN *et al.* Br J Surg 2008; 95: 460

BISMUTH *et al.* Les TOVBP Paris, Masson 1981
 GIGOT *et al.* Surg Endosc 1997; 11: 1171

MECHANISMS of BDI during Chole

87 % during Calot triangle dissection

- . misidentification with cystic duct
- . misidentification with cystic artery
- . cystic duct injury
- . CBD tenotomy
- . during urgent haemostasis

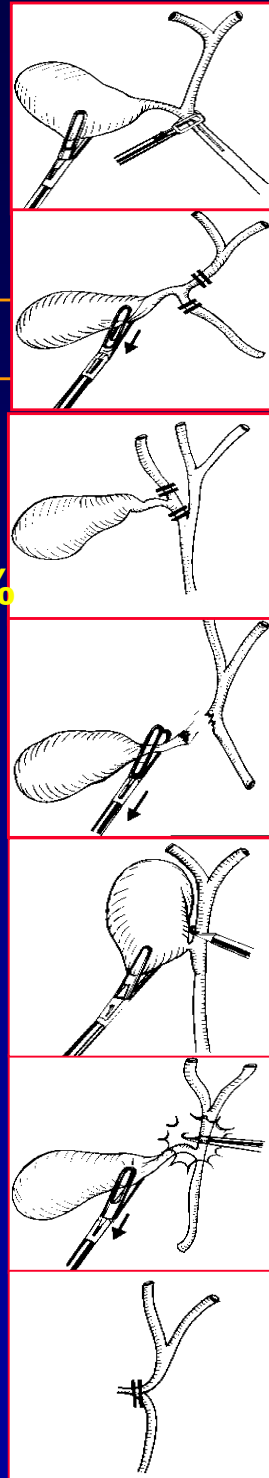
- . instrumental
 - . thermal
 - . lateral clipping
- usually combined



AVOID THE USE OF MONOPOLAR CAUTERY WITHIN THE CALOT TRIANGLE

open	laparoscopic
French survey	Belgian survey

6 %
35 %
43 %
%
3 %
1.5 %
21 %
13 %
1.5 %



Vasculo-biliary injuries in 25-35%

SARNO *et al.* Br J Surg 2012; 99: 1129
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SEVERITY of BDI during LAPAROSCOPIC CHOLECYSTECTOMY

SEVERITY

* lateral injury : 48 %

* complete
transsection : 32 %

* resection : 10 %

* thermal : 10 %

52 %

SITE (BISMUTH classif.)

* Type I : 51 %

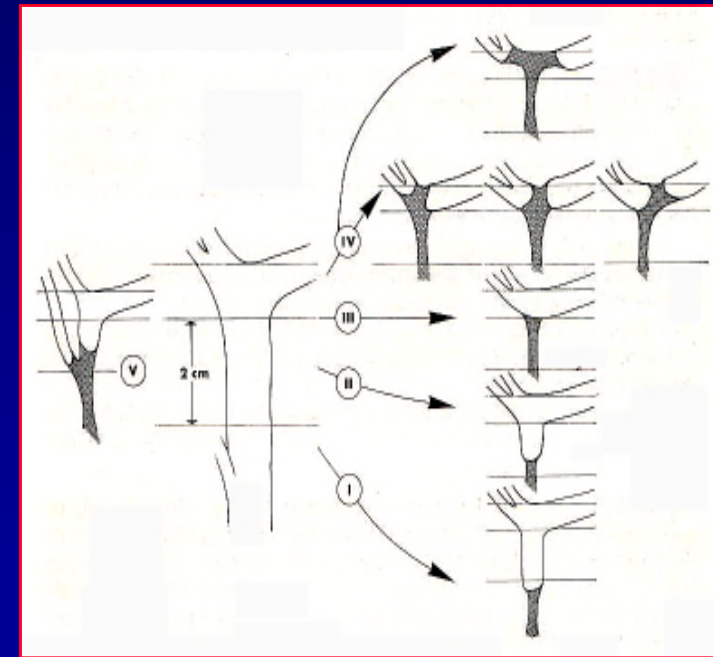
* Type II : 28 %

* Type III : 9 %

* Type IV : 3 %

* Type V : 9 %

21 %



***DIFFERENT SEVERITY* of BDI during LC ?**

MORE SEVERE INJURY

RUSSELL

Connecticut LC Registry (1989-1993)

	Patients	Transection or excision	p
Open chole	14.990	0.01 %	0.001
Lap chole	15.221	0.13 %	

RUSSEL *et al.* Arch Surg 1996; 131(4):382-388

RULES for a SAFE SURGICAL DISSECTION

CLASSICAL APPROACH

1. Adequate **exposure the hepatoduodenal ligament**
2. Adequate **exposure the CALOT triangle**
3. Safe **dissection of the CALOT triangle**
4. Close **dissection of the Hartman pouch**
5. **Performance of IOC**

MODIFIED APPROACH

in difficult cases

6. Adequate ***conversion to open*** approach
7. Conversion to ***subtotal cholecystectomy***
8. **Tube-cholecystostomy**

RULES for a SAFE SURGICAL DISSECTION

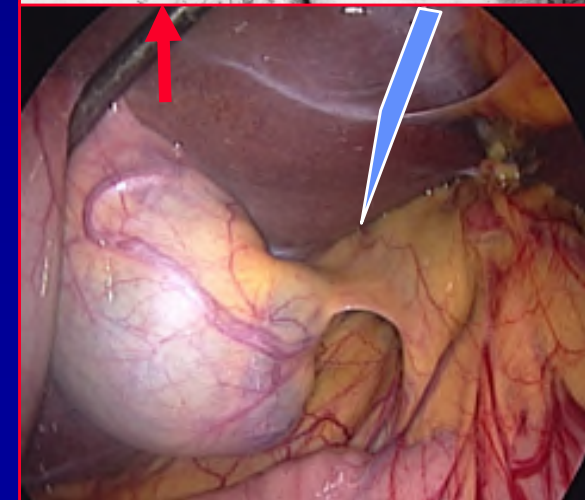
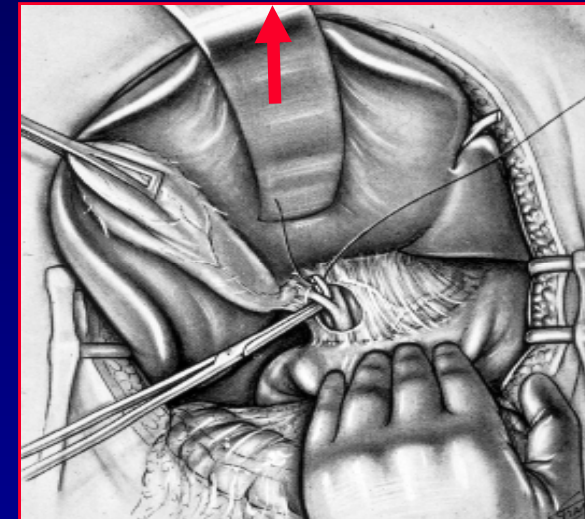
1. Adequate exposure of the hepatoduodenal ligament

Get a vertical approach of the operative field

- by using **high trocar** position in obese patients
- by liberal use of a **30°** angle scope

Get an adequate visualization of the operative field

- by using high quality of **vision** (optic) and light
- by lifting up the **quadrate lobe** of the liver (S4)
- by using a reverse **Trendelebourg** position (**30°**)
- by using an **additional trocar** in case of large left liver lobe
- by pulling down the duodenum, if necessary



RULES for a SAFE SURGICAL DISSECTION

2. Exposure of the Calot triangle

By opening/ stretching the Calot triangle

by lateral and inferior traction on the GB neck

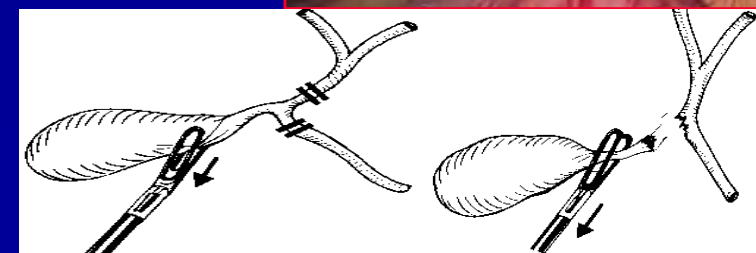
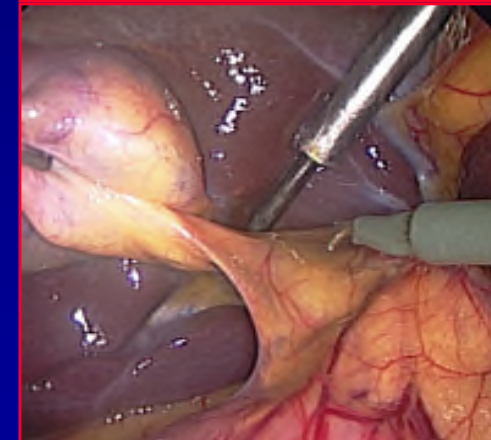
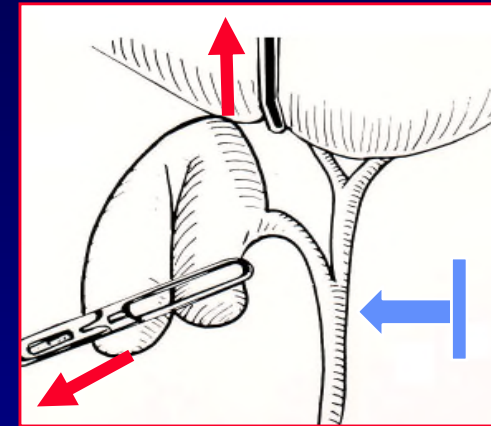
(THUS, placing cd at right angle to CBD, to reduce the likelihood of misidentification)

By avoiding excessive cephalad push of the GB fundus

leading to close the CALOT triangle (parallel alignment of CBD and CD)

By avoiding excessive traction on the GB

- risk of **tenting** the CBD
- risk of traumatic **rupture** of CD-CBD junction or CD **avulsion**

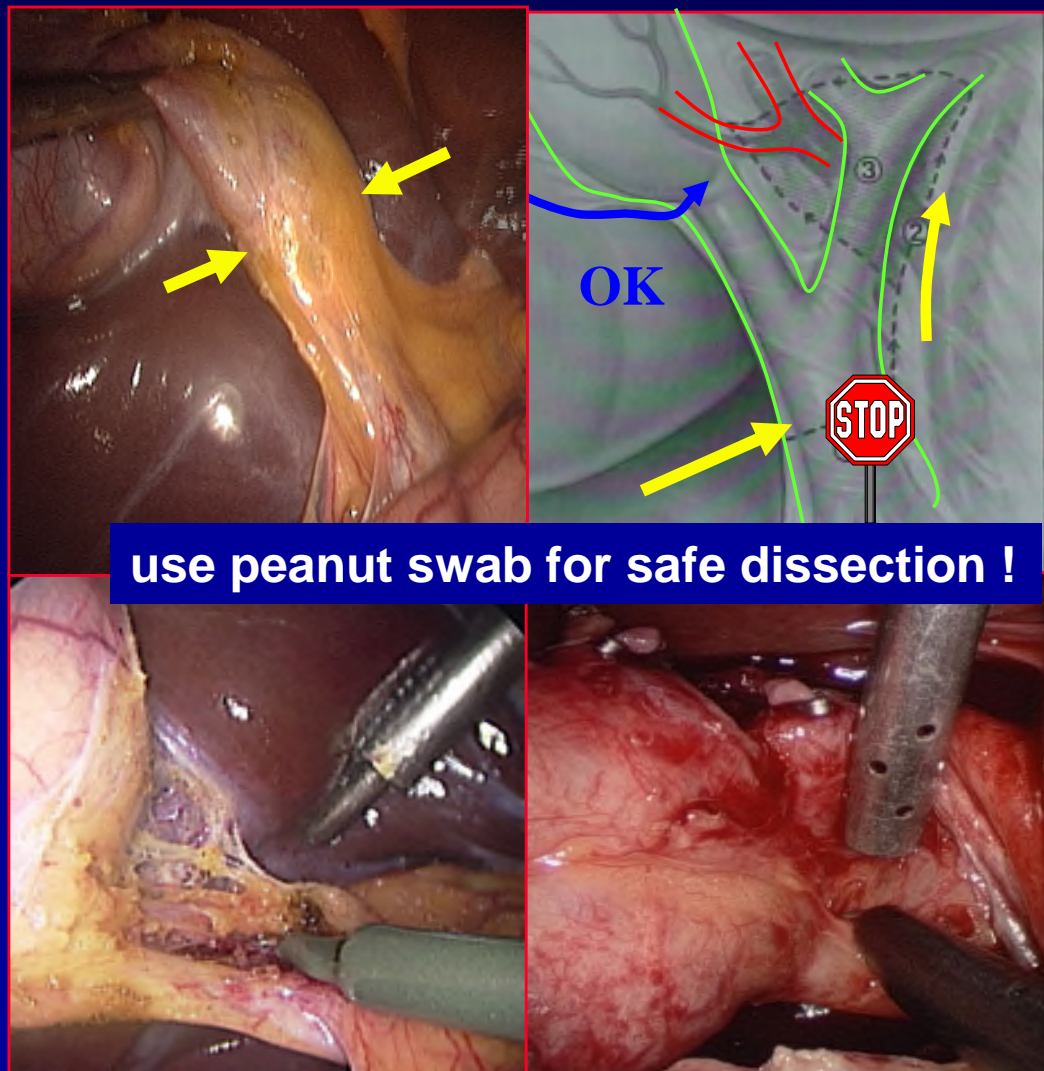


RULES for a SAFE SURGICAL DISSECTION

3. Safe dissection of the Calot triangle (1)

a) Start dissection at the gallblader (GB) neck – cystic duct (cd) junction

- ✓ DO NOT START the dissection at the CD-CBD junction !!!
- ✓ Dissect from the GB neck toward the cystic duct
- ✓ Get clear identification of the infundibulo-cystic duct junction: visualize the continuity of the CD into the GB
- ✓ Gain circumferential control of this junction
- ✓ STAY AWAY FROM THE CBD (danger with cautery)
- ✓ Use ATRAUMATIC BLUNT DISSECTION !!!
- ✓ AVOID excessive ELECTRO-CAUTERY



RULES for a SAFE SURGICAL DISSECTION

3. Safe dissection of the Calot triangle (2)

Rule-1: **Clear completely the Calot triangle !!!**

- ventrally and dorsally
- viewing both ventral and dorsal aspect by manipulating the gallbladder neck
- so that the only visible structures in Calot triangle = cystic duct and artery

→ the "**Flag technique**"

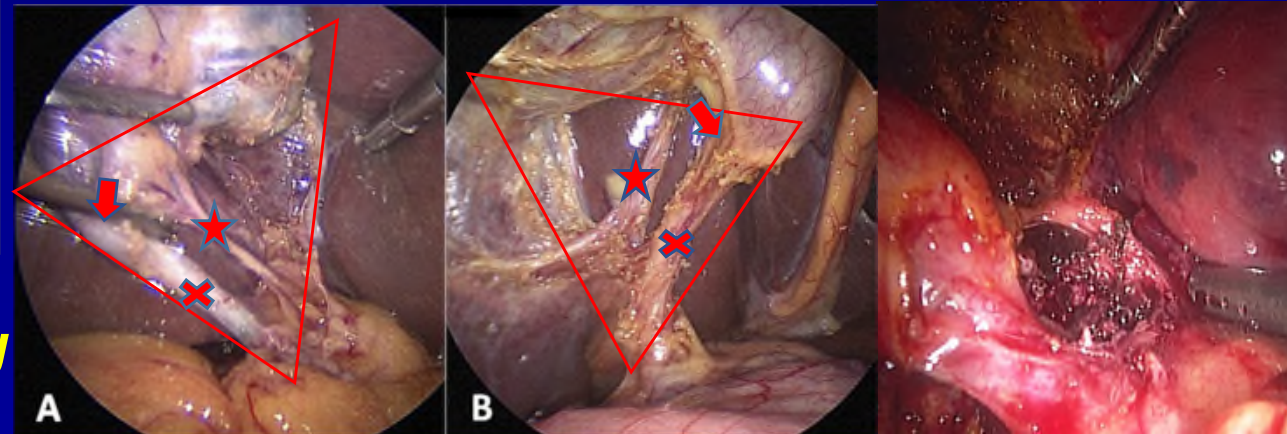
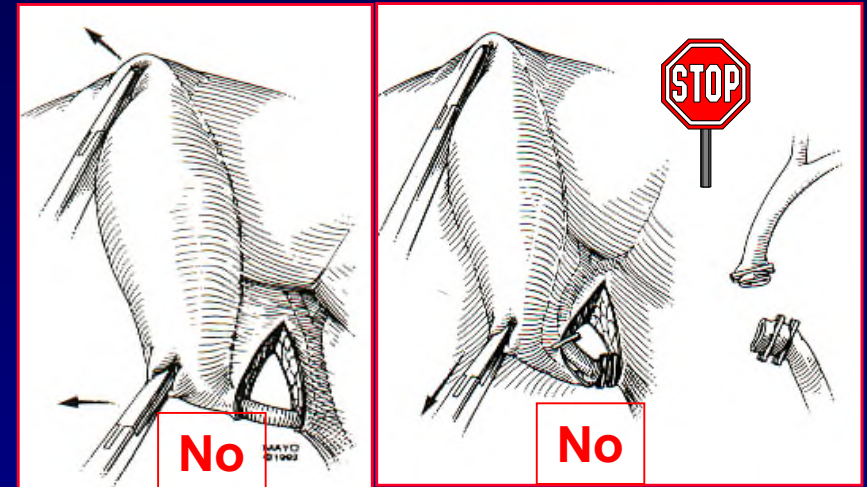
(Jean Mouiel)

→ the « **Window technique** »

(Mikael McMahon)

→ the « **Critical View of Safety** »

(Steve Strasberg)

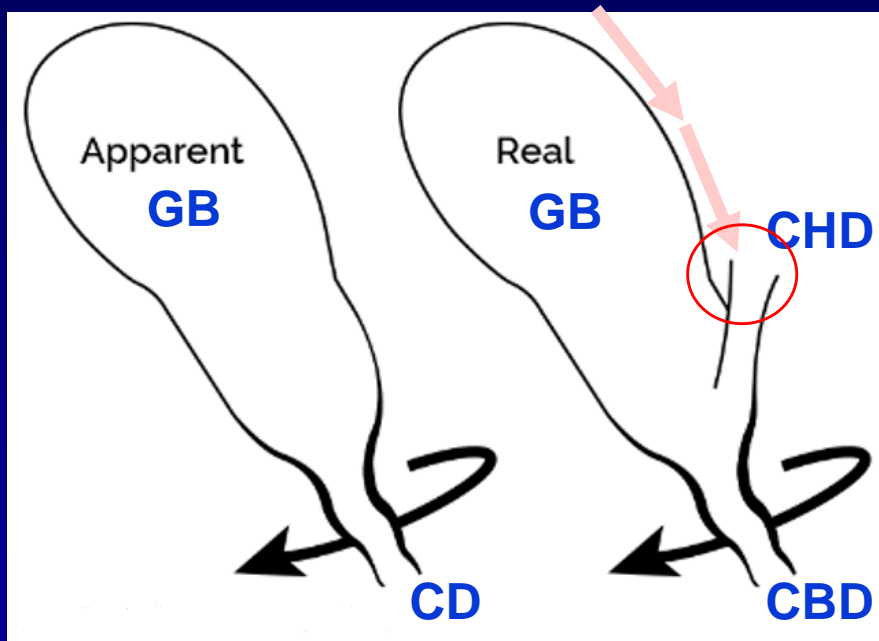


Rule-2: **See the cystic duct being the sole structure entering the GB infundibulum !!!**

RULES for a SAFE SURGICAL DISSECTION

3. Safe dissection of the Calot triangle (3)

Rule-2: See the cystic duct being the sole structure entering the GB infundibulum !!!



