Iatrogenic bile duct injuries in the laparoscopic era

Jose Ramos

University of the Witwatersrand
Donald Gordon Medical Centre

Bile duct injuries

- Discontinuity of the bile ducts
- Obstruction and stricture
- Bile leak
- Unexplained cholangitis

Issues to be considered

- What is the extent of the problem?
- Is there an injury?
- What type of injury has occurred?
- What is the anatomy of the injury?
- Are other complications present?
- Which injuries require surgery?
- Time since injury?
- When should repair be performed?
- Who should do the repair?
- What type of repair should be performed?
- What outcome can be expected?

How common is BDI?

- Open cholecystectomy

  0.1% – 0.2%

- Laparoscopic cholecystectomy

  0.4% - 0.7%

- Incidence (USA)

  750000 cholecystectomies per year

  300-500 / 100 000 Lap Cholecystectomy

  4000 BDI per year Fischer et al *HPB 2009;11:32–37*

  Pop 300 million = 1.33/100 000 BDI/year

- South Africa?

  Pop 52 million = 691 BDI/year

Cost implications for South Africa

- 500 injuries / year
- Medical costs
  - R100 000 cost per case
  - R50 million/year
- Medicolegal costs?

  Most frequent claim in general surgery

Cost to Surgeon and Patient?

How can we prevent BDI?

Table 9 Lau classification, mechanisms of injury, prevention and treatment (2007)[4]

	Mechanism of injury	Preventive measures	Treatment for early detection	Treatment for late detection
1	– Insecure closure of cystic duct – Too deep dissection into gallbladder bed	– Attention to operative details	– Control bile leak with suturing – Laparotomy if required – Drain subhepatic space	– Drain intraperitoneal collection – Control sepsis – Endoscopic stenting
2	– Incision of CBD instead of cystic duct for operative cholangiogram – Clipping of CBD but recognized – Laceration of cystic duct/CBD junction – Diathermy injury to CBD/CHD	– Strasberg's critical view of safety – Avoid too much traction on gallbladder – Careful use of diathermy	– Conversion to laparotomy – Repair small laceration – Place of T tube controversial – Drain subhepatic space – If tissue necrosis extensive due to diathermy, treat as Type 3	– Early diagnosis without stricture – Laparotomy, repair and drainage – Late diagnosis with stricture, treat as Type 3
3	– CBD mistaken as cystic duct, with CBD/CHD transected or resected – Diathermy injury	– Strasberg's critical view of safety – Avoid dissection too close to CBD	– Conversion to laparotomy – Trim divided ducts to healthy tissue – Close distal stump – HJ to proximal stump – Drain subhepatic space	– Control sepsis first by draining intraperitoneal collection and proximal bile duct – Laparotomy and HJ when sepsis controlled
4	– Right HD or sectoral duct mistaken for cystic duct	– Recognition of biliary anomaly	– Right/left hepatic duct biliary-enteric anastomosis	– Asymptomatic: follow up – Symptomatic: HJ, liver resection if HJ not possible
5	– Right hepatic artery mistaken for cystic artery – Diathermy or clip injuries to right hepatic artery during haemostasis	– Recognition of vascular anomaly – Avoid blind use of diathermy and clip	– Reconstruction of vessels and bile ducts if technically possible – If not technically possible, ligate duct and vessels and wait and treat as late detection	– Asymptomatic with liver atrophy: follow up – Symptomatic: HJ ± liver resection/liver transplant

CBD, common bile duct; CHD, common hepatic duct; HD, hepatic duct; HJ, hepatico-jejunostomy.

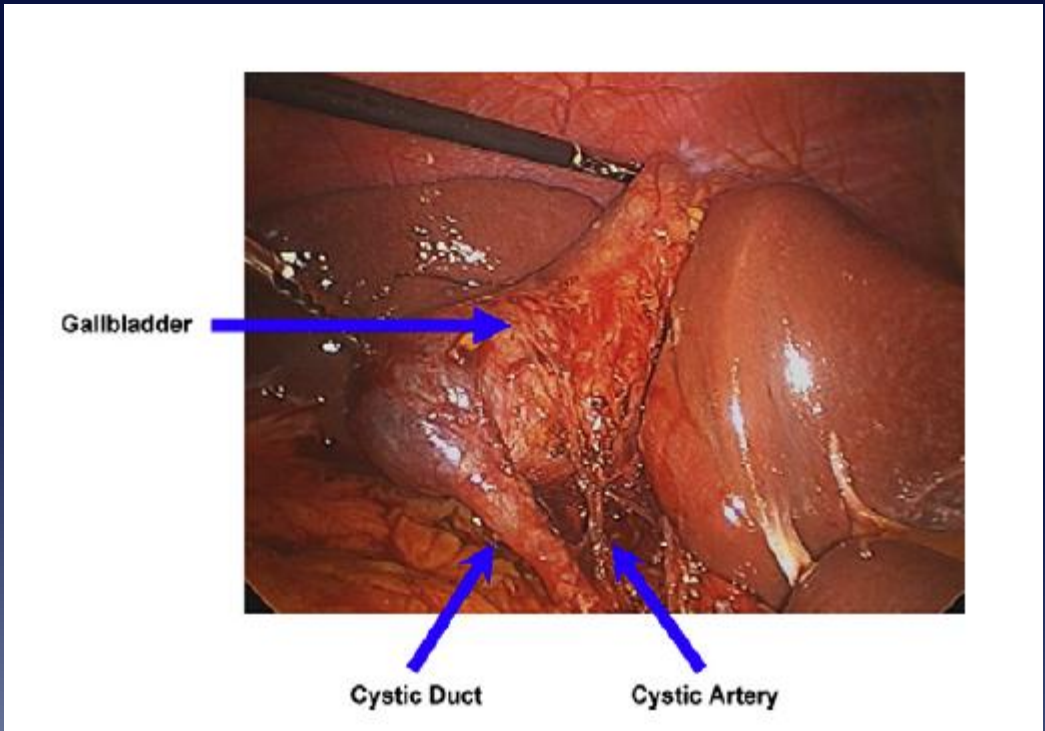
HPBASA

Management of bile duct injury after laparoscopic cholecystectomy: a review

Wan Yee Lau, Eric C. H. Lai and Stephanie H. Y. Lau
Faculty of Medicine, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong SAR, China

ANZ J Surg 80 (2010) 75–81

Critical view of safety



Strasberg S, Hertl M, Soper N. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll Surg 1995;180(1):101–25.

Which type of surgeon is at risk of causing BDI?

- High-risk vs Low-risk taker

  17% increase in the relative risk of CBDI.

  Findings suggest a group of surgeons might be at increased risk for a potentially preventable injury

  Massarweh J Am Coll Surg 2009;209:17–24.

- Junior?
- Older surgeon?
- Training program vs solo practice?

Is there an injury?

- Intra-operative
  - Bile leakage at time of surgery
  - Obvious ductal injury at surgery
  - Intra-operative cholangiogram shows injury
- Post-operative
  - Jaundice
  - Bile leakage from wound or drain
  - Abdominal pain
  - Pyrexia, “failure to thrive”
  - Abnormal liver functions
- Late
  - Abnormal liver functions
  - Jaundice
  - Cholangitis
  - Lobar atrophy and dilated ducts

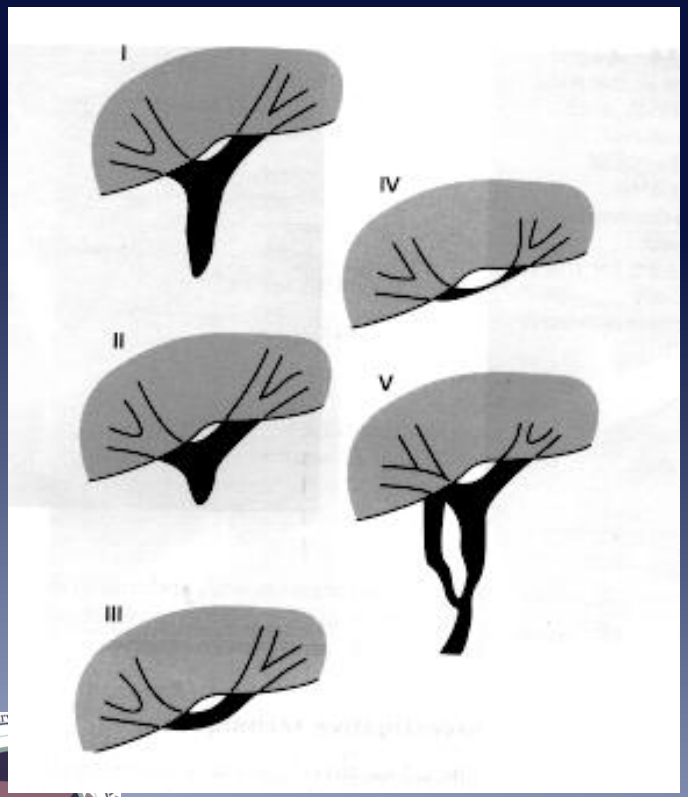
Investigation of possible injury

- LFT's, WCC, CRP
- Sonar, CT – collections, liver ischaemia
- MRCP – clips may impair definition
- ERCP
- PTC
- (HIDA Scan)