Situations in which GB/CD funnel may be GB/CBD funnel

- Acute or chronic cholecystitis
- Large impacted GB stone
- Adhesions between CBD-CD-GB
- Parallel or fused CD

AVOID THE INFUNDIBULAR TECHNIQUE ... because dangerous !

STRASBERG SM, et al. The "hidden cystic duct" syndrome and the infundibular technique of laparoscopic cholecystectomy- the danger of the false infundibulum.
J Am Coll Surg 2000; 191: 661-667.

RULES for a SAFE SURGICAL DISSECTION

4. Close dissection of the Hartman pouch

Rule-3: Extend the dissection up to and all around the GB infundibulum

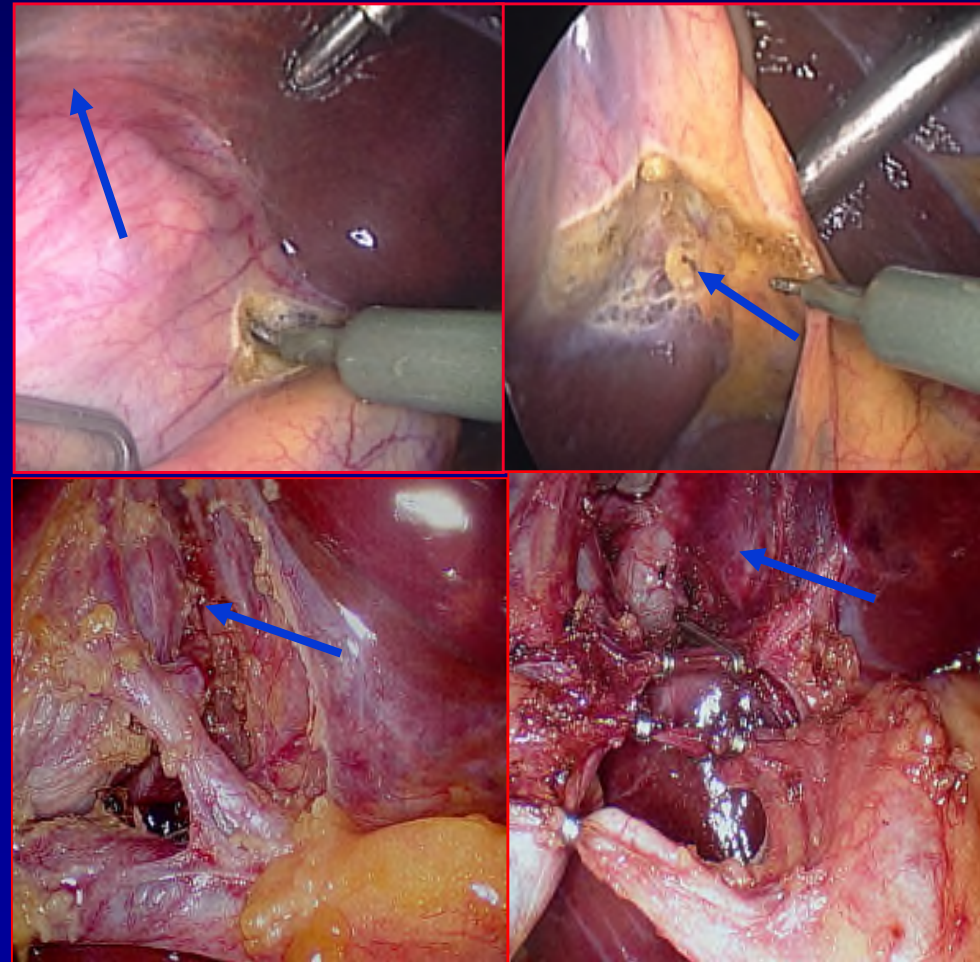
.... Be aware that is an area where right biliary anomalies potentially are present

- Incise the peritoneum around the Hartman pouch ventrally and dorsally

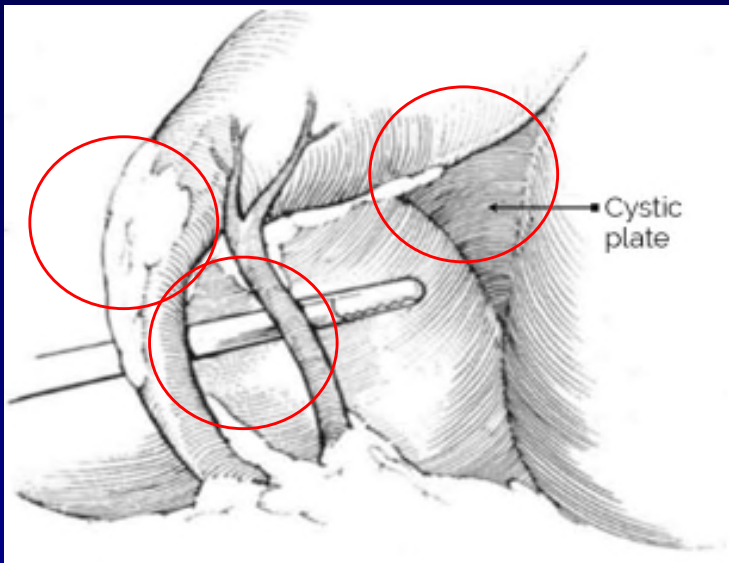
- Keep the dissection close to the gallbladder wall !!!
- Clear the first 1/3 of the GB from the liver bed
- To be able to flip the Hartman pouch up and down

- use atraumatic blunt dissection if severe inflammation

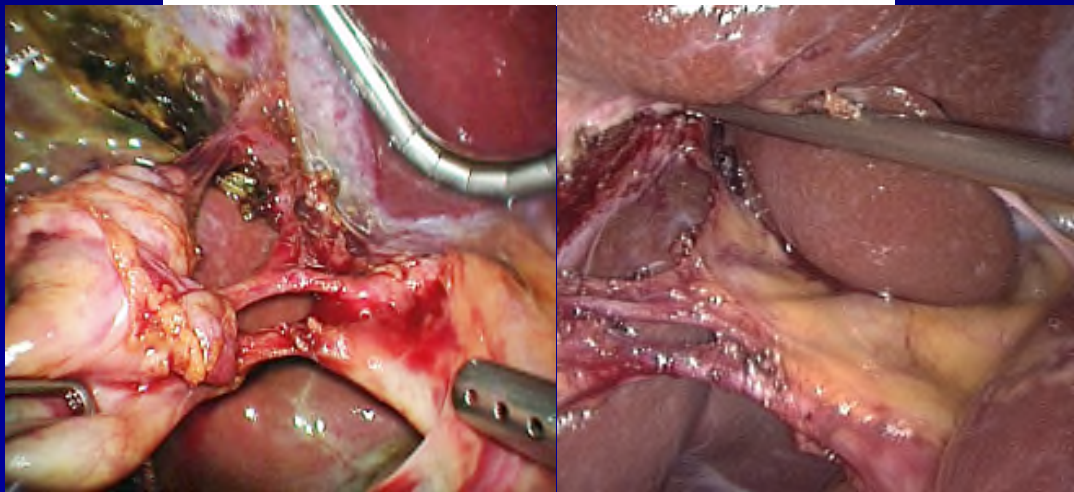
Take care of ARHD (detected on preop MRCP)



THE CRITICAL VIEW of SAFETY



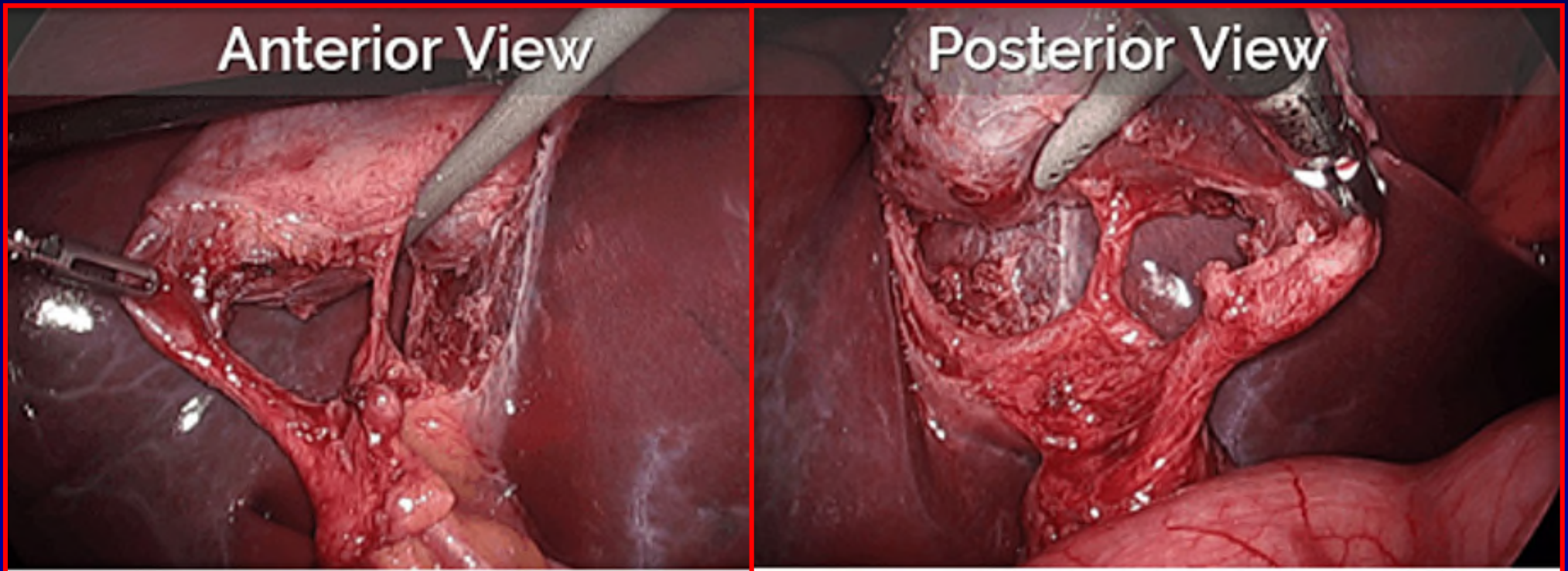
- CVS is a method of ductal identification
- CVS is not a method of dissection
- The aim of dissection in the CALOT triangle is to display the CVS



THIS STEP is the KEY
for a SAFE LAP CHOLE

A Simple Effective Method for Generation of a Permanent Record of the Critical View of Safety during Laparoscopic Cholecystectomy by Intraoperative “Doublet” Photography

Dominic E Sanford, MD, Steven M Strasberg



Intraoperative doublet photographs should be routinely used for recording the Critical View of Safety (CVS) in the medical record (**medico-legal documentation**)

RULES for a SAFE SURGICAL DISSECTION

3. In difficult cases (inflammation)

c) Avoid persisting to dissect scarring tissues in Calot triangle

in severe acute or chronic cholecystitis

- ▶ use an inside approach with subtotal cholecystectomy

d) Use blunt dissection

e) Avoid overuse of electrocautery

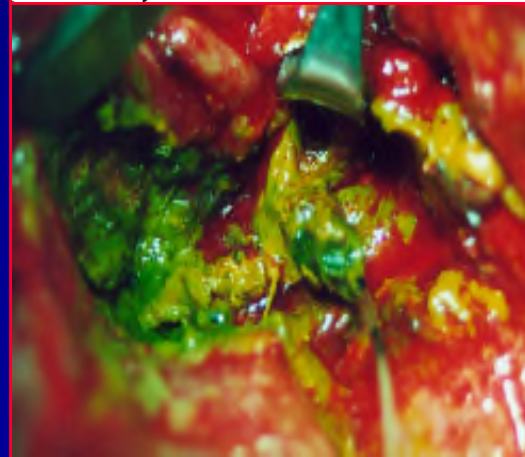
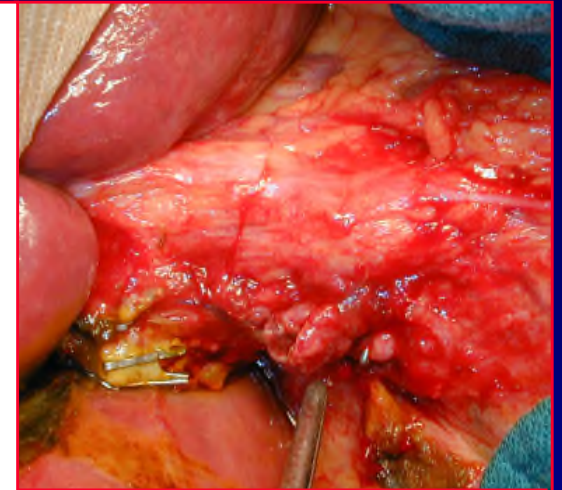
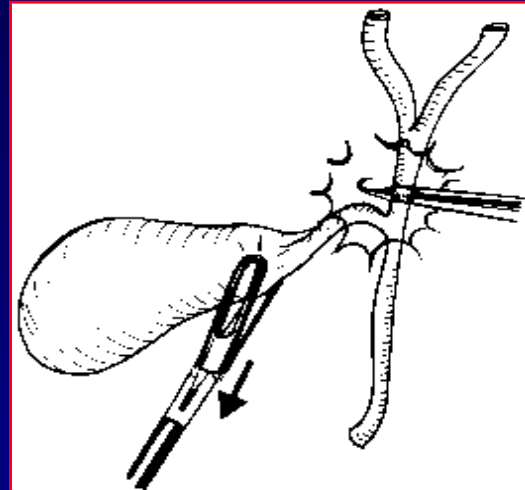
within the Calot triangle !!!

especially in difficult lap Chole

f) Avoid blind application of clips or cautery to control haemorrhage

during the dissection of the Calot triangle

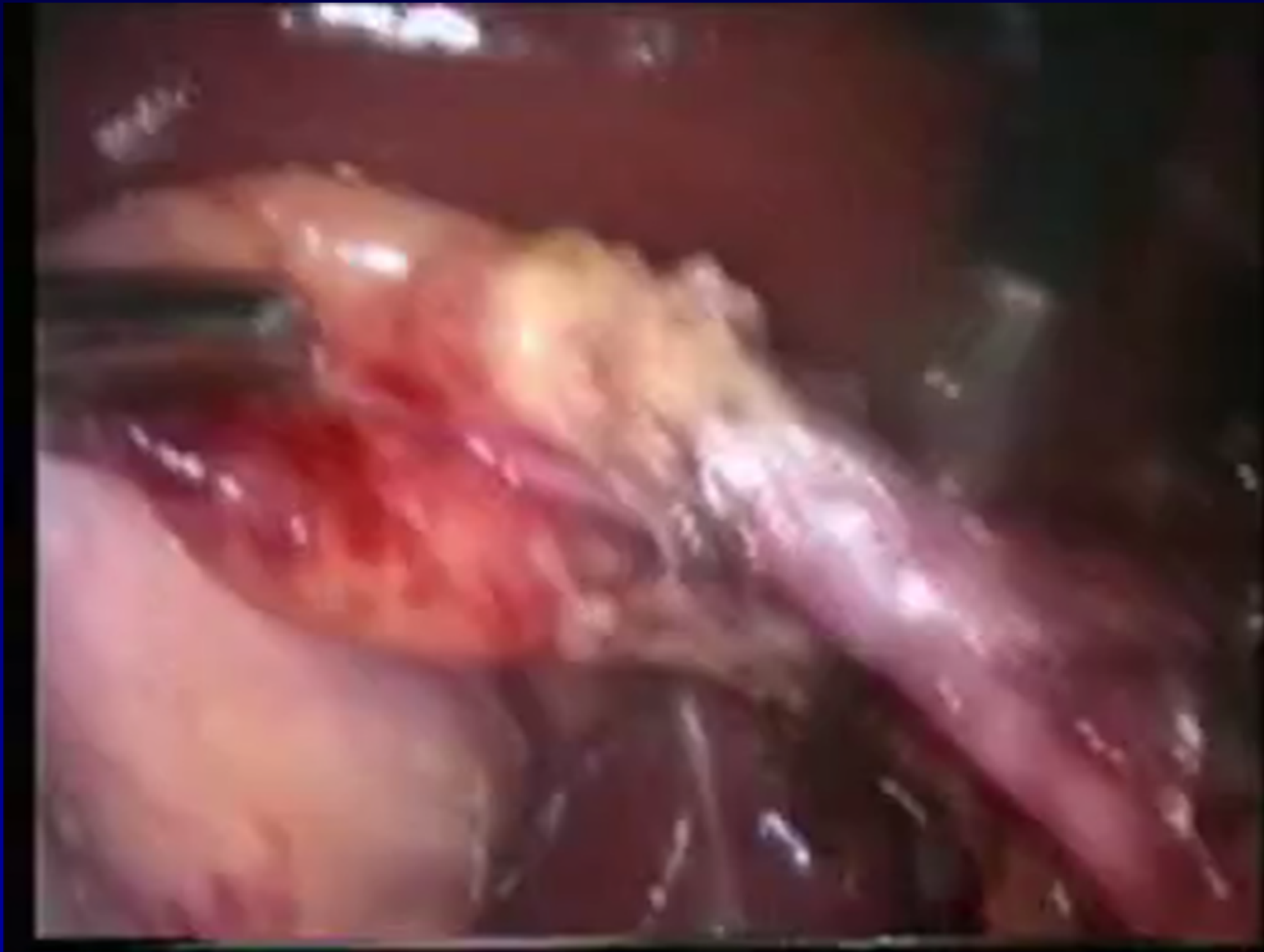
→ **Arterial injury** is often associated to BDI