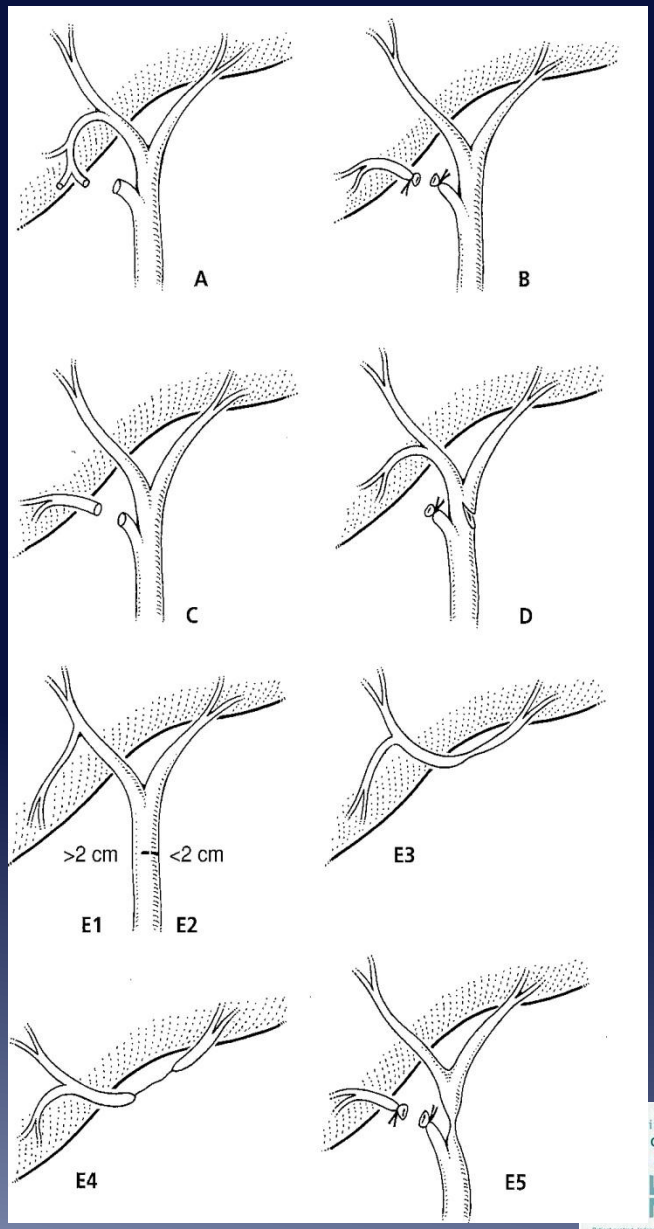
Type of injury

- Bile duct in-continuity
  - Cystic duct leak
  - Leak from partial injury of bile duct
  - Narrowing of bile duct – clip or endoloop
  - Leak from duct of Luschka in GB fossa
  - (Leak from cut liver edge)
- Bile duct transected
  - Level of injury wrt to confluence of bile ducts
  - Separation of hepatic ducts

Classification

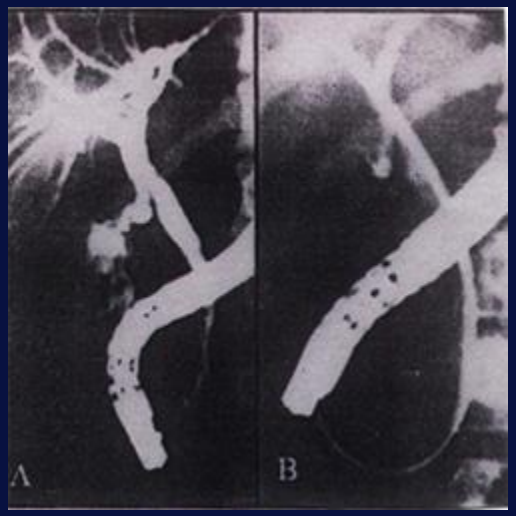


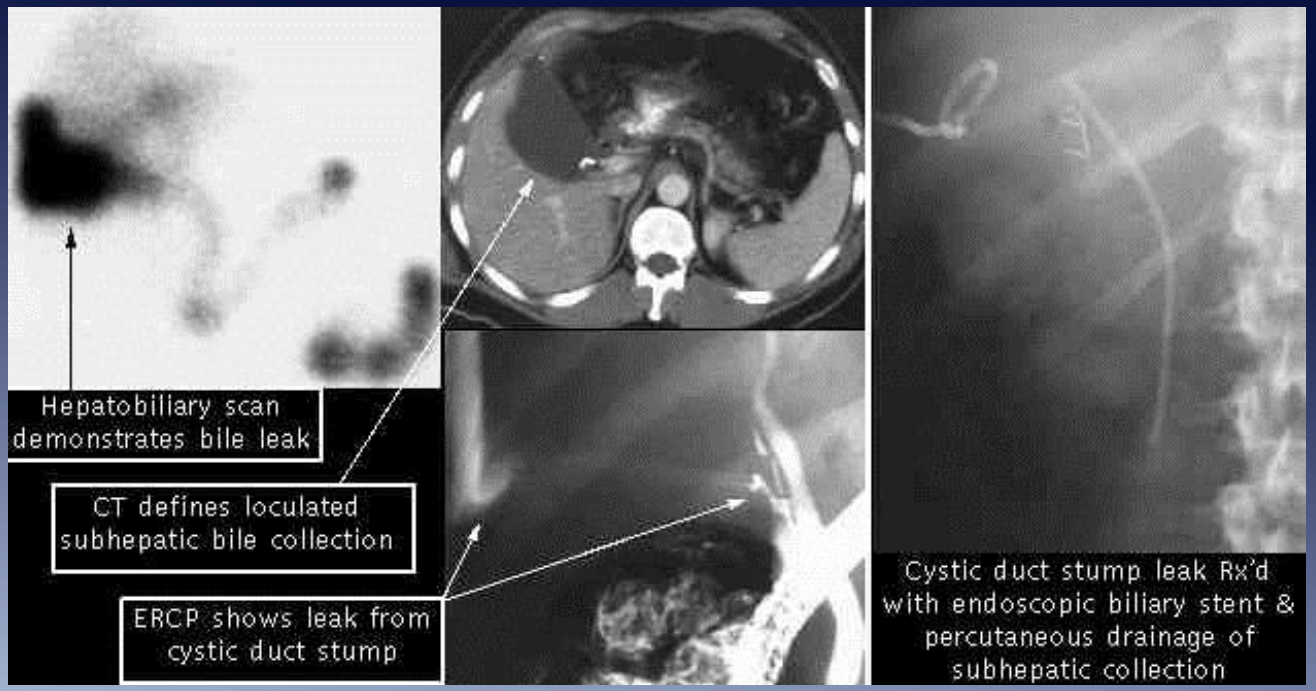
Bismuth



Strasberg

Cystic duct leak



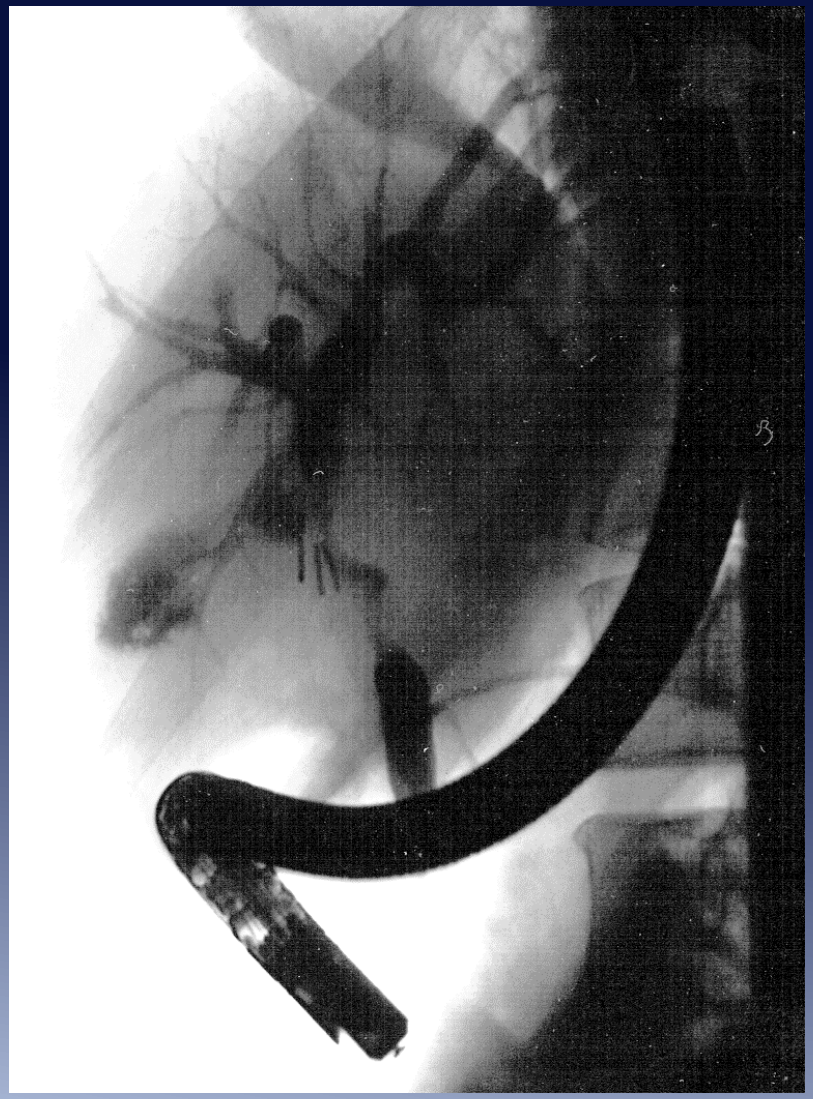


Hepato Pancreatico Biliary Association of South Africa
HPBASA

Wits University
Donald Gordon Medical Centre

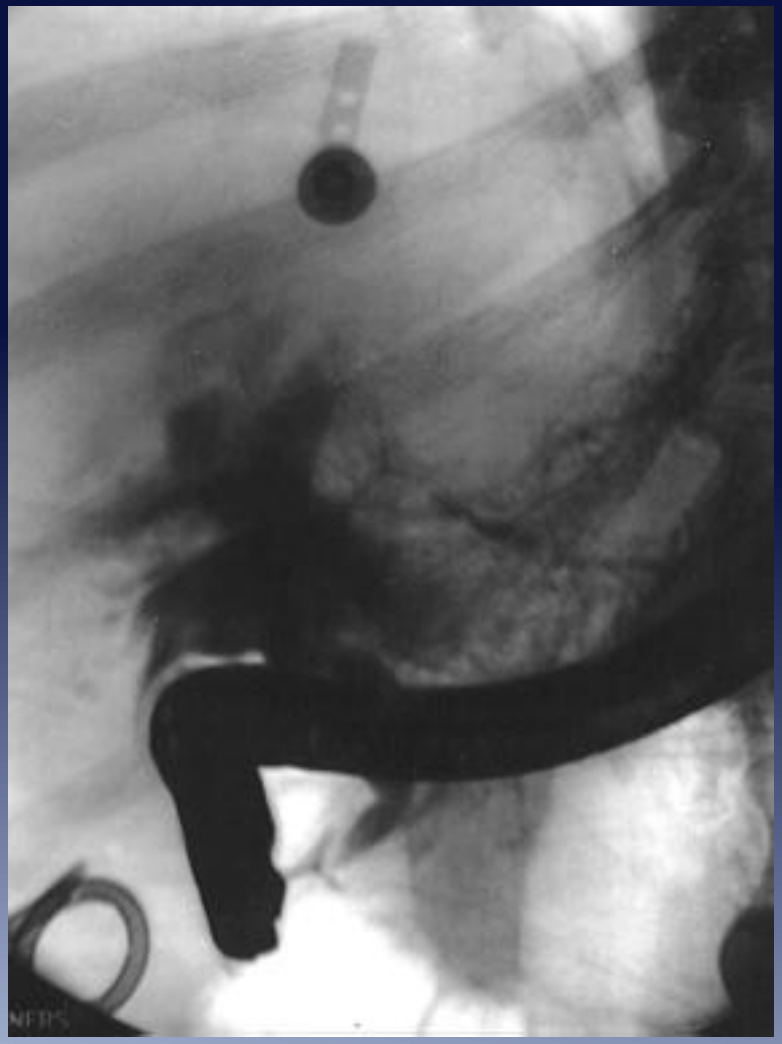
Other leaks

Bile duct in-continuity

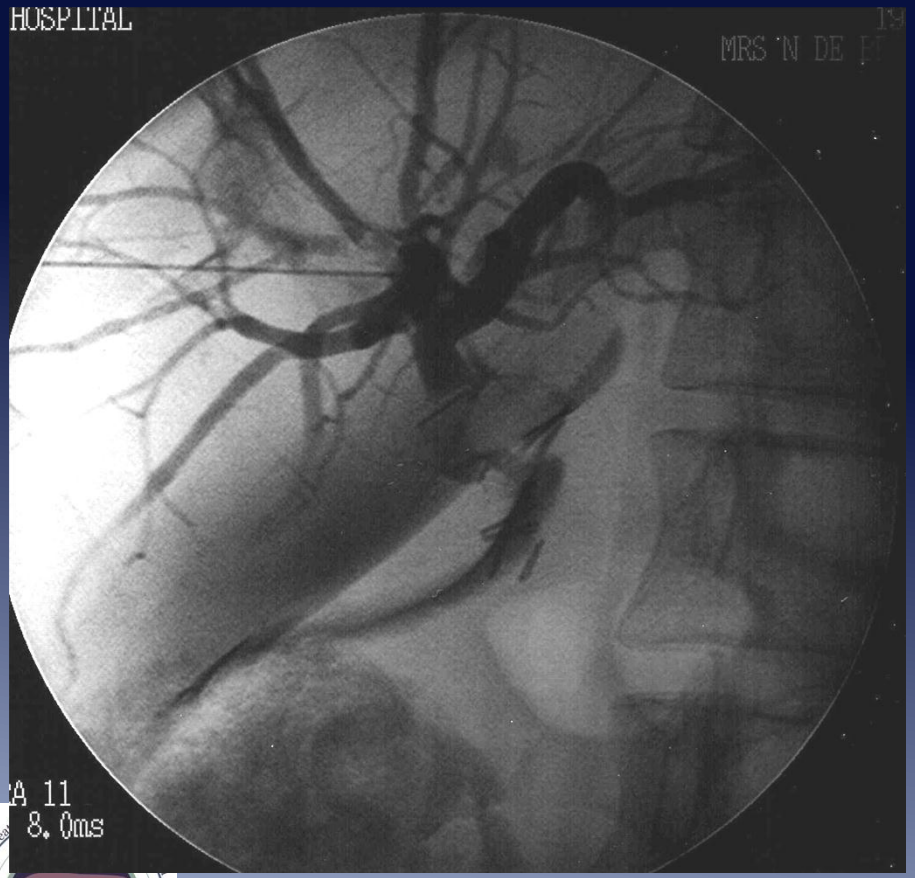


Bile duct in-continuity

Bile duct NOT in-continuity



Bile duct NOT in-continuity



Complications

- Cholangitis
- Biliary collections
- Abscess
- Biliary peritonitis
- Late
  - Lobar / sectoral / segmental atrophy
  - Biliary cirrhosis
  - Liver failure

Which injuries require surgery?

- Surgery NOT required (70%)
  - Leak from cystic or other small superficial ducts
  - Partial injury to main bile duct
- Surgery required (30%)
  - Bile duct discontinuity
  - Transection
  - Failed ERCP or PTC treatment of strictures
  - Lobar obstruction with recurrent cholangitis may require biliary reconstruction or resection

Proportion requiring surgery

- Academic Medical Centre, Amsterdam
- 500 pts, 1991-2005
- 151 (30.2%) underwent surgery

de Reuver et al Ann Surg 2007;245:763-770

Timing of repair

- Immediate
- Early

  Within 2-6 weeks of injury
- Delayed

  6 weeks after injury
- Late

de Reuver et al Ann Surg 2007;245:763-770

When should repair be performed?
Immediate

Advantages

- Tissues healthy
- no inflammation

Disadvantages

- Small ducts
- Extent of injury may not be apparent
- Anatomical assessment of biliary tree may not be ideal