RULES for a SAFE SURGICAL DISSECTION

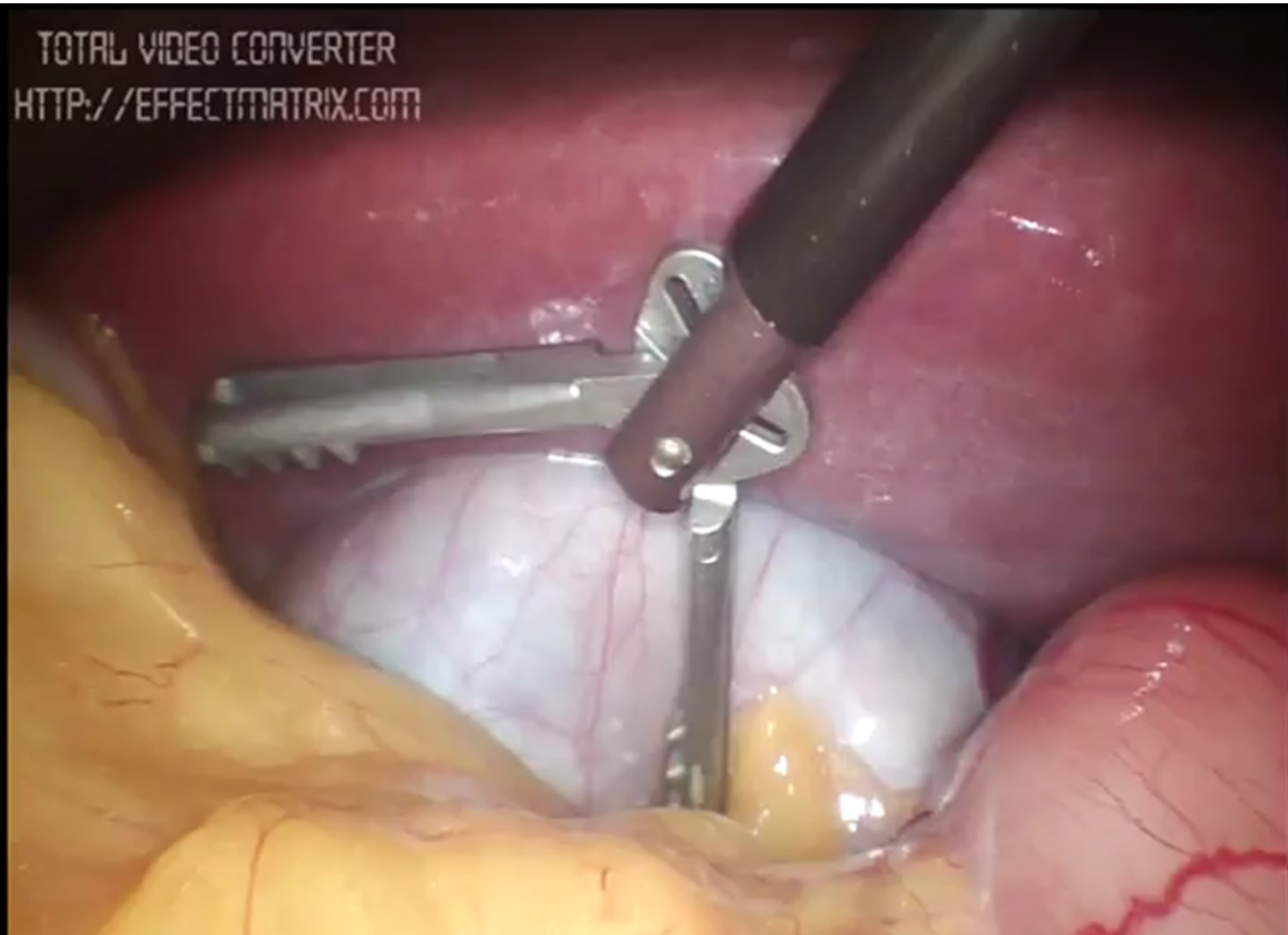
**If the CRITICAL VIEW of SAFETY is *NOT* achieved
mostly in difficult cases**

- **Pausing Rules**
 - Do NOT go further
 - Call for another opinion
- **Use bail-out procedures**
 - Conversion to open cholecystectomy
 - Subtotal cholecystectomy
 - Cholecystostomy tube placement



with the courtesy of **Prof GOUMA Dirk** – AMC - Amsterdam

TOTAL VIDEO CONVERTER
[HTTP://EFFECTMATRIX.COM](http://effectmatrix.com)

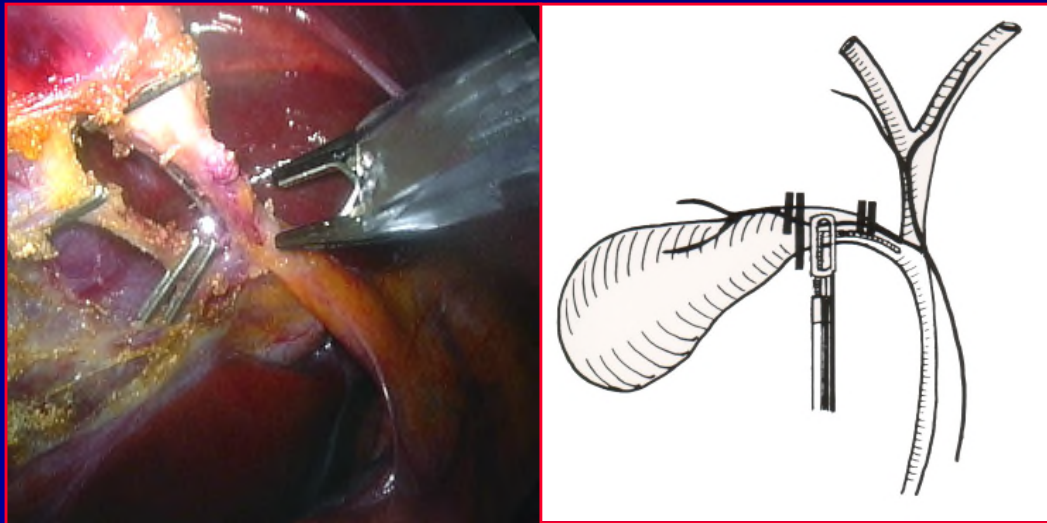
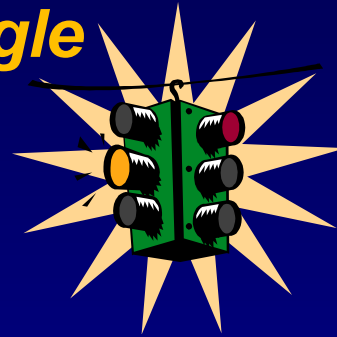


RULES for a SAFE SURGICAL DISSECTION

5. at the end of dissection of the Calot triangle

AVOID to divide any ductal structures within Calot triangle
.... before accurate identification of anatomy

- by surgical dissection
- by Intra-Operative Cholangiography (IOC)



- IOC is able to detect BDI in 90-95 % ...
- ... IOC may **miss thermal injury**
- Use IOC as a roadmap to identify the presence of biliary anatomy and anomalies
- IOC may be **ineffective if misinterpreted**
- IOC may have some **protective effect on BDI !!!**

FORD *et al.* Br J Surg 2012; 99: 160

SHEFFIELD *et al.* JAMA Surg 2013; 310(8): 812

BDI during LC : the Belgian Registry

A completed *and* correctly interpreted IOC

1. increases the chance of detection
2. decreases the severity of injury
3. decreases the related-mortality and morbidity

BUT at 2 conditions:

1. IOC must be performed **at the end of complete Calot triangle dissection**
2. **Correct interpretation of pictures** by the surgeons is required
(23% of misinterpretation in the Belgian registry)

ARCHER *et al.* Ann Surg 2001; 234: 549

FLUM *et al.* J Am Coll Surg 2007; 204(4): 656

ALVAREZ *et al.* Br J Surg 2014 DOI:10.1002/bjs.9486

BDI during LC : the *Belgian Registry*

THE ROLE OF *IOC* for PEROPERATIVE DETECTION of BDI

65 patients

perop detection

* **no IOC :**
(43 patients)

32 %

* **IOC. done :**
(22 patients)

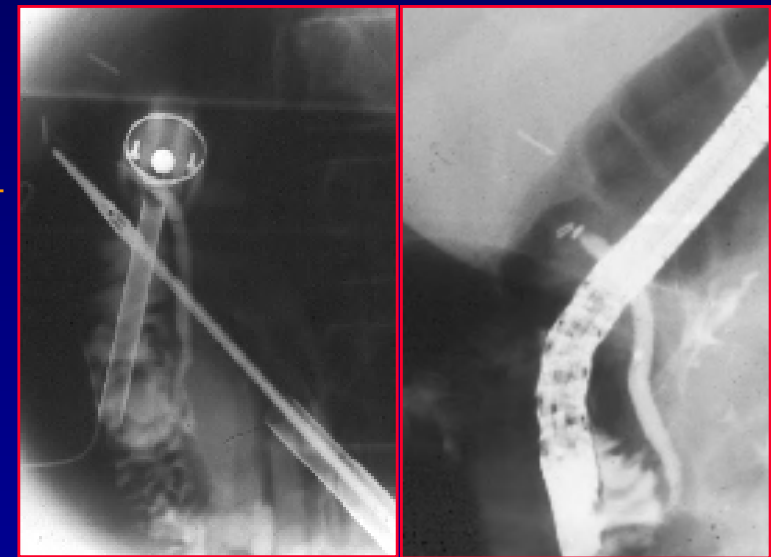
68 %

p = 0.05

34 %

+ 23 % misinterpreted

+ 9 % normal X-ray



91 %

of detection if IOC
done and correctly
interpreted

Thermal injury !!!

MINIMIZATION of BDI by IOC

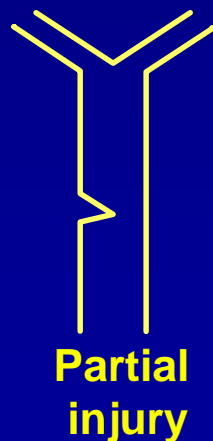
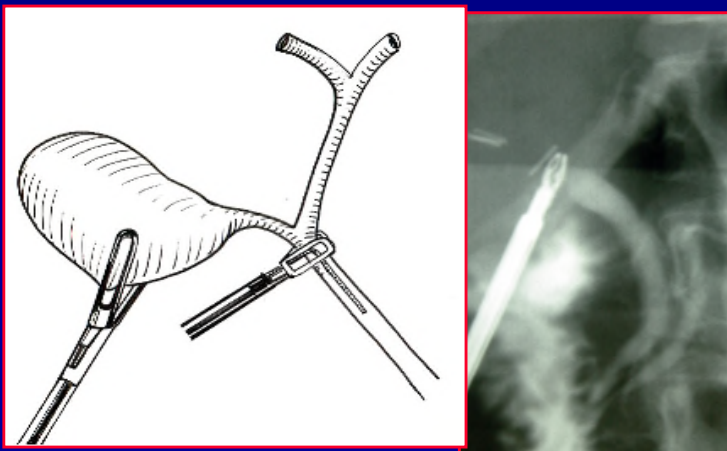
Performance of accurate *IOC* can prevent a severe BDI

In the classical and most common mechanism injury (43 %)

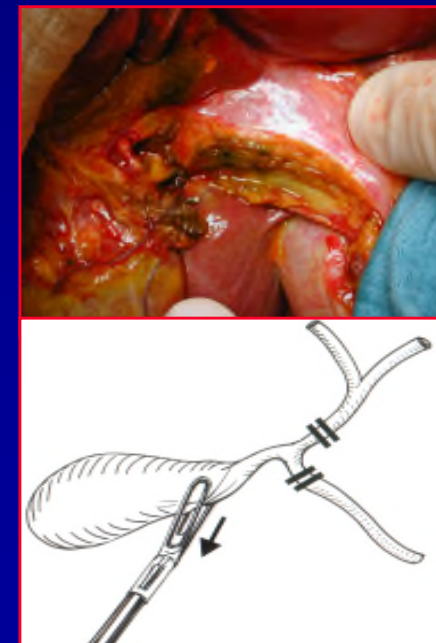
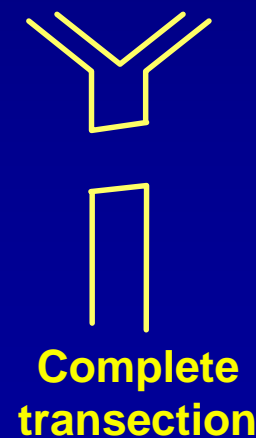
(misidentification between CD and CBD)

- **with IOC** : led to adequate detection of a laceration injury of the CBD and easy repair.
- **without IOC** : then, double clipping and transection, leading to complete CBD transection (if not resection according to further dissection)

Thus, IOC is able to prevent the aggravation of a partial ductal laceration to a complete transection or excision of CBD during lap. chole



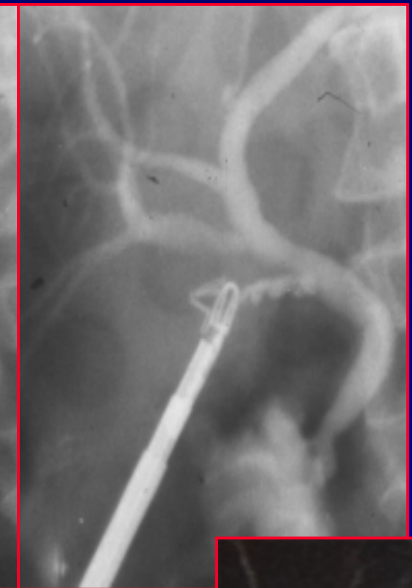
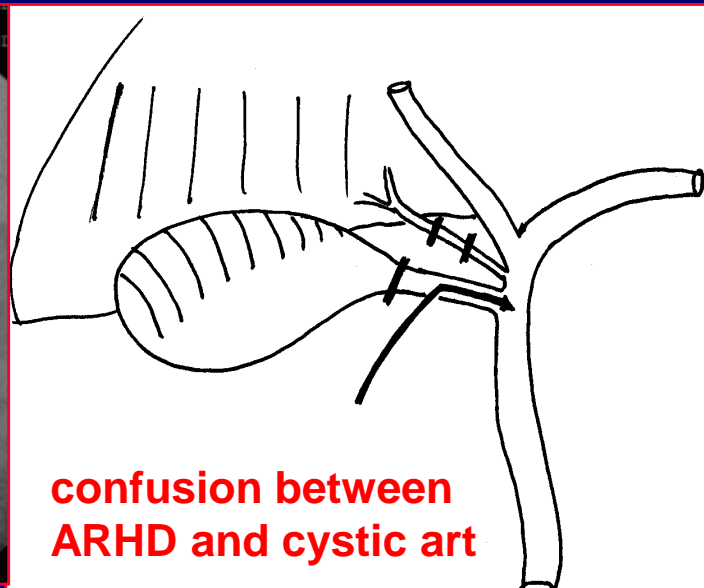
if
no
IOC



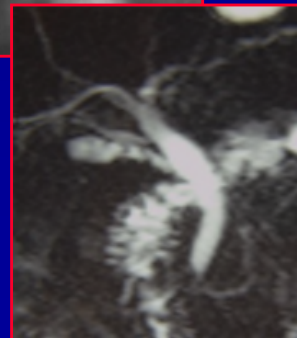
REAL ROLE of PREVENTING BDI by IOC

When confusing an ARHD with the cystic artery within the Calot triangle, the performance of IOC after dissection and clipping without division will **prevent definitive injury to an ARHD**

... simply by removing the clips

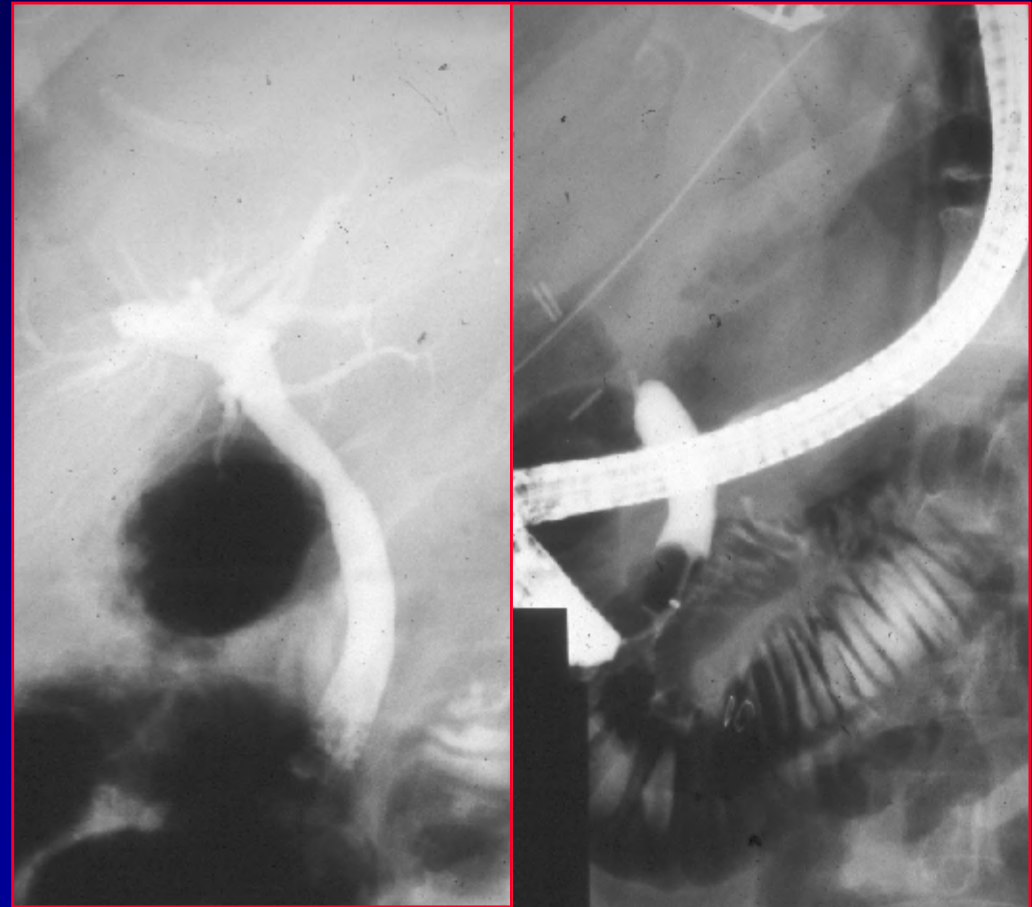


we do routine *preop MRCP* in acute or chronic cholecystitis :



BDI during LC : the *Belgian Registry*

Preoperative
biliary work-up
(including ERCP)
does not protect the
patient against BDI



20 % of patients with BDI have had **preoperative ERCP**

RULES for a SAFE SURGICAL DISSECTION

CLASSICAL APPROACH

1. Adequate exposure the hepatoduodenal ligament
2. Adequate exposure the CALOT triangle
3. Safe dissection of the CALOT triangle
4. Close dissection of the Hartman pouch
5. Performance of IOC

EXIT STRATEGIES in difficult cases

6. Adequate ***conversion to open*** approach
7. Perform ***subtotal cholecystectomy***
8. ***Tube cholecystostomy***

CONVERSION TO LAPAROTOMY

..... is often the safest option !

in « difficult » cases (acute or chronic inflammation)

- when poor visualization or exposure
- when inflammation obscures the anatomy within Calot triangle
- when the anatomy is confusing
- when excessive bleeding or use of electrocautery

if questionable bile duct injury

- on IOC
- continuous and unexplained leakage of bile during operation
- on surgical dissection

NOT A FAILURE, but the sign of a sound surgical judgement !

SUCCESSFUL CONVERSION IS BETTER THAN BDI

... and better accepted by the patient

CONVERSION TO LAPAROTOMY

..... is it really the safest option ?