- Skill of operator?

When should repair be performed?
Delayed

Advantages

- Elective repair
- Can be performed in referral centre
- Extent of injury established
- Tissues healthy
- Sepsis resolved
- Ducts usually more dilated and healthy

Disadvantages

- Delay may be long
- Multiple interventions to control complications
- Recurrent cholangitis from strictures
- Stress to patient from drains, interventions etc

TABLE 6. Short- and Long-term Results of Reconstructions After BDI According to Timing of Repair

	Timing		
	Acute (n = 15) (%)	Delayed (n = 96) (%)	Late (n = 40) (%)
Characteristics			
Age (yr) [mean (SD)]	45 (13.2)	50 (15.2)	47 (14.2)
Gender, women (%)	10 (67)	60 (63)	31 (77)
ASA classification, ASA 1%–2%	12 (80)	84 (87)	36 (90)
Type of injury, A and B	0 (0)	8 (8)	6 (15)
Level of injury, Bismuth I–III (%)	9 (60)	71 (74)	31 (77)
Preop. percutaneous transhepatic catheter (%)	6 (40)	52 (54)	16 (40)
Short-term			
Patients with an overall complication	7 (46.7)	24 (25.0)	12 (30.0)
Patients with a surgery-related complication	5 (33.3)	15 (15.6)	9 (22.5)
Surgical complications			
Anastomotic leakage	2 (13.3)	3 (3.1)	1 (2.5)
Bleeding	0 (0)	0 (0)	1 (1)
Abscess/biloma	4 (26.7)*	9 (9.3)	1 (2.5)
Wound infection	0 (0)	6 (6.2)	3 (7.5)
Cholangitis	2 (13.3)	3 (3.1)	4 (10.0)
Nonsurgical complications			
Cardiopulmonary	1 (6.7)	3 (3.1)	1 (2.5)
Other miscellaneous	2 (13.3)	4 (4.1)	1 (2.5)
Reoperation initial stay	1 (6.7)	5 (5.2)	1 (2.5)
In-hospital mortality	0 (0)	0 (0)	0 (0)
Long-term			
Stricture formation	5 (33.3)†	5 (5.2)	5 (12.5)

*$P < 0.05$ (χ^2).
†$P < 0.01$ (χ^2).

Philip R. de Reuver, MD, Irene Grossmann, MD, Olivier R. Busch, MD, Huug Obertop, MD, Thomas M. van Gulik, MD, and Dirk J. Gouma, MD

Annals of Surgery • Volume 245, Number 5, May 2007

Primary versus delayed repair for bile duct injuries sustained during cholecystectomy: results of a survey of the Association Francaise de Chirurgie

Antonio Iannelli[1], Jacques Paineau[2], Antoine Hamy[3], Anne-Sophie Schneck[1], Caroline Schaaf[1] & Jean Gugenheim[1]

Table 1 Major series published in the literature over the study period

Authors	Year	No. of patients	BDI rate (%)
Scott *et al.*[8]	1992	12 397	0.80
Deziel *et al.*[9]	1993	77 604	0.59
Russel *et al.*[6]	1996	30 211	0.04–0.24
Richardson *et al.*[5]	1996	5913	0.4–0.8
Adamsen *et al.*[4]	1997	7654	0.74
Gigot *et al.*[10]	1997	9959	0.50
Tagarona *et al.*[7]	1998	1630	1.00
Vecchio *et al.*[11]	1998	114 005	0.50
Flum *et al.*[12]	2001	30 630	0.25
Krähenbühl *et al.*[13]	2001	12 111	0.30
Savassi-Rocha *et al.*[14]	2003	91 232	0.18
Flum *et al.*[26]	2003	1 570 361	0.50
Nuzzo *et al.*[15]	2005	56 591	0.42
Debru *et al.*[16]	2005	3145	0.16
Diamantis *et al.*[2]	2006	3637	0.52
Giger *et al.*[17]	2006	22 953	0.30
Waage *et al.*[18]	2006	152 776	0.40
Tantia *et al.*[1]	2007	13 305	0.39
Karvonen *et al.*[19]	2007	3736	0.86
Georgiades *et al.*[3]	2008	2184	0.69
Yaghoubian *et al.*[20]	2008	2470	0.80
Ou *et al.*[21]	2009	10 000	0.16
Machi *et al.*[22]	2009	1381	0.20

BDI, bile duct injury.

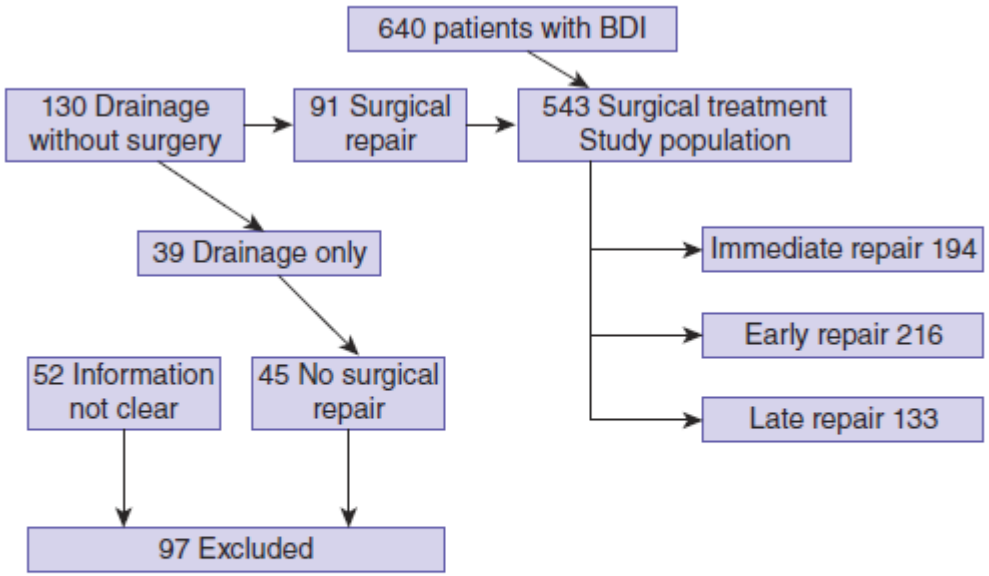


Figure 1 Flow chart of the 640 patients included in the French Surgical Association nation survey on bile duct injury (BDI). BDI; immediate repair: at the time of cholecystectomy; early repair: within 45 days of cholecystectomy; late repair: beyond 45 days of cholecystectomy

20 year retrospective study
Iannelli et al HPB (Oxford). 2012 Dec 27

Table 2 Patients characteristics and type of intervention

	Immediate repair No. of patients 194	Early repair No. of patients 216	Late repair No. of patients 133	*P*
Age	54 (18–89)	54 (17–92)	54 (20–85)	NS
Gender	M 79 F 115	M 82 F 134	M 51 F 82	NS
BMI (kg/m^2)	26.4 (15.8–44)	26.4 (16.4–63)	26.4 (15–44)	NS
RYHJJ	35 (18%)	91 (42.1%)	127 (95.5%)	<0.05
CD	2 (1%)	6 (2.8%)	2 (1.5%)	NS
DR	157 (81%)	119 (55.1%)	4 (3%)	<0.05

RYHJJ, Roux-en-Y Hepatico-jejunostomy; CD, choledoco-duodenostomy; DR, direct repair; NS, not significant.

Table 3 Postoperative complications, postoperative mortality and repair failure in the 3 groups

	Immediate repair No. of patients 194 (%)	Early repair No. of patients 216 (%)	Late repair No. of patients 133 (%)	*P*
Postoperative complications				
RYHJJ	18/35 (51.4%)	16/91 (17.6%)	16/127 (12.6%)	<0.001
CD	0/2 (0%)	0/6 (0%)	0/2 (0%)	NA
DR	58/157 (36.9%)	46/119 (38.7%)	3/4 (75%)	NS
Postoperative mortality				
RYHJJ	1/35 (2.9%)	2/91 (2.2%)	1/127 (0.8%)	NS
CD	0/2 (0%)	0/6 (0%)	0/2 (0%)	NA
DR	5/157 (3.2%)	2/119 (1.7%)	0/4 (0%)	NS

RYHJJ, Roux-en-Y Hepatico-jejunostomy; CD, choledoco-duodenostomy; DR, direct repair; NS, not significant; NA, not applicable.