- Indeed,
 - Be sure that **you are experienced with open surgery**
 - ... call a more experienced surgeon
 - Be sure that **you will do better by open**
- Otherwise, abort laparoscopy, drain and get out

SEVERE CHOLECYSTITIS

IN CASE OF DIFFICULT DISSECTION

Due to inflammatory process, Mirizzi syndrome, etc

During dissection of the CALOT triangle or the HARTMANN pouch

..... then CHANGE THE TECHNIQUE

Move from the CONCEPT of COMPLETE CHOLECYSTECTOMY

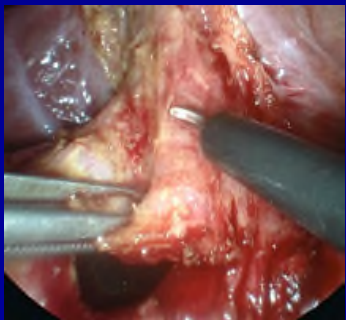
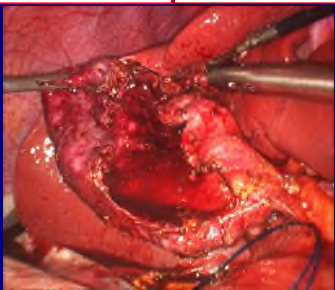
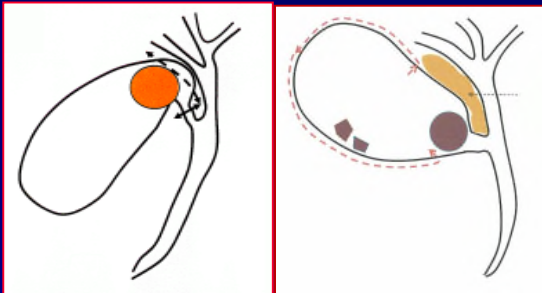
from **OUTSIDE** (CLASSICAL)

.... to the **ENDOVESICULAR APPROACH** (from **INSIDE**)

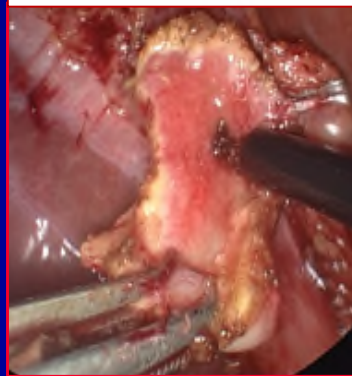
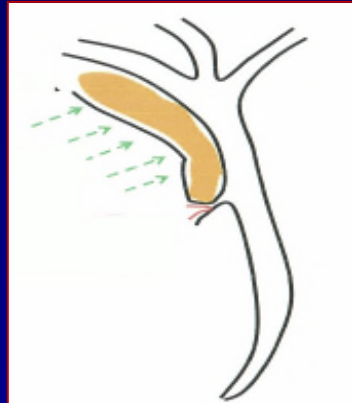
followed by **SUBTOTAL CHOLECYSTECTOMY**

CONVERSION to the *INSIDE* APPROACH and *SUBTOTAL* CHOLE

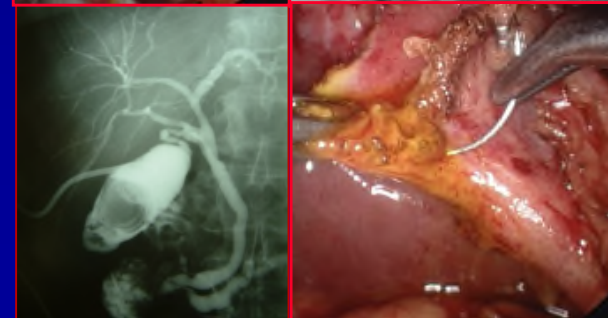
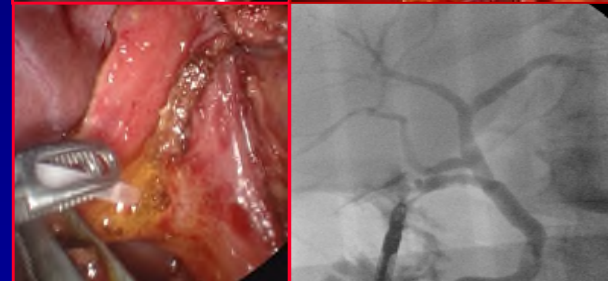
PHASE-1 : inside approach of gallbladder



PHASE-2 : subtotal cholecystectomy



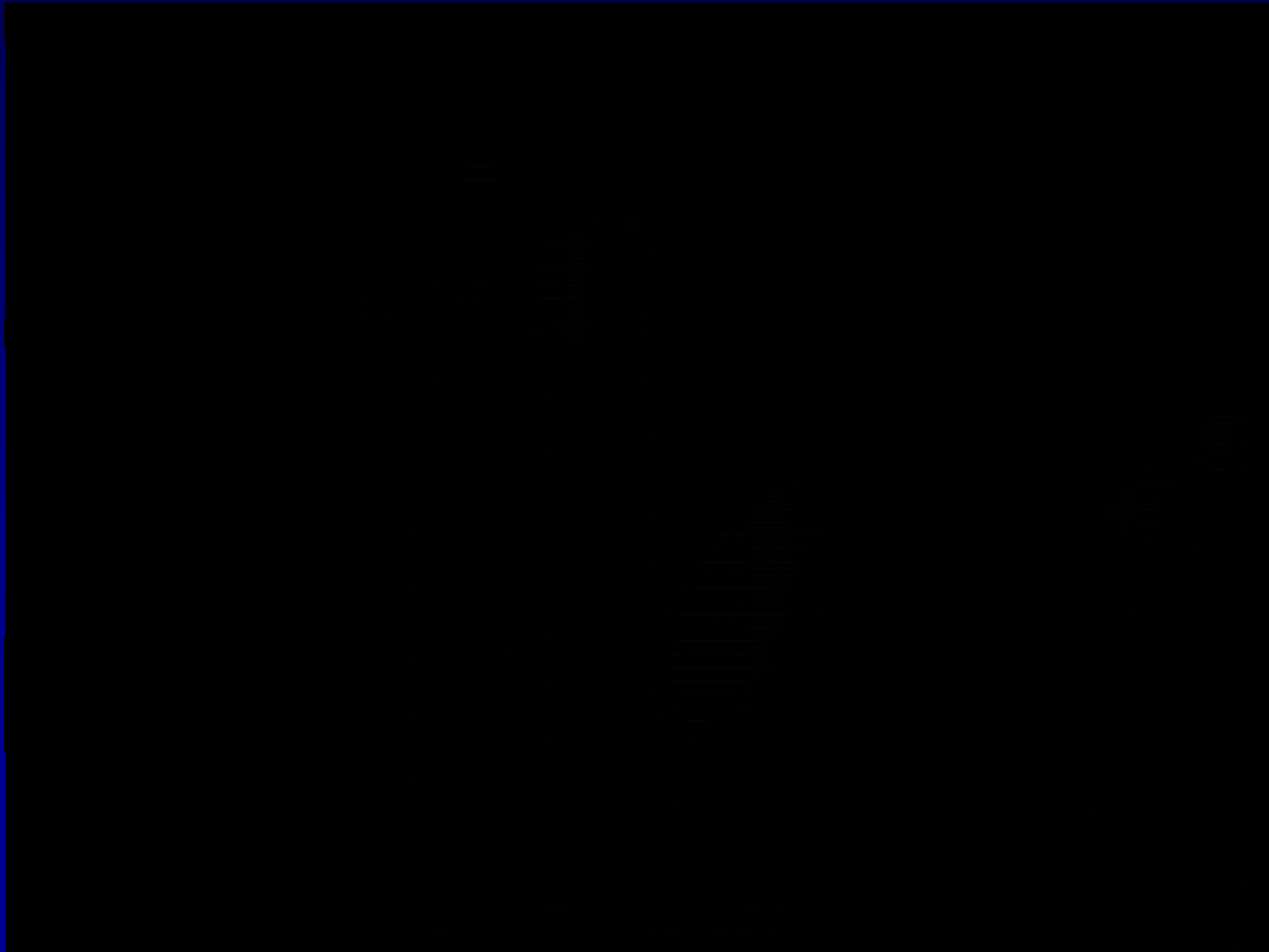
PHASE-3 : endovesicular IOC



PHASE-4 : Argon on GB bed



CONVERSION to the *INSIDE* *APPROACH* and *SUBTOTAL CHOLE*



SUBTOTAL CHOLECYSTECTOMY FOR DIFFICULT GALLBLADDER: *UCL experience*

PATIENTS & INDICATIONS

28 consecutive patients (**8 %**)

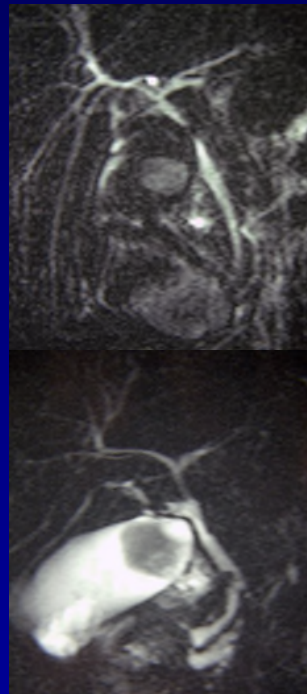
- 36 % were > 75 years
- 18 % were > 80 year-
- ASA III: 5 patients (**18 %**)

Indications:

- Gangrenous cholecystitis (n=1)
- Delayed cholecystitis (n=25)
- Scleroatrophic cholecystitis (n=1)

Risk factors

- **Anomalous RHD (n=19) : 68 %**
- Mirizzi syndrome (n=3)
- Huge impacted stone in GB infundibulum (n=1)



Delayed cholecystitis + ARHD = subtotal chole

RESULTS

Intraoperative

- IOC in 82 % (endovesicular)
- Conversion in 18 %
- subhepatic drain in 100 %

Postoperative

- minor complications in 18 %
- **no biliary leak or complications**
- no reoperation
- median POHS : 3 days

Long-term

- median FU : 4 months
- Control MRCP in 20 patients
- **no biliary stricture**
- **All ARHD preserved !!!**

SUBTOTAL CHOLECYSTECTOMY FOR DIFFICULT GALLBLADDER: *UCL experience*

PATIENTS

INDICATIONS

RESULTS

28 consecutive patients

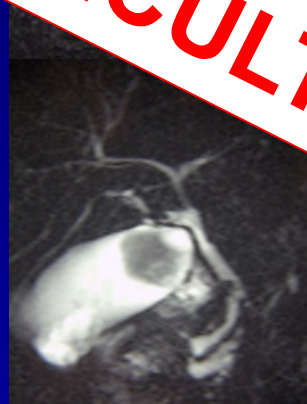
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Intraoperative

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- Drain in 100 %

Long-term

- median FU : 4 months
- Control MRCP in 20 patients
- **no biliary stricture**
- **All ARHD preserved !!!**

THE LAPAROSCOPIC SOLUTION IN DIFFICULT CASES

PREVENTION of BDI during Lap Chole **..... including difficult cases**

CONCLUSIONS

- 1. Only by surgeons properly trained and proctored**
- 2. The use of a cautious surgical technique is the KEY:**
 - * Precise identification of anatomy
 - * Meticulous surgical dissection
 - * **Critical view safety technique**
 - * **Routine IOC**
- 3. In difficult cases ...**
 - ✓ Low threshold for **conversion to open chole**
 - ✓ **Alternative technique: inside approach + subtotal chole**

Keep ALWAYS in mind the risk of BDI when doing LC

CULTURE of SAFETY in CHOLECYSTECTOMY

Steven STRASBERG

COSIC



1. Putting SAFETY FIRST
2. Using a RELIABLE METHOD of ductal identification such as CVS
3. Keeping the POSSIBILITY of **ABERRANT ANATOMY** in mind at all times
4. RECOGNIZING when the dissection is approaching **A ZONE OF GREAT DANGER** and HALTING the dissection before entering the zone
5. Getting HELP from another surgeon when things are difficult
6. Sometimes finishing the operation by a SAFE METHOD OTHER THAN CHOLECYSTECTOMY

[STRASBERG J Am Coll Surg 2013; 217: 751.](#)

[http://www.journalacs.org/article/S1072-7515\(13\)00358-X/fulltext](http://www.journalacs.org/article/S1072-7515(13)00358-X/fulltext),

https://cme-online.wustl.edu/strasberg/Culture_of_Safety_in_Cholecystectomy.html.

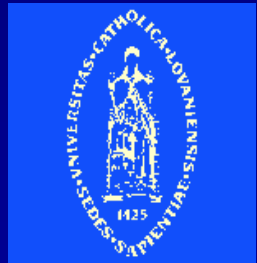
Part-1: *incidence, risk factors, prevention*

QUESTIONS ?

BILE DUCT INJURY during LAPAROSCOPIC CHOLECYSTECTOMY HOW TO TREAT PROPERLY ?

Prof. Em. Jean-François GIGOT, MD, PhD, FRCS

Université Catholique de Louvain (UCL) - Belgium



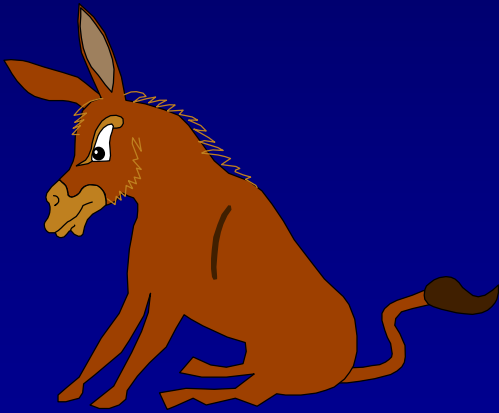
DIPLÔME INTER UNIVERSITAIRE – Année 2020/2021

Montpellier . Reims . Strasbourg

Chirurgie Hépato-Bilio-Pancréatique et Transplantation Hépatique

REIMS : 11-13/02/2021

Finally, once a BDI has occurred, **it is the responsibility of the surgeon to rapidly diagnose and treat it**, to prevent increased morbidity from a delayed diagnosis.



***ERRARE
HUMANUM EST,
PERSEVERARE
DIABOLICUM EST***



« Failure to recognize a BTI increases patient's morbidity from delayed diagnosis and also makes further repair more difficult ».

RANTIS (USA)

« the best chance at repair of a BDI is the first attempt »

H. BISMUTH (F)

BDI during LC : *Belgian Registry*

POSTOPERATIVE OUTCOME

Patients	Mortality	Biliary complic.	Reinterv.	FU (mo) median	Recurrent Stricture
. Perop. detect. : 45 %	7 %	24 %	14 %	46	29 %
. Peritonitis : 34 %	20 %	50 %	23 %	53	47 %

OUTCOME OF BILE DUCT INJURIES IN NATIONAL MULTICENTER SERIES

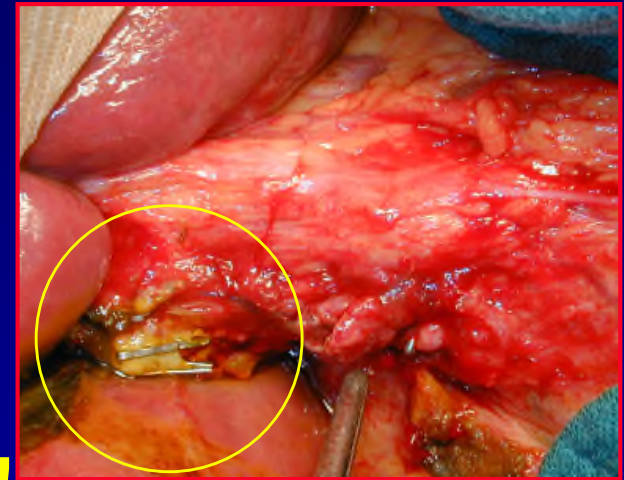
Authors	Year	Country	Patients	Complic	Mortality	Reinterv	FU (mo)	Poor results
• GOUMA	1994	Netherlands	32	34 %	6.3 %	?	?	?
• SCHOL	1995	Netherlands	49	33 %	6 %	12 %	6	25 %
• GIGOT	1995	Belgium	65	31 %	9 %	14 %	49	33 %
• Z'GRAGGEN	1998	Switzerland	32	?	9.4 %	75 %	?	?
• REGÖLY	1998	Hungary	148	?	4.7 %	15 %	?	10 % (SS)

5 – 10 %

POOR

WHY DOES THE PRIMARY SURGEON GET MORE OFTEN POOR RESULTS ?

- * **Unfamiliar surgeon** with difficult BD repair
- * **Acutely ill patients**
- * **Poor local operative conditions :**
 - duct is often narrow !!!
 - local inflammation
 - bile peritonitis
- * **Specific risk factors :** - **thermal injury !**
- **vascular injury !**
- * **Psychological impact of injury** makes the primary surgeon often unsuitable for repair and management



VASCULAR INJURY is a *major risk factor* of poor outcome for PRIMARY REPAIR of BDI

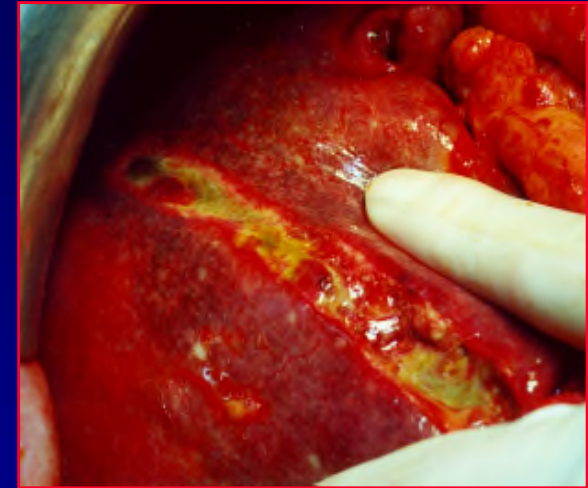
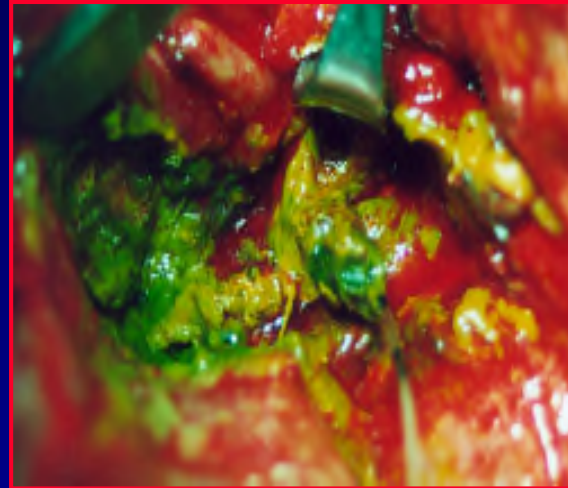
Vascular injury is frequently associated to LC-BDI

30 – 50 %

Bismuth classification

- type I : 5 %
- type II : 18 %
- type III : 27 %
- type IV : 60 %

Stewart et al. Ann Surg 2003 ; 237 : 460



Bile Duct Injury during Lap Chole

* **the best** : to avoid injury

* **the best scenario when BDI occurs** :

to diagnose immediately the injury and to repair properly

- at the time of primary operation
- with local HPB surgeon expertise
- adequate local conditions

* **the worst scenario** :

to diagnose late to try to repair in difficult conditions

- a few days or weeks later
- complicated clinical presentation
- bile duct look like a « wet tissue paper »

Failure to recognize a BDI

- increases patients' **morbidity / mortality** from delayed diagnosis
- makes further **repair more difficult**
- responsible for **poor long-term outcome**
- increase the chance of **litigation**



Bile Duct Injury during Lap.Chole.

TIMING of REPAIR

- **IMMEDIATE :** = at the time of primary operation

- **EARLY :** < 2 months of the primary operation

- **LATE :** > 2 months of the primary operation

PEROPERATIVE MANAGEMENT
of BILE DUCT INJURY
during LAP CHOLE

IMMEDIATE PRIMARY REPAIR

WHY DOES THE PRIMARY SURGEON GET MORE OFTEN POOR RESULTS ?

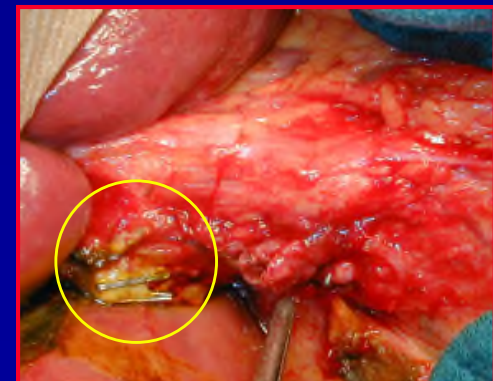
DIFFICULTIES of IMMEDIATE BILIARY REPAIR

Positive factors:

- * absence of local inflammation (except from the disease)
- * no peritonitis
- * usually good quality of tissues for suturing

Negative factors:

- * small caliber of non dilated ducts
- * non expert surgeon (often unfamiliar with difficult BD repair)
- * possibly coexistent **thermal and/or vascular injury**
- * psychological impact of injury makes the primary surgeon unsuitable for repair and management



IMMEDIATE REPAIR of BDI during LC

KEY-FACTORS of DECISION

1. Keep in your own expertise

.... if you feel in trouble, call for an expert !

2. Evaluate local extra-biliary conditions :

(inflammation, sepsis, bile contamination, **arterial injury**, ...)