Iannelli et al HPB (Oxford). 2012 Dec 27

Table 4 Surgical repair failure rates according to the timing of repair

Immediate repair 194 patients			Early repair 216 patients			Late repair 133 patients			P
Primary repair procedure No. of patients	Repair failure rate No. of patients (%)	Type of repair	Primary repair procedure No. of patients	Repair failure rate No. of patients (%)	Type of repair	Primary repair procedure (no. of patients)	Repair failure rate No. of patients (%)	Type of repair	
RYHJJ 35	23/35 (62.9%)	Surgery 22/23 (95.7%) Stent 1 (4.3%)	RYHJJ 91	42/91 (46.2%)	Surgery 36/42 (85.7%) Stent 6/42 (14.3%)	RYHJJ 127	9/127 (7.1%)	Surgery 8/9 (88.9%) Stent 1/9(11.1%)	<0.001
CD 2	0/2	Surgery Stent	CD 6	0/6	Surgery Stent	CD 2	1/2 (50%)	Surgery 1/1 (100%) Stent	NS
DR 157	101/157 (64.3%	Surgery 88/101 (87.1%) Stent 13/101 (12.9%)	DR 119	51/119 (42.9%)	Surgery 44/51 (86.3%) Stent 7/51 (13.7%)	DR 4	0/4	Surgery Stent	<0.001
Total 194	124/194 (63.9%		Total 216	93/216 (43.1%)		Total 133	10/133 (7.5%)		<0.001

RYHJJ, Roux-en-Y Hepatico-jejunostomy; CD, choledoco-duodenostomy; DR, direct repair; Stent: Interventional endoscopy or radiology for bile duct stent (considered as a repair failure).

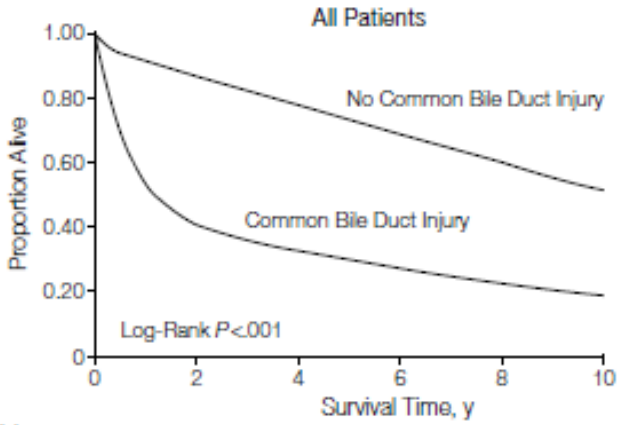
Overall failure rate for immediate repair 64% vs 43% for early repair vs 7,5% for late repair

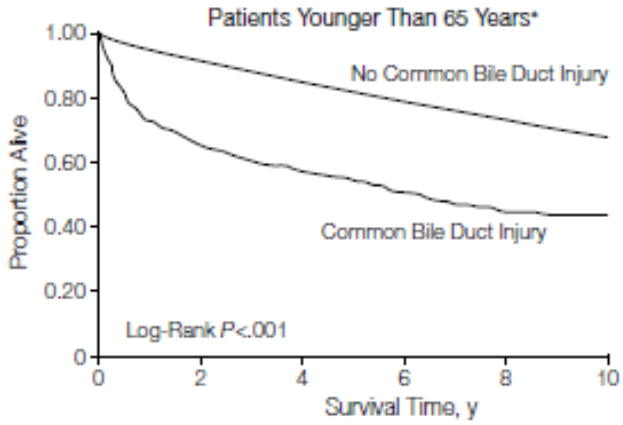
Iannelli et al HPB (Oxford). 2012 Dec 27

Who should do the repair?

- Stewart et al *Arch Surg 1995;130:1123-1128*
  Successful outcome
  - 94% at referral centre
  - 17% if done by initial surgeon
  - 0% if repair repeated by initial surgeon
- Flum et al *J AMA. 2003;290:2168-2173*
  - 1570361 cholecystectomies, 1992-1999, 7911 (0.5%) BDI
  - 75% of injuries repaired by same surgeon
  - 11% higher risk of death for repair by same surgeon
- Carrol et al *Surg Endoscopy 1998;4:310-314*
  Successful outcome
  - 79% for referred cases
  - 27% for primary surgeon

Figure. Proportion Surviving After Common Bile Duct Injury





No. at Risk												
Common Bile Duct Injury												
No	1 458 821	1 265 487	937 488	579 466	278 804	53 543	178 381	161 935	119 007	71 853	33 592	6422
Yes	7719	2942	2056	1288	633	143	576	375	265	154	70	14

Proportion of patients surviving after cholecystectomy with or without common bile duct injury.
*The mean age of those younger than 65 years was 54.8 years.