3. Evaluate local biliary conditions :

- bile duct caliber ? (usually small)
- associated **thermal injury** ?
- level of injury (high ?)
- classify type and severity of injury ! ... **search for missed duct !!!**
... **think to anatomical variations**

Bile Duct Injury during Lap Chole

CLASSIFICATION OF BDI

- ✓ Conversion (+)
- ✓ IOC (+++)
- ✓ Dissection (-)

Features to be taken in consideration

Mechanisms of injury

Type of injury

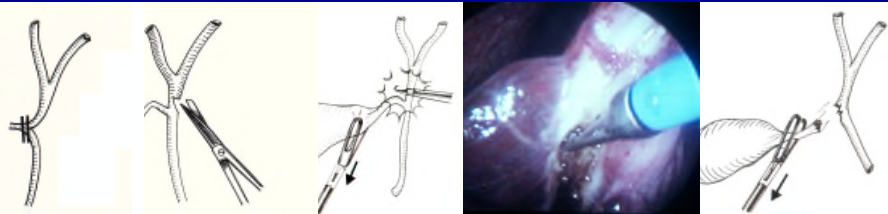
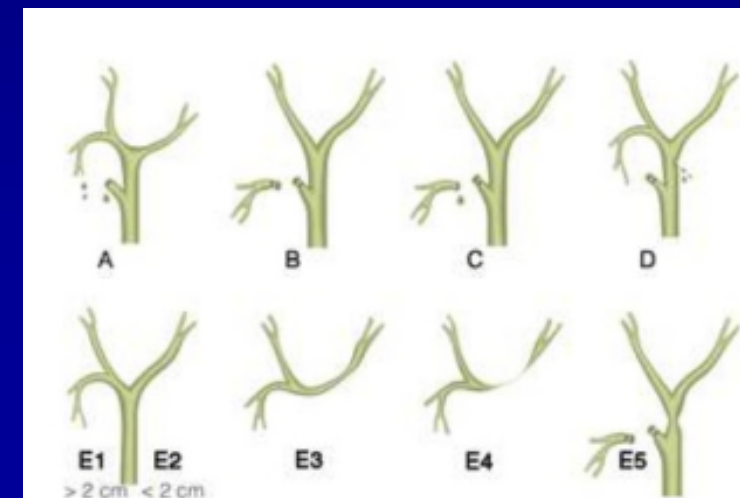
Site - level of injury

- obstruction (clip, ligation)
- instrumental injury
- thermal injury
- disruption, avulsion

- pinhole
- partial laceration
- complete transection
- wide excision
- stricture
- necrosis

- CBD
- CHD
- Hilum
- RHD
- ARHD

STRASBERG classification

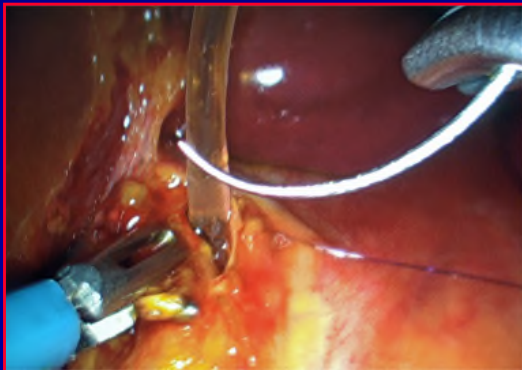
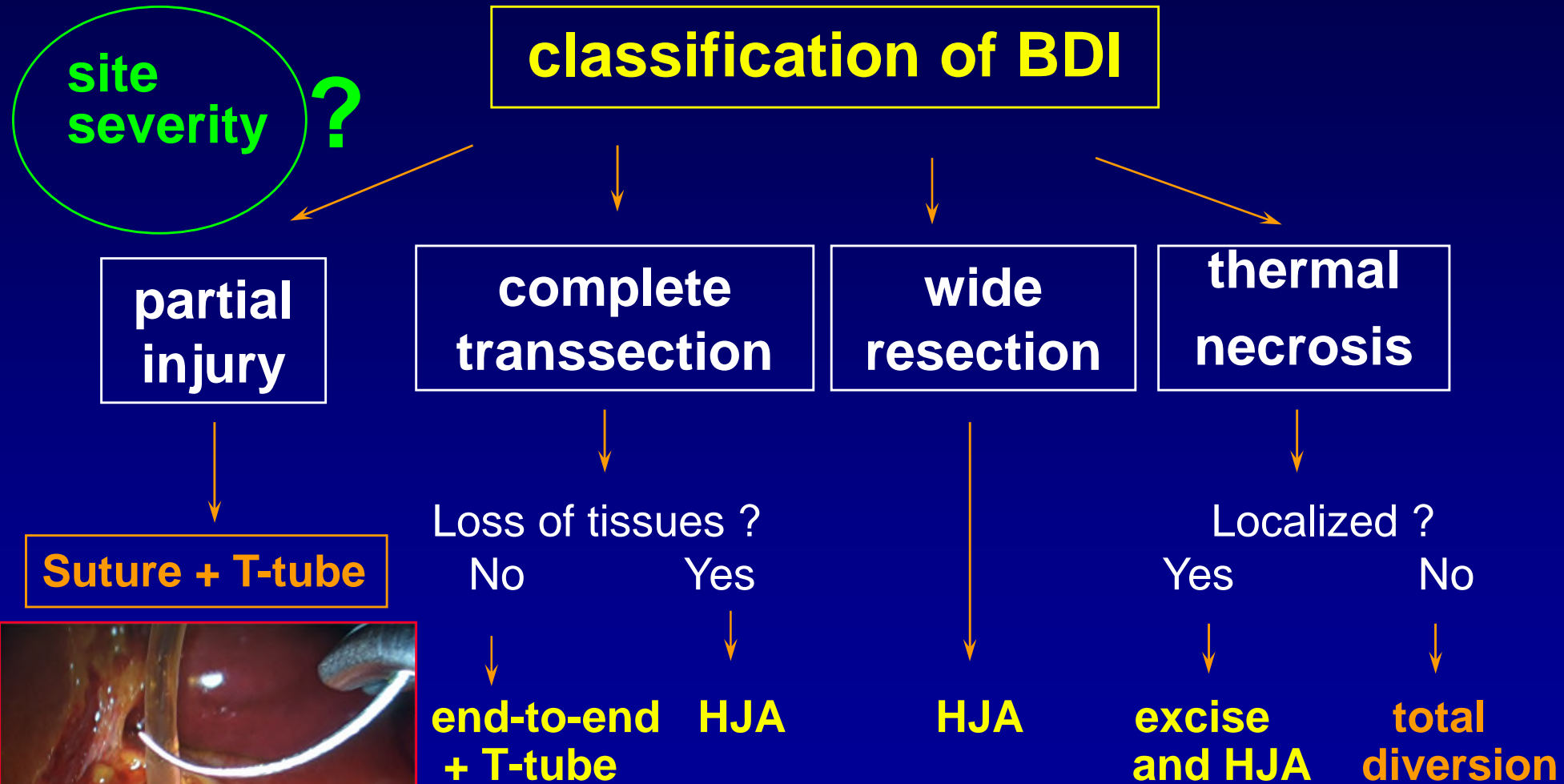


Primary repair of BDI during LC

SURGICAL TECHNIQUE

- * Think to anatomical variations
- * use a *meticulous surgical* technique
- * if doubt,
 - wait, think and see again
 - use additional diagnostic tools (*IOC*)
 - *ask for another opinion*

IMMEDIATE REPAIR of BDI during LC TREATMENT ALGORITHM

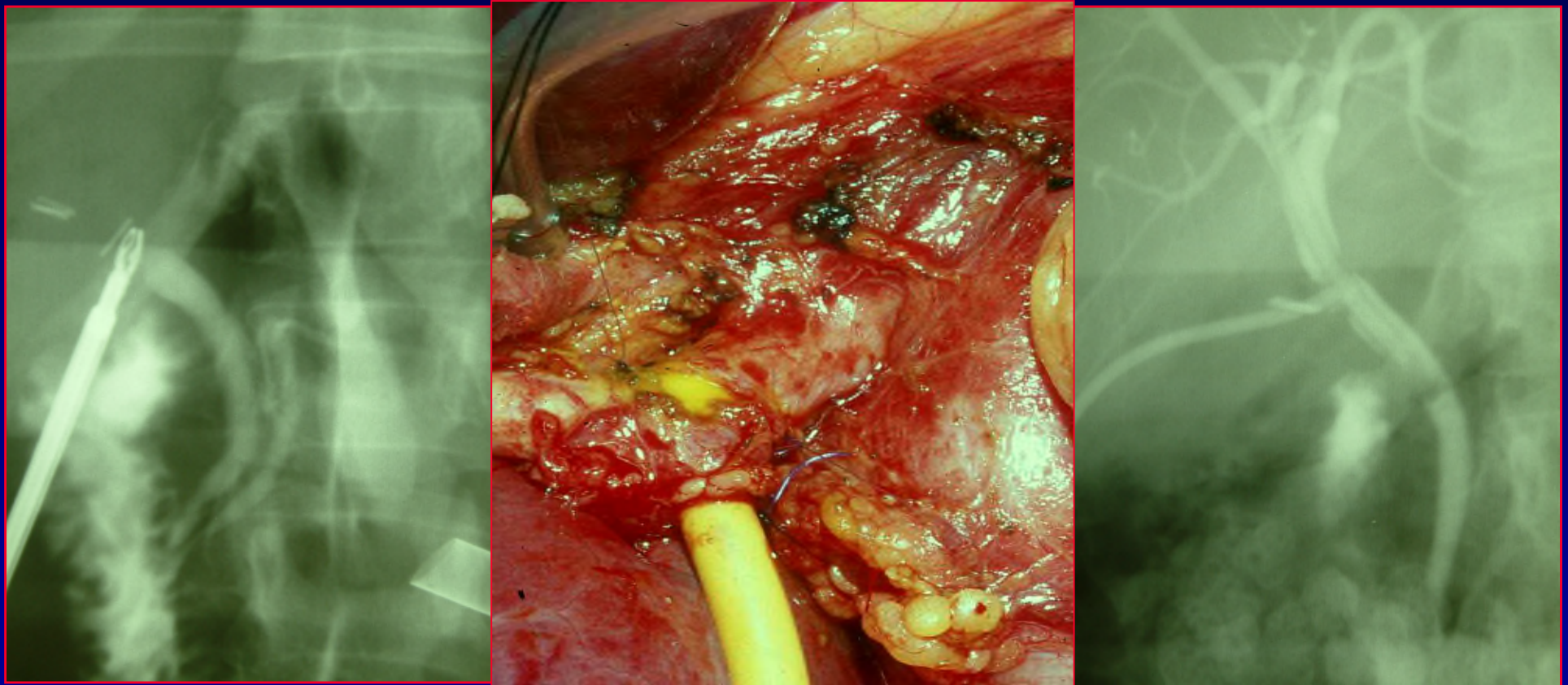


Courtesy of P. Honoré

Laparoscopic approach is unable to deal with all types of bile duct injury following cholecystectomy

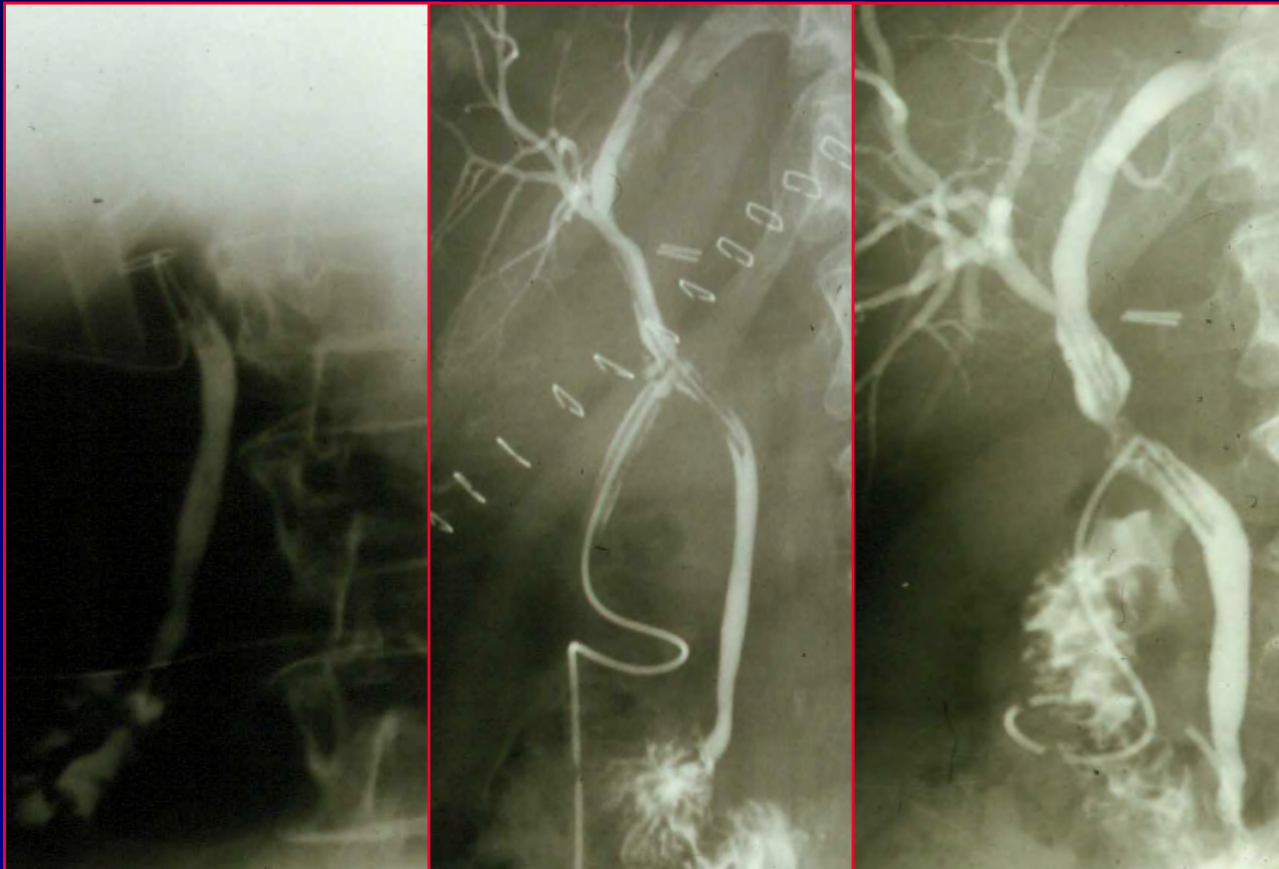
Bile Duct Injury during Lap. Chole.

partial laceration of the choledochus



- suture on healthy tissues
- fine absorbable sutures
- watertightness test at the end of repair (methylene blue test)
- T-tube leaved in place enough time to detect stricture (3 – 6 months ?)

BILE DUCT INJURY during LAP. CHOLE



Long-term follow-up
(at least 10-20 years)
is mandatory
before definitive
conclusions
about the outcome
of LC-related BDI

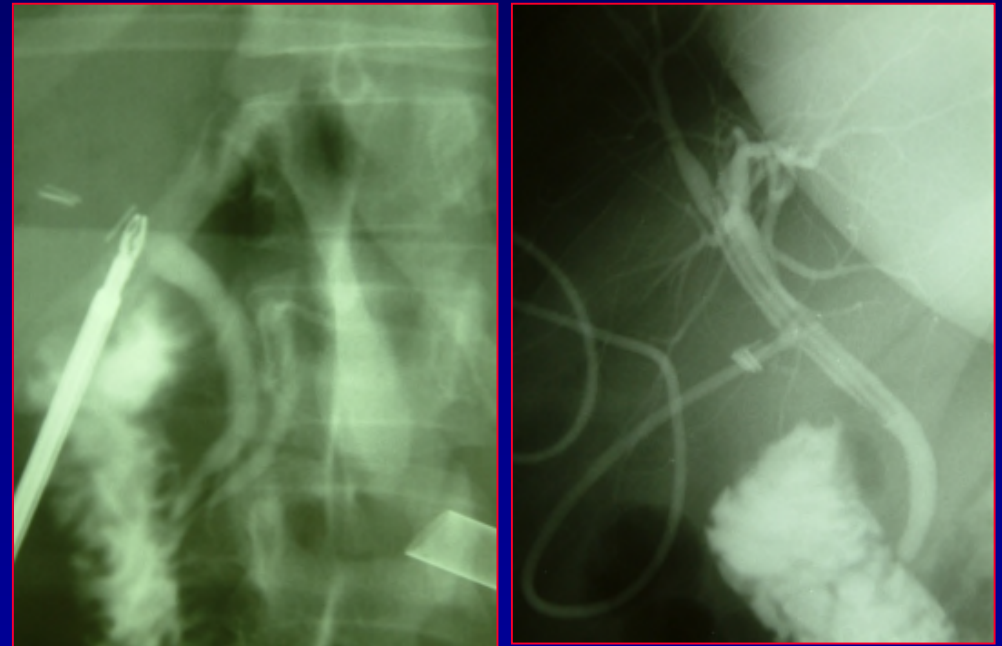
if stricture occurs, discuss **endoscopic stenting (for at least but no more than 1 year)** or immediate secondary surgical repair

Bile Duct Injury during Lap. Chole.

END-to-END BILIARY REPAIR

CAUSES of FAILURES

- * **loss** of ductal tissue
- * **tension** on the suture line
- * inadequate **blood supply**
(coexistent thermal / arterial injury)
- * small **caliber** of the ducts
- * **proximal** location of BDI
- * **inexperience** of the surgeon
- * **No** biliary decompression with a **T-tube**
- * **No watertightness test** performed

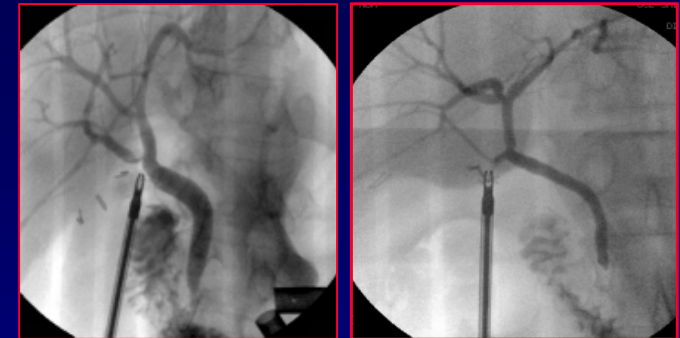


- rarely possible
- poor results reported

LAPAROSCOPIC COMPLETE TRANSECTION of an *ANOMALOUS R. HEPATIC DUCT*

STRATEGY OF TREATMENT

do a selective cholangiography !!



if limited biliary sector
and thin duct



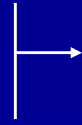
then, close it permanently

if large biliary sector
and large stoma



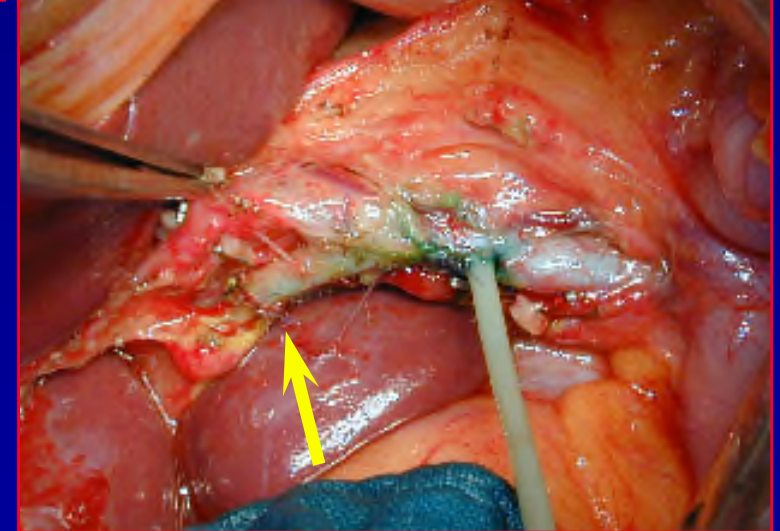
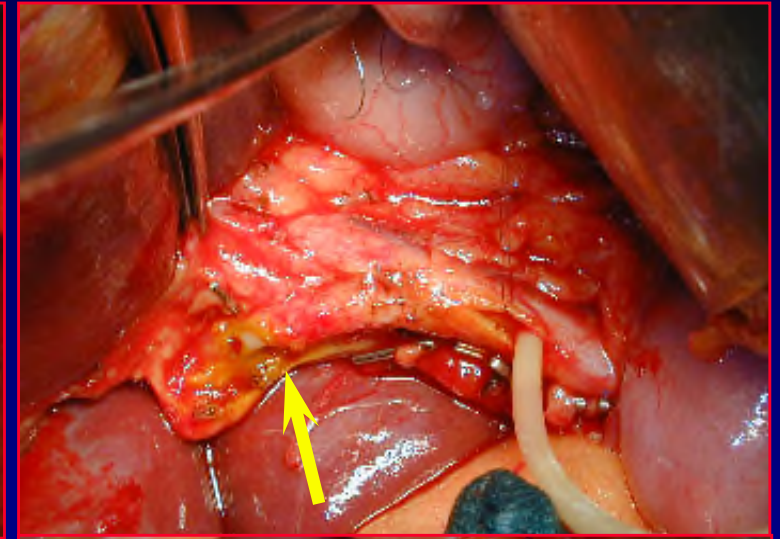
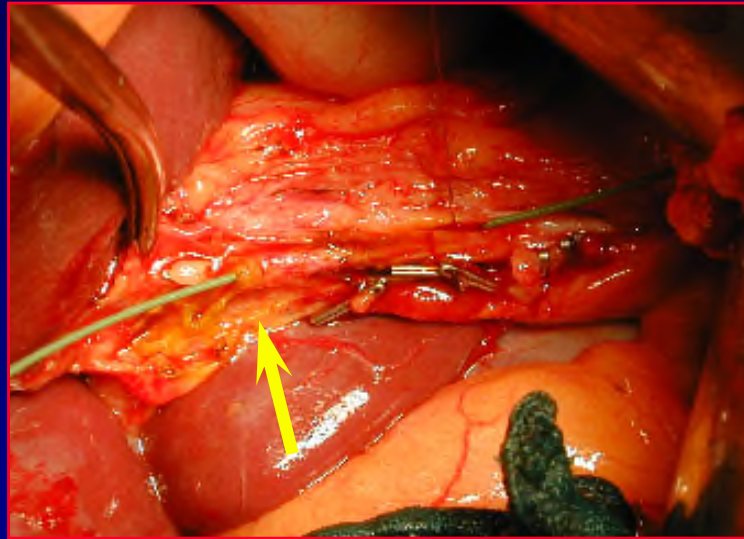
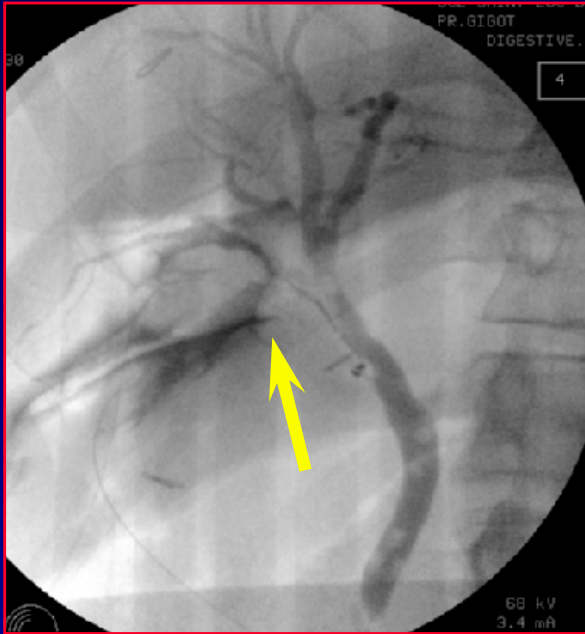
make a repair (HJA)
(expertise is required)

if large biliary sector
and thin duct



clip temporary and come
back later, when dilated

LAPAROSCOPIC BDI to an ANOMALOUS RIGHT HEPATIC DUCT



lateral BDI to
anomalous ARHD
during delayed LC
for cholecystitis



primary repair
by *direct suture*
with T-tube
insertion

MANAGEMENT OF MAJOR BDI DURING LC BY THE PRIMAY SURGEON

**If you feel uncomfortable with the bile duct repair
because**

- you don 't know what to do
- you feel you without enough expertise

DO NOT DO IT

→ drain, close and
transfer to HPB specialist



Drainage does not affect negatively outcome

The treatment of complex BTI
should take place in
a ***specialized referral center***
for optimal care



expert multidisciplinary teams !
(radiologists, endoscopists, surgeons ...)

PEROP MANAGEMENT of BDI during LC BY THE PRIMARY SURGEON

CONCLUSIONS

- Remember that you are **at the best moment to repair**
 - BUT - thermal and ischemic injury are underestimated
 - microsurgical skill is often required
- Tailor your surgical treatment to a **correct classification of BDI**
- Long-term follow-up is mandatory before to conclude to success
- **keep within your expertise**
 - call for assistance if available locally
 - contact HPB specialist and follow advice
- in case of **major BDI** and if you feel in trouble : **DO NOT DO IT**
 - drain, close and get out
 - **transfer** to HPB surgeon rather than transgress

MANAGEMENT of *POSTOPERATIVE BILIARY FISTULA*

The role of *interventional radiology and endoscopy* should not be minimized in the management of patients with BDI.

Percutaneous drainage of subhepatic bile collections is clearly **preferable to** an explorative **laparotomy !!!**



AVOID to reoperate **WITHOUT** having a complete **MAPPING** of the biliary tract !!!



Bile Duct Injury during Lap.Chole.

UNFAVORABLE CONDITIONS

- * **IMMEDIATE REPAIR :**
 - * small caliber of non dilated ducts
 - * but absence of local inflammation
(except if cholecystitis)

- * **EARLY REPAIR :**
 - * small caliber of non dilated ducts !!!
 - * local inflammation
 - due to primary disease (acute cholecystitis)
 - due to biliary fistula, if present
 - * sepsis and poor patients condition
 - due to local infection, abscess, ...
 - due to coexistent bile peritonitis

- * **LATE REPAIR :**
 - * optimized conditions
 - * presence of ductal dilatation with fibrotic tissues

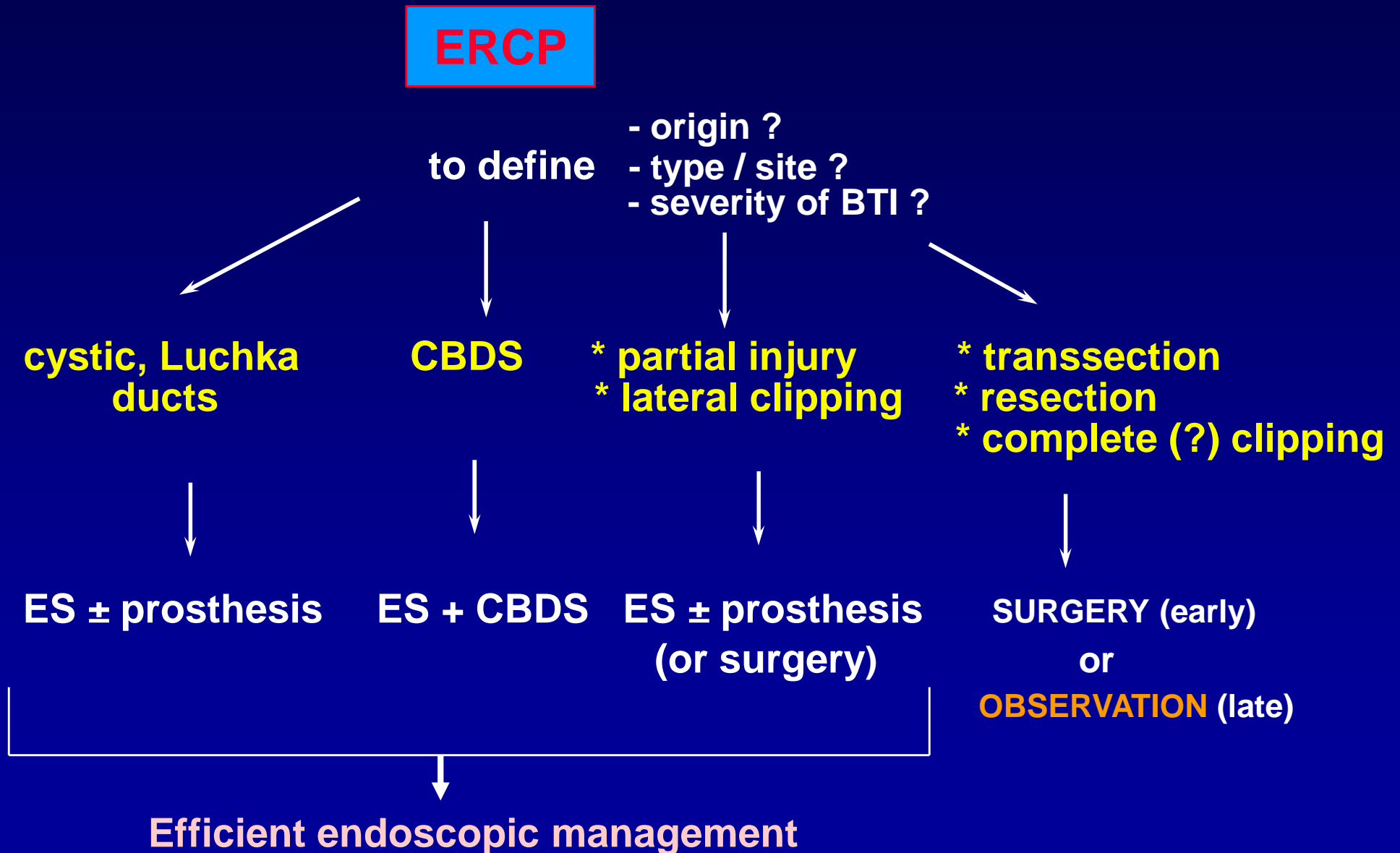
Bile Duct Injury during Lap.Chole.

Postoperative Biliary Fistula

STRATEGY

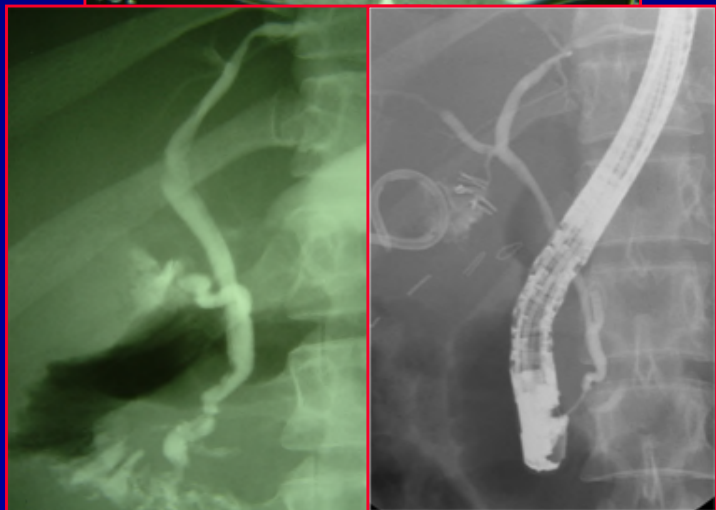
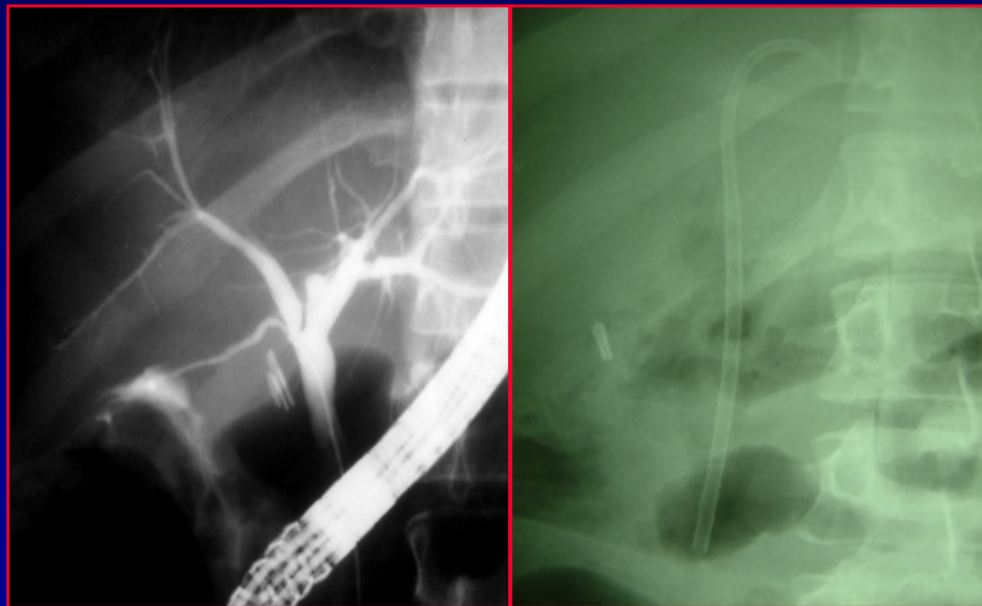
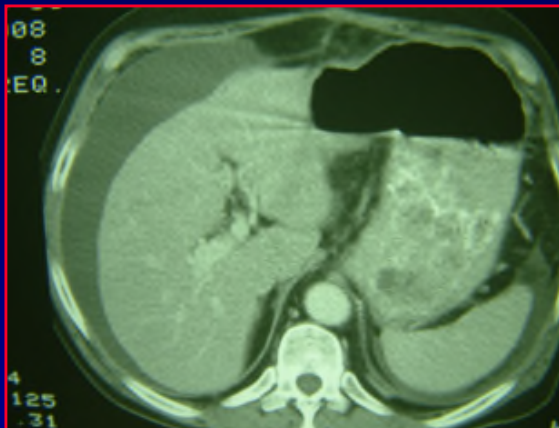
1. **go back to the initial operation** (your souvenir, your operative record / **video** and especially **IOC pictures**, if any) :
→ the clue is often there !!!! ... *search for a missed duct*
2. **Precise clinical evaluation of the patient** :
 - *general status* (few symptoms, cholangitis, septic shock, ...)
 - status of the *abdomen* (soft or tender, peritonitis,)
 - amount of *bile fistula* and evolution (total diversion ?)
3. **Biology** : - CRP, WCC
 - LFTs : cholestasis ? signs of liver parenchymal damage ?
 - kidney function, if severe sepsis
4. **Radiological evaluation before any therapeutic decision !!!**

POSTOPERATIVE BILIARY FISTULA TREATMENT STRATEGY ALGORITHM



MANAGEMENT of BILE LEAK from ACCESSORY DUCTS (cystic or Luchka ducts)

→ Combined interventional radiology and **ENDOSCOPY ...**



... is elegant, safe and efficient !!!

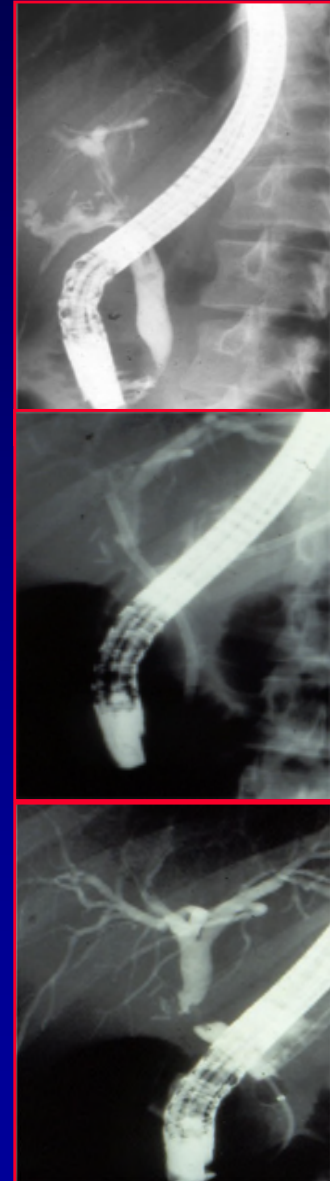
ENDOSCOPIC SERIES of POSTOP. *BILE DUCT LEAKS*

RESULTS

- Compilation of 8 endoscopic series > 25 patients
- Total of **553 patients**
- **Endoscopic success rate :**
 - Cystic duct leak : **95 – 98 %**
 - Luschka accessory bile duct : **100 %**
 - Common bile duct : **80 – 90 %**(immediate results)

THE GOLD STANDARD TREATMENT

CHO (1997), TZOVARAS (2001), DE PALMA (2002), CHRISTOFORIDIS (2002), SANDHA (2004), AGARWAL (2006)



ENDOSCOPIC MANAGEMENT of POSTCHOLECYSTECTOMY *BILE DUCT LEAKS*

CONDITIONS

- expert endoscopist is required
- daily multidisciplinary teamwork between surgeons and endoscopists
- plastic stents (*no metallic stents*)
- multiple stents (to avoid late stricture)
- minimal duration of stenting : 6-8 weeks
- risk of cholangitis (obstructed stent)

ADVANTAGES

- Associated obstructive **CBDS** are present in a mean of 26 % of the patients (ES)
- no general anesthesia compared to surgery !
- similar short term results than surgery, with the advantages of minimal invasiveness
- practically no procedure-related mortality
- patients prefer endoscopy to surgery
- *failures always leave a chance for surgery !!!*



EARLY MANAGEMENT OF BDI DURING LC BY THE PRIMARY SURGEON

CONCLUSIONS

- Remember that you are **at the worst timing to repair** (especially if non HBP surgeon and if delay > one week) : role of thermal and ischemic injury
- Use as much as you can **interventional endoscopic and / or radiological techniques**
- Do **NEVER REOPERATE** without complete **MAPPING** of the **BILIARY tract** (MRCP / ERCP)
- **Keep within your expertise**
 - call for assistance if available locally
 - contact HPB specialist and follow advice



MANAGEMENT of POST-OPERATIVE BILIARY PERITONITIS

**a high index of suspicion for BDI should be
maintained for any patient who do not
recover normally and quickly after LC**

mean delay for reoperation in Belgian registry : **11 days** (1 – 21)



BDI during LC : the Belgian Registry

TYPE OF TREATMENT

	N°	mean delay of treat. (d)	Observ	Stenting (E / S)	Suture	Suture + T-tube	HJA	Diversion
* perop. detection	29	0	-	-	3 **	22	4	-
* biliary fistula	8	90	2	-	-	1	5	-
* bile peritonitis	22	11	-	E2/S1	1	6	6	6
* biliary stricture	6	61	-	E1	-	1	4	
* entire series	65		2	4	4 **	30	19	6

* laparoscopically

POSTOPERATIVE BILE PERITONITIS

DIAGNOSTIC and TREATMENT STRATEGY

EMERGENCY SITUATION

- * septic condition (infected bile)
- * long standing peritonitis

- * good clinical condition
- * recent peritonitis

ERCP

complete laceration

partial laceration, cystic or Luchka duct

LAPAROTOMY

A non surgical option is possible

1. endoprosthesis
2. percutaneous or surgical drainage (laparoscopic >>> open)

- * peritoneal lavage
- * biliary drainage

- bilio- digestive anastomosis if possible
- otherwise, *external biliary diversion*

CONDITIONS

- clinical improvement
- no residual bile collections on repeat CT examination

Bile Duct Injury during Lap.Chole.

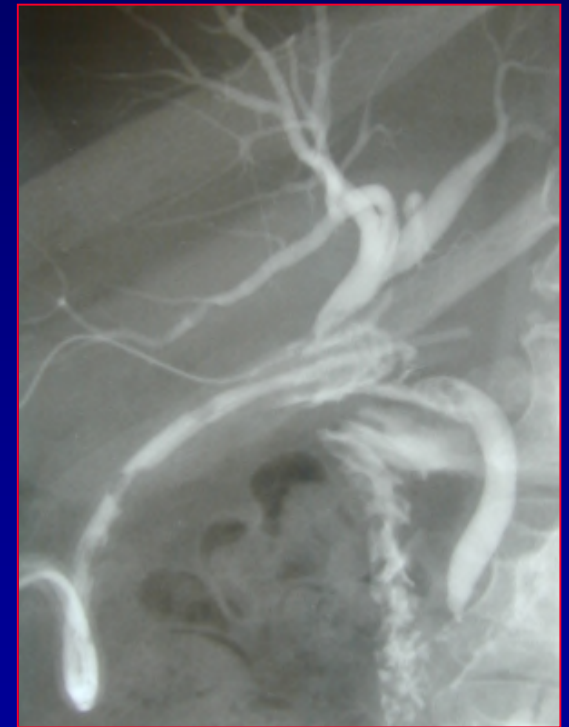
TOTAL BILIARY DIVERSION

INDICATIONS

- **when a biliary repair is impossible or unsafe**
 - proximal thermal necrosis
 - severe local inflammation
 - tiny proximal duct

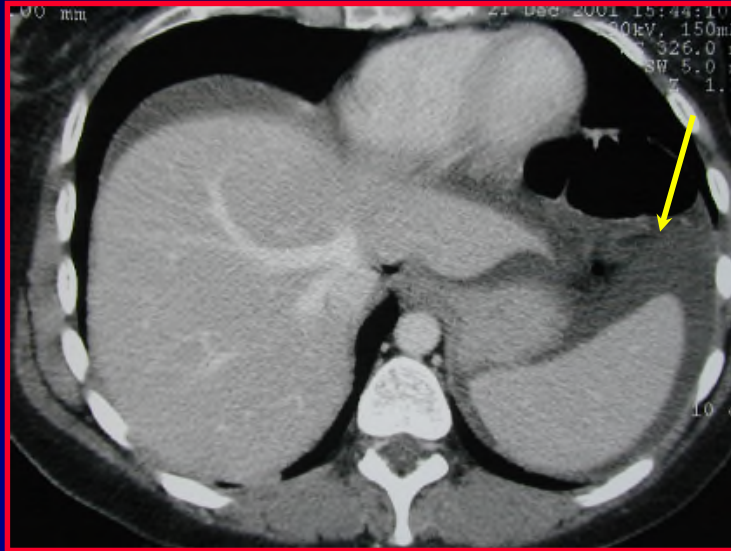
TECHNIQUE

- insert a drain into the proximal biliary stump
- and multiples large sub-hepatic Silastic drains
 - NOT too close of the hepatoduodenal ligament
 - Because of the **risk of vascular injury !**
- large sub-hepatic omentoplasty

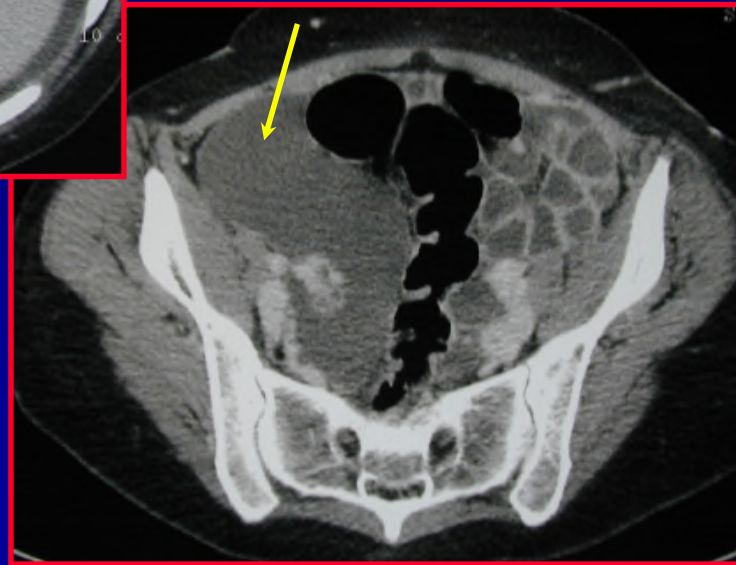


Then, wait 3-4 months (sometimes more) for fibrosis and BD dilatation

BILE PERITONITIS following LAP. CHOLE

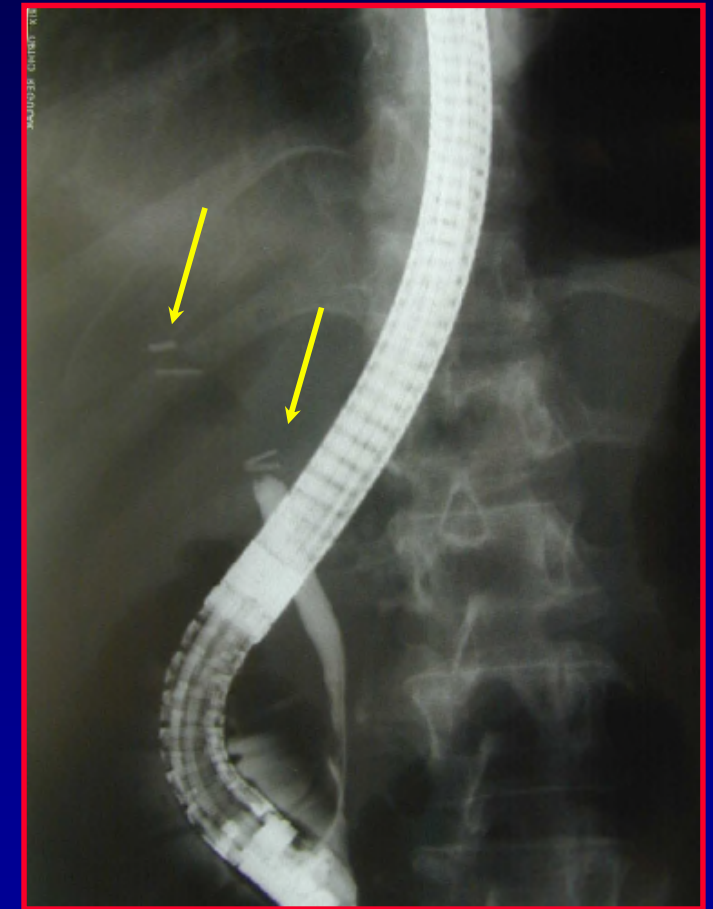


- * F 30 years-old
- * Lap chole
8 days ago



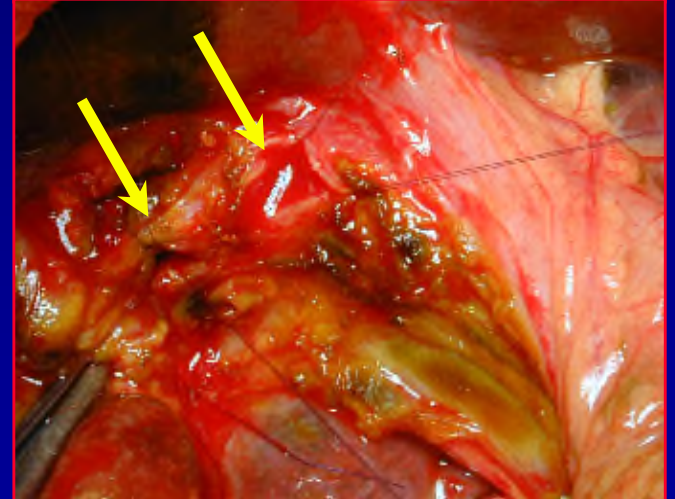
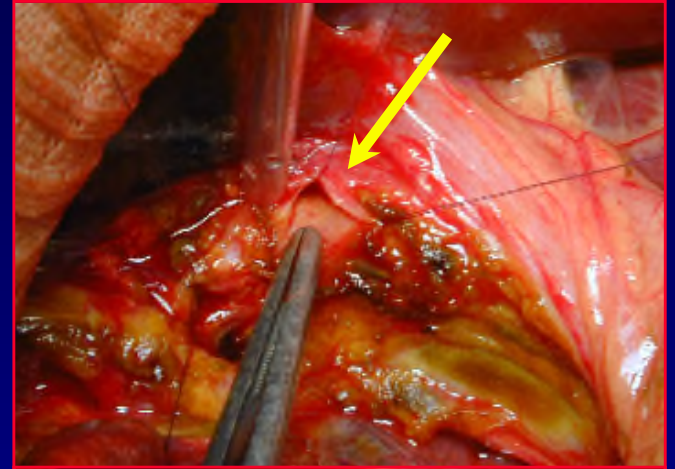
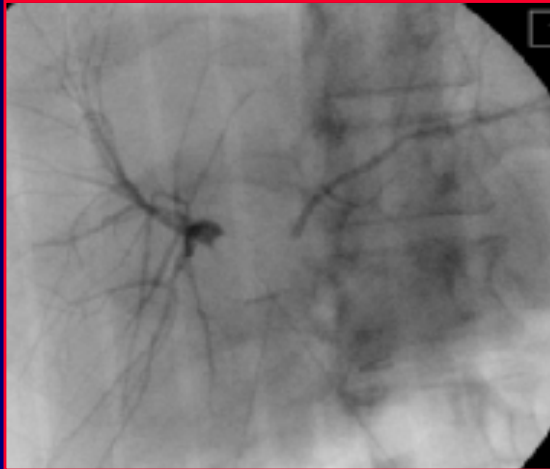
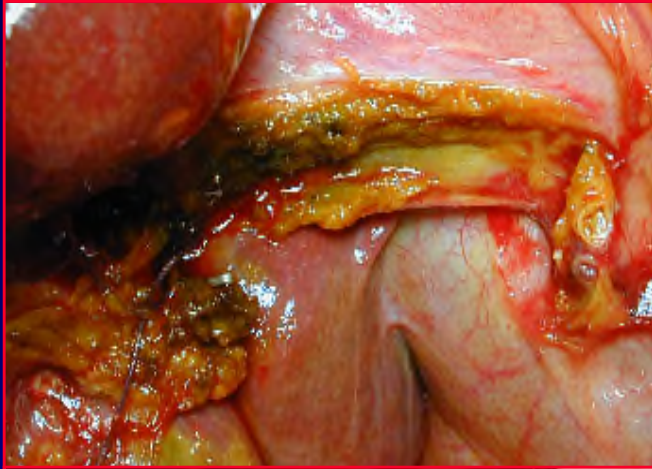
Bile peritonitis

CT 21.12.01



ERCP

SEVERE BDI following LAP. CHOLE



excision of EHBD and main biliary convergence

??? Early repair (free of symptoms 5 years later) or no repair ???

ROLE of RELAPAROSCOPY in the MANAGEMENT of *BILE PERITONITIS* after LAP. CHOLE.

IDENTIFICATION OF SITE OF LEAKAGE

WILLS 2000 (10 patients) : 80 % of detection (sutured)

→ 2 drainage alone : 2 leaks resolution

but one laparotomy D7 for pelvic collection infected

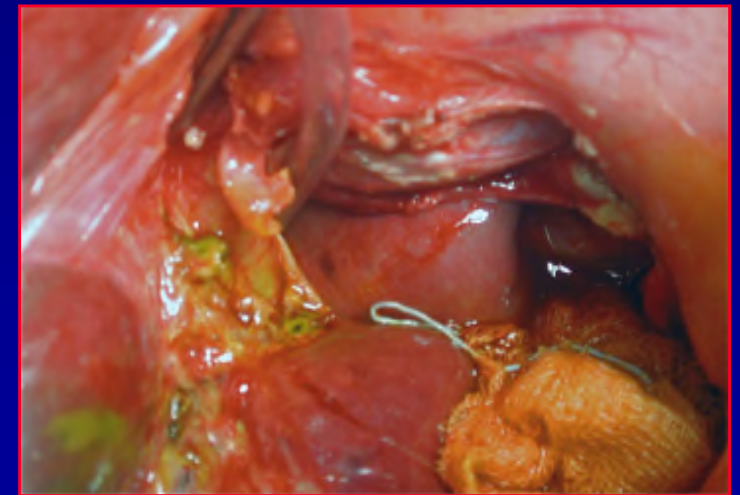
AHMAD (2007)

- by laparotomy (6 patients) : 100 %

- by laparoscopy (5 patients) : 40 %

(4 drainage / 1 Luschka duct sutured)

The source of biliary leak is not always identified



Courtesy of P. Honoré

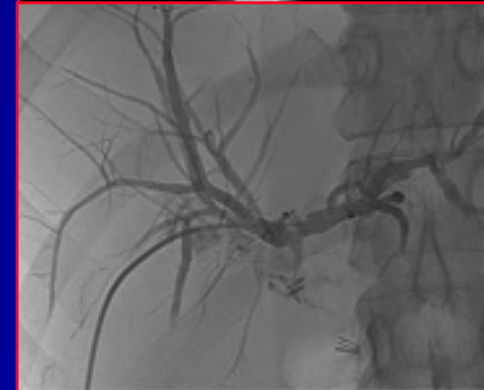
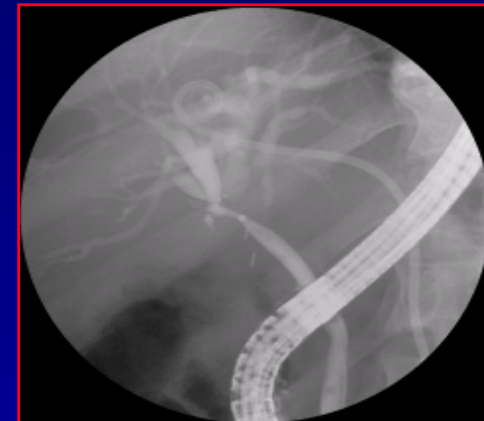
MANAGEMENT of POST-OPERATIVE BILIARY STRICTURES

Optimized conditions

- * local inflammation is gone
- * proximal ducts are dilated
- * thick / fibrotic ductal wall
- * thermal and ischemic lesions are resolved

The Key-Question :

OPERATE or STENT ?



BENIGN BILIARY STRICTURES: OPERATE or STENT ?

BACKGROUND

- there is often a *historical competition* between surgeons and endoscopists
- few centers where daily multidisciplinary teamwork is efficient
- **differences in concept management** (surgery is a one-shot surgery)
- increasing long-term results are reported with endoscopic approach of BDI



BENIGN BILIARY STRICTURES: OPERATE or STENT ?

LIMITATIONS

1) Endoscopic approach is **NOT AN ALTERNATIVE** for many patients

- only possible if the bile duct is still in continuity

SINE QUA NONE CONDITION !

- complete transection is formal indication for surgical repair
- impossible if the bile duct is not endoscopically accessible anymore

(i.e: hepatico-jejunostomy)

% of previous biliary repair with HJA in surgical series :

- in 562 patients with **BD injuries** : 21 %
- in 811 patients with **BD strictures** : 59 %

BENIGN BILIARY STRICTURES: OPERATE or STENT ?

LIMITATIONS

2) Endoscopic approach is **NOT TECHNICALLY FEASIBLE** in all patients

- ineffective for complete / angulated biliary obstruction
(ligation, clips), complete transection
- initial technical failure rate :
 - from 0 to 38 %
 - mean : **12 %** (in 9 series totalizing 587 patients)
 - even in expert series : Bergman (2001): 57 patients : **20 %**
De Palma (2003): 74 patients : **25 %**
Prat (2006) : 88 patients : **22 %**
 - depending of reported patients selection :
0 % (Davids-1993, Costamagna- 2003)

BENIGN BILIARY STRICTURES: OPERATE or STENT ?

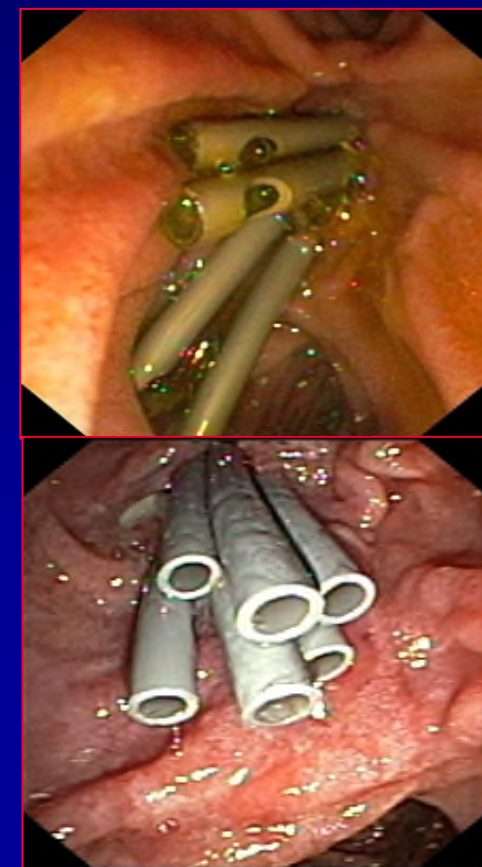
DIFFERENT CONCEPT

Endoscopic treatment requires **REPEATED PROCEDURES**

- **repeated** endoscopic or radiological procedures
- multiple **stents replacement**
 - in 447 endoscopic patients : mean stent exchange was **5**
- significant **duration of treatment**
 - in 521 endoscopic patients : mean treatment duration was **12** mo (8-14)
- additional hospital stays for stent exchanges or complications

... in comparison, surgery is a «one-shot» procedure !

Dumonceau et al. *Gastrointest Endosc* 1998; 47: 8
Costamagna et al. *Gastrointest Endosc* 2001; 54: 162
Draganov et al. *Endoscopy* 2002; 55: 680



ENDOSCOPIC TREATMENT of *BILE DUCT STRICTURES*

Authors	Patients	Bismuth type I-II	Immediate success	Duration stenting	Nb stents
DUMONCEAU 1998	48	85 %	98 %	12 mo	1- 3
BERGMAN 2001	74 (47)	92 %	80 % (94 % if complete excluded)	12 mo	2
COSTAMAGNA 2001	45	60 %	89 %	12.1 mo	mean 3.2
DE PALMA 2003	57	96 %	75 % (91.5 % if complete excluded)	12.4 mo	1- 3
KUZELA 2005	43	100 %	100 %	12 mo	mean 3.4

ENDOSCOPIC TREATMENT of *BILE DUCT STRICTURES*

Authors	Early complicat	Late complicat	Death to treat	mean FU (mo)	Recurent stricture	Time to recurrence
DUMONCEAU 1998	13 % (severe: 6%)	20 % (mild)	0 %	50	19 % (repeat)	77 % ≤ 1 year (from Liver Tx)
BERGMAN 2001	19 %	13 %	5 %	109 (9 years)	20 %	100% ≤ 2 years
COSTAMAGNA 2001	9 % (AC)	19 % (AC)	0 % (1 stroke)	49	0 % (repeat)	--
DE PALMA 2003	7 %	12 %	0 %	49	13 %	at a mean of 4.8 months
KUZELA 2005	12 %	0 %	0 %	16	0 % (repeat)	--

BENIGN BILIARY STRICTURES :

OPERATE or STENT ?

DAVIDS

Retrospective study from AMC (Amsterdam)
Ann Surg 1993; 217 : 237

SURGERY

ENDOSCOPY

	SURGERY	ENDOSCOPY	
• Patients :	35	66	
• Initial trauma from biliary surgery :	89 %	89 %	
• Type 3-5 Bismuth :	31 %	17 %	
• Complications :			
. early (< 30 days) :	26 %	8 %	p < 0.03
. late :	0	27 %	
. total :	26 %	35 %	NS
• Mortality :	0	1	
• mean FU period (mo) :	50	42	
• Successful outcome :	83 %	83 %	
• Interval for restructure (mo) :	40	3	p < 0.04

Similar results of surgery and endoscopy

ENDOSCOPIC TREATMENT of *BILE DUCT STRICTURES*

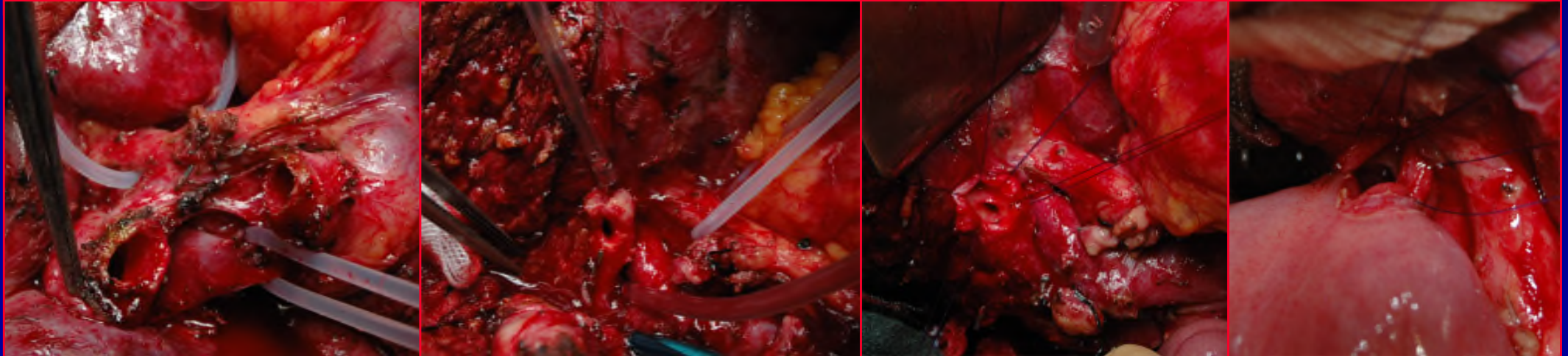
ENDOSCOPIC TREATMENT should be
the ***INITIAL MANAGEMENT of CHOICE***
for **POSTOPERATIVE BILE DUCT STRICTURES !!!**

***.... when the bile duct is still in continuity and
if the stricture is incomplete***

Endoscopic treatment ... a bridge too far !

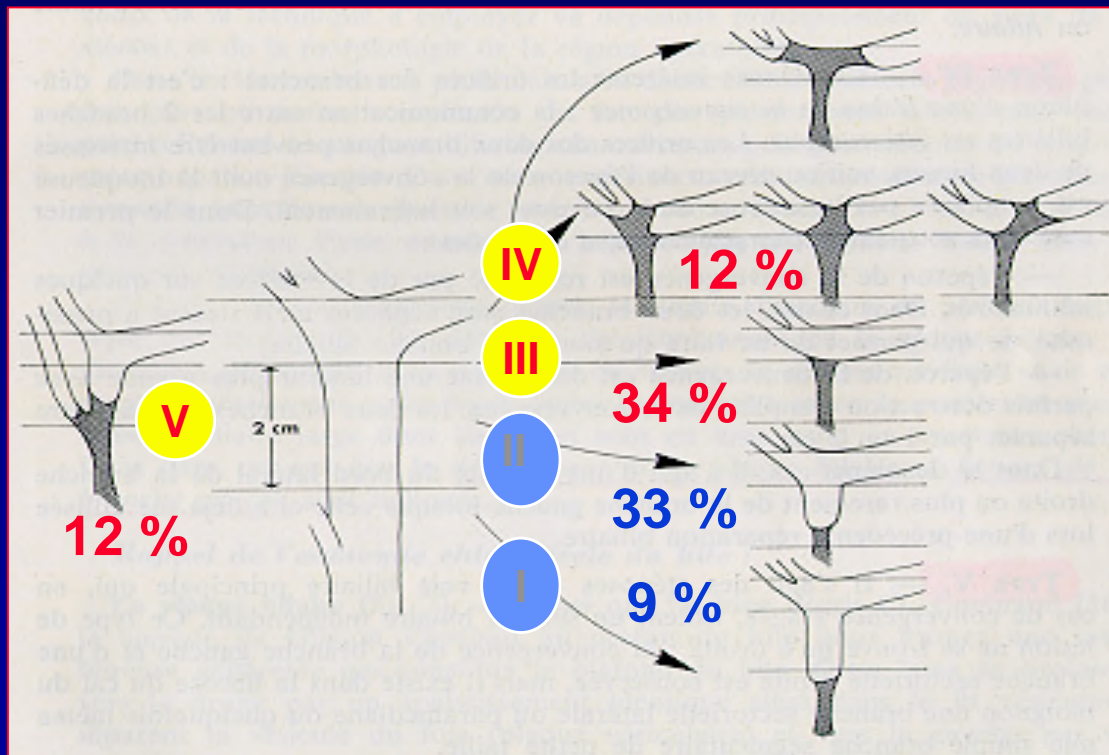


- 58 years-old
- LC-related BDI of RHD
- repeat attacks of cholangitis
- finally requiring R. hemihepatectomy



BENIGN BILIARY STRICTURES

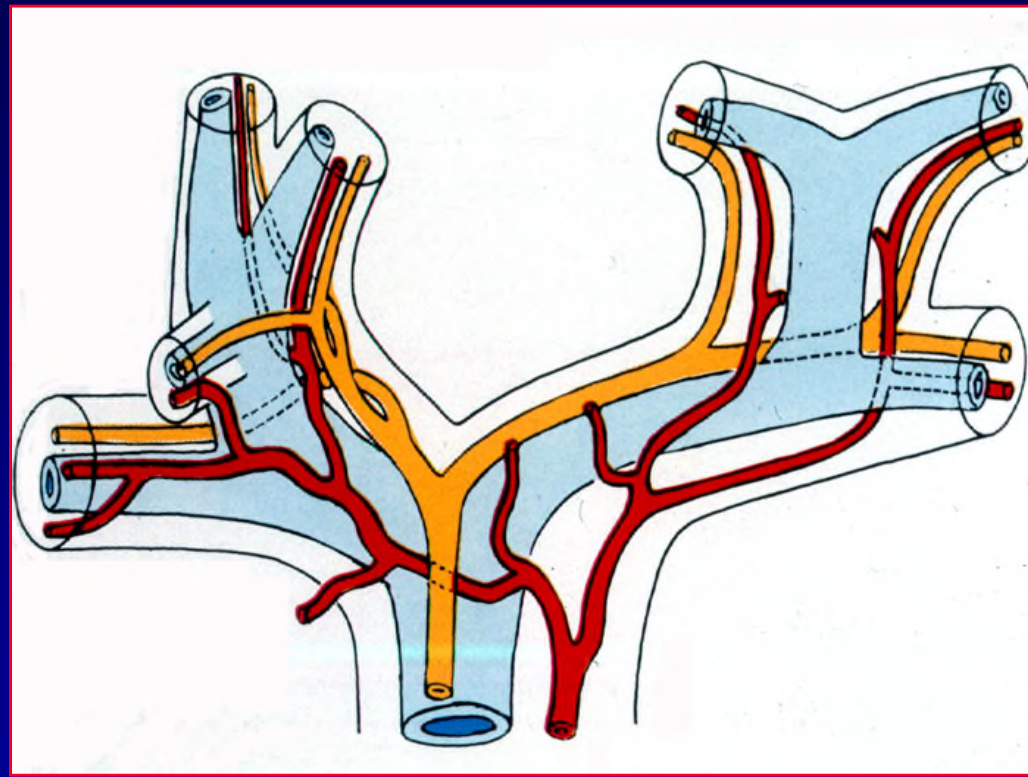
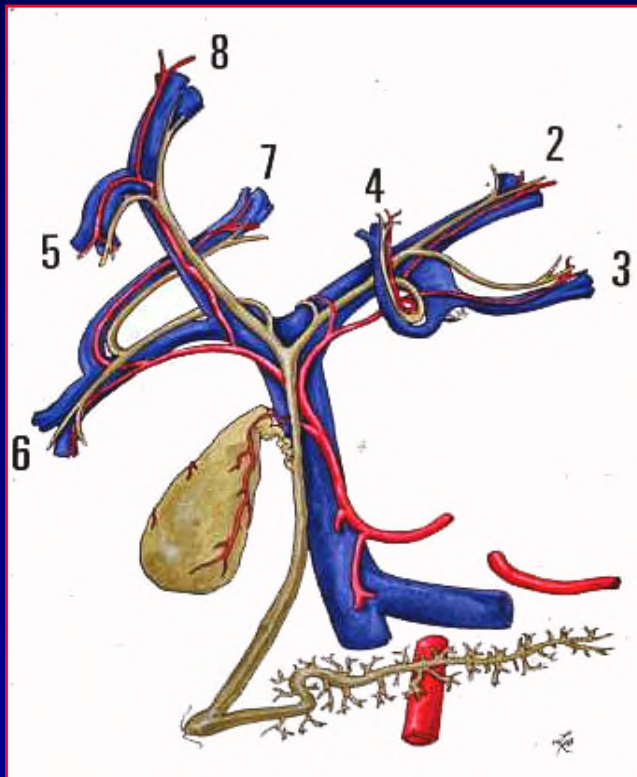
BISMUTH-CORLETTE classification



- in type I : simple HJA
- in type II-III-IV :
HEPP-COUINAUD approach !!!
- in type IV (with interruption of main biliary convergence) :
 - duct-to-duct approximation (following reconstruction of the main biliary convergence)
 - multiple anastomoses

58 % of severe injury (type III, IV, V)

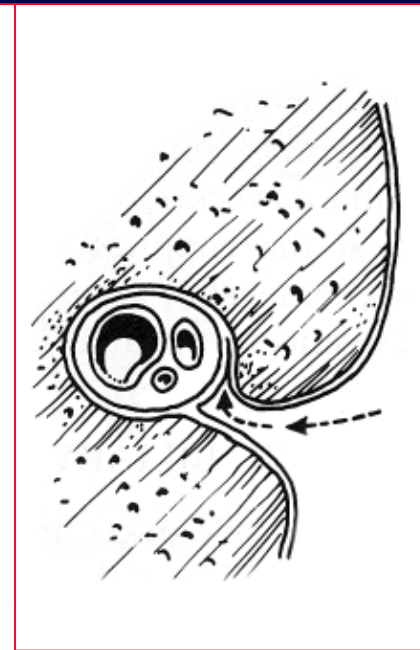
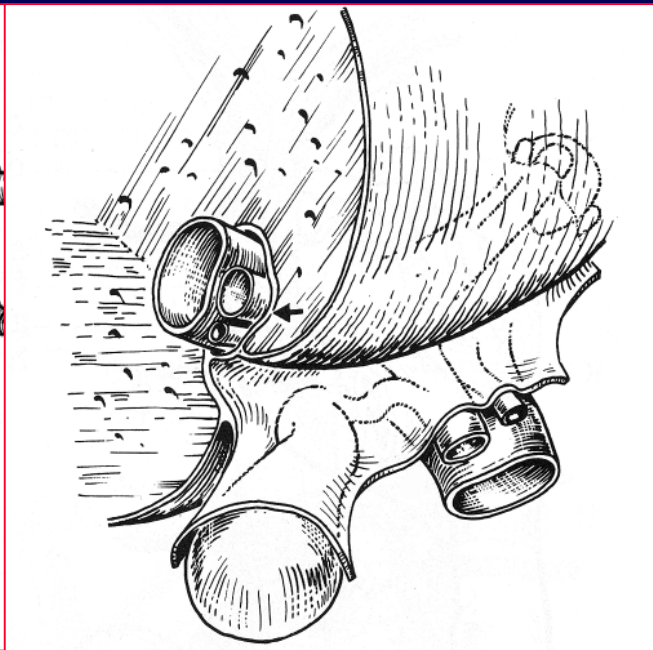
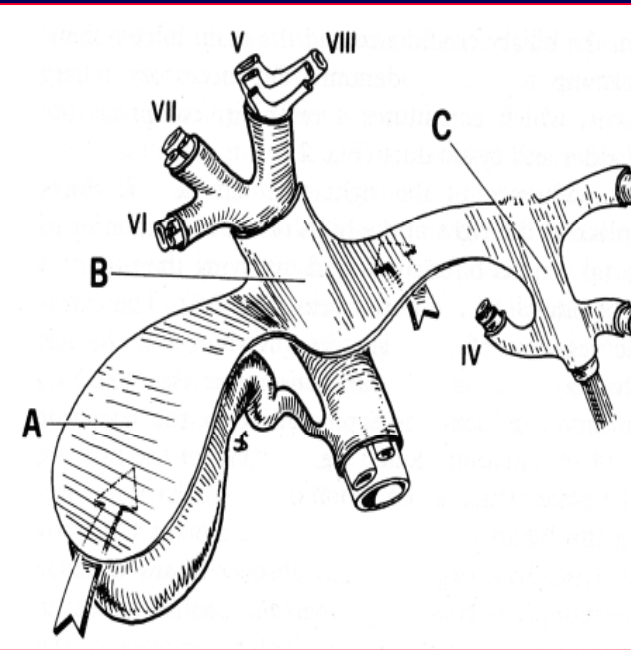
ANATOMY of the LIVER HILUM



Basic anatomical principles:

1. the bile duct is anatomically located **anteriorly and superiorly** to the hilar vessels
2. **long extrahepatic portion** (2-3 cm) of the **left hepatic duct** compared to the short and vertical direction of the right HD

ANATOMY of the LIVER HILUM



Anatomical considerations :

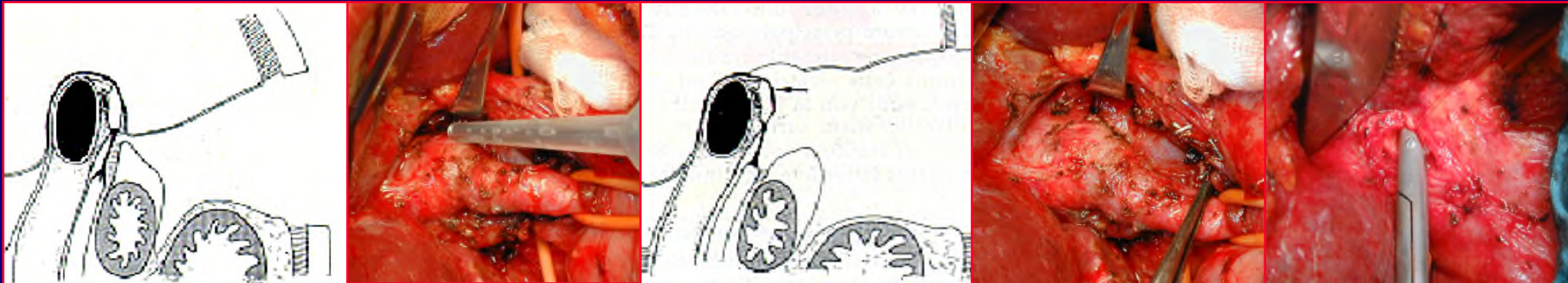
1. the hilar plate is a part of the glissonian sheet
2. the quadrate lobe (segment IV-b) is « covering » the liver hilum

Procedure of *lowering the hilar plate* is required to access the hilum

BENIGN BILIARY STRICTURES

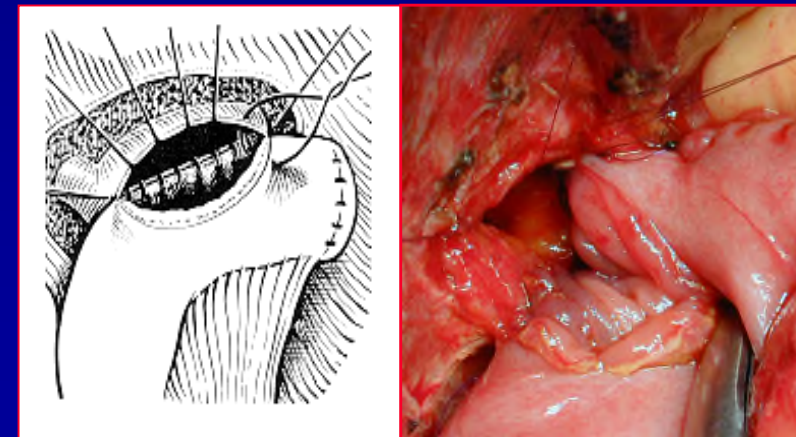
SURGICAL STRATEGY

* Lowering the Hilar plate



* Restore bilio-digestive drainage

- by using a well-vascularized Roux-en-Y HJA
- on a normal suprastenotic biliary mucosa
- using a mucosa-to-mucosa anastomosis
- avoiding residual excluded biliary segments



CHOLECYSTECTOMY-related BILE DUCT STRICTURES : UCL experience (120 patients)

FEATURES	REFERRED	LOCAL	p value
Patients	105	15	-
Initial cholecystectomy :			
- acute/chronic cholecystitis	41 %	100 %	0.001
- Local risk factors	?	100 %	?
- laparoscopic chole	63 %	80 %	NS
- IOC	21 %	94 %	0.001
- peroperative detection	24 %	94 %	0.001
At referral:			
- delay before referral	148 days	No delay	0.001
- Prior repair	71 %	0	0.001
- Severity (Strasberg type E)	97 %	13 %	0.001
UCL management :			
- Immediate/ early repair	11 %	100 %	0.001
- Hepp-Couinaud or HJA or RHH	97 %	0	0.001
- Postop complications of repair	26 %	6.7 % (other surgeon)	0.001
- Postop mortality of repair	1 %	0 %	NS
- Median FU of repair	125 months	44 months	-
- Grade A or B results of repair	91.4 %	93.3 %	NS
- Late stricture rate after repair	9.6 %	0	NS

MANAGEMENT of *BENIGN BILIARY STRICTURES*

CONCLUSIONS

1. Multidisciplinary team approach is required
2. Better results in expert centers
3. Endoscopic stent therapy is a valuable option in selected patients with **type 1 and 2 strictures** if endoscopic expertise is available.
4. Multiple stent therapy is associated with success improvement.
5. Endoscopic insertion of multiple stents should be the first line treatment in selected patients, with surgical reconstruction reserved for complete strictures, failures of endoscopy and high strictures
6. **Late timing of biliary repair is a key-factor for long-term successful outcome**
7. **Secondary biliary repair of high strictures should be done in expert centers**

LC-related BILE DUCT INJURY

FINAL CONCLUSIONS

1. If you perform laparoscopic cholecystectomy, **you must be able** to deal with BDI at all stage of diagnosis and **to manage properly** these patients (medico-legal consequences)
2. In complex BDI, **the best is to TRANSFER the patient to a specialized referral HPB center** (medico-legal consequences)
3. **PLEASE, inform the patient**
 - **Before surgery** : informed consent (risk of conversion and BDI)
 - **After BDI** : about what happens, what should be the consequences, what is the treatment plan?) **This may avoid litigation !!!**

***THANK YOU
FOR YOUR ATTENTION***