Flum et al J AMA. 2003;290:2168-2173

Table 3 Success of initial biliary reconstruction by surgeon and timing of repair

Timing of repair	Biliary surgeon				Primary surgeon			
	n	Success initial repair	Cumulative success with dilatation	Bivariate *P*-value	*n*	Success initial repair	Cumulative success with dilatation	Bivariate *P*-value
Operative repair	–	–	–	0.854	60	10%	12%	0.103
1 week	31	90%	100%		35	20%	29%	
2 weeks	30	93%	93%		30	17%	27%	
3–6 weeks	33	91%	91%		29	14%	28%	
>6 weeks	43	88%	95%		9	0%	22%	
Total	137	91%	95%		163	13%	21%	

Lygia Stewart & Lawrence W. Way

HPB 2009, 11, 516–522

Selected Series Reporting Outcome after Repair of Benign Biliary Strictures

Reference	*N*	Mechanism of Injury	Previous Repair Attempt	Morbidity/Mortality	Successful Outcome	Mean Follow-up
Chapman et al, 1995	122	OC (all)	80 (66%)	NR/1.8% †	76%	86 mo
McDonald et al, 1995	45	OC 26 LC 16 Other 3	11 (24%)	36%/0	95% ‡	55 mo
Stewart & Way, 1995	45	LC (all)	27 (60%)	4%/0	94%	NR
Tocchi et al, 1996	84	OC 60 CBDE 4 Trauma 4 Other 16	4 (5%)	21%/2.2%	83% §	108 mo
Lillemoe, 1997	59	LC (all)	15 (25%)	NR/0	92% §	33 mo
Frilling et al, 2004	40	LC (all)	10 (25%)	NR/5%	82.5%	16 mo (median)
Schmidt et al, 2005	54	LC and OC	22 (41%)	NR/1.9% ¶	92.6%	61.9 mo (median)

Table 3 Post-operative data stratified in the two time periods

	Group I 1990–2004		Group II 2005–2008		*P* (0.001)
	No. ($n = 172$)	%	No. ($n = 140$)	%	
Post-operative complications					
Cholangitis	53	31	19	13	0.001
Cholangitis/year (2 year follow-up) %	11		6		0.310
Stenosis	23	13	7	5	0.010
Abscesses	12	7	8	6	0.479
Fistula	9	5	4	3	0.396
Biloma	14	8	18	13	0.192
Reintervention after index operation	16	9	9	6	0.400
Redo hepaticojejunostomy	6		4		
Portoenterostomy	2		0		
Abscess drainage	2		1		
Liver resection	4		0		
Hernioplasty	2		2		
Bleeding	1		2		
Intestinal occlusion	1		0		
Median (range) first repair-reintervention in months	24 (0.1–174)		0.3 (0.1–11)		
Other treatments					
Percutaneous drainage	8	5	8	6	0.797
ERCP (stents)	0	0	3	2	0.893
Transplant	1	1	0	0	1.000
Follow-up (months)					
Median (range)	52 (12–224)		25 (6–70)		
Lost to follow-up	24	14	8	6	0.020

ERCP, endoscopic retrograde cholangio-pancreatography.

Mercado et al. Transition from a low- to a high-volume centre for bile duct repair: changes in technique and improved outcome HPB 2011, 13, 767–773

TABLE 5. Short- and Long-term Results of Reconstructions After BDI According to Referral Pattern

	Referral	
	Primary (n = 63) (%)	**Secondary (n = 87) (%)**
Characteristics		
Age (yr) [mean (SD)]	50 (14.6)	49 (14.9)
Gender, women (%)	37 (58)	63 (72)
ASA classification, ASA 1%–2%	56 (89)	75 (86)
Level of injury, Bismuth I–III (%)	50 (79)	60 (69)
Preop. percutaneous transhepatic catheter (%)	31 (49)	42 (48)
Short-term		
Patients with an overall complication	12 (19.0)	30 (34.4)*
Patients with a surgery-related complication	5 (7.9)	23 (26.4)†
Surgical complications		
Anastomotic leakage	2 (3.1)	4 (4.6)
Bleeding	0 (0)	1 (1.1)
Abscess/biloma	2 (3.1)	11 (12.6)*
Wound infection	1 (1.5)	8 (9.2)
Cholangitis	0 (0)	8 (9.2)*
Nonsurgical complications		
Cardiopulmonary	2 (3.1)	3 (3.4)
Other miscellaneous	2 (3.1)	5 (5.7)
Reoperation initial stay	0 (0)	7 (8.0)*
In-hospital mortality	0 (0)	0 (0)
Long-term		
Stricture formation	2 (3.1)	12 (13.8)*

*$P < 0.05$ (χ^2).
†$P < 0.01$ (χ^2).

Annals of Surgery • Volume 245, Number 5, May 2007

Timing of referral impacts surgical outcomes in patients undergoing repair of bile duct injuries

Craig P. Fischer, Bridget N. Fahy, Tom A. Aloia, Barbara L. Bass, A. Osama Gaber & R. Mark Ghobrial

Department of Surgery, Weill Cornell Medical College, The Methodist Hospital Department of Surgery, Houston, TX, USA

HPB 2009, 11, 32–37

Table 4 Univariate and multivariate analysis of major complications

Variable	Major complications [No. (%)]	Univariate analysis odds ratio (95%CI)	*P*	Multivariate analysis odds ratio (95%CI)	*P*
Age >45	12 (27)	1.37 (0.11–0.45)	0.034	0.38 (0.14–0.44)	0.06
Age <45	33 (75)	–		–	
BDI type D					
Yes	32 (71)	2.54 (1.44–4.54)	0.004	2.57 (1.46–4.58)	0.004
No	4 (9)	–		–	
BDI level IV–V					
Yes	11 (24)	1.32 (0.12–0.79)	0.03	0.34 (0.013–0.81)	0.04
No	1 (2)	–		–	
Delayed referral					
Yes	28 (62)	1.63 (1.35–1.86)	0.02	1.68 (1.39–2.12)	0.07
No	2 (4)	–		–	
Any pre-referral intervention					
Yes	35 (78)	1.20 (0.98–1.74)	0.04	1.25 (1.10–1.83)	0.06
No	3 (7)	–		–	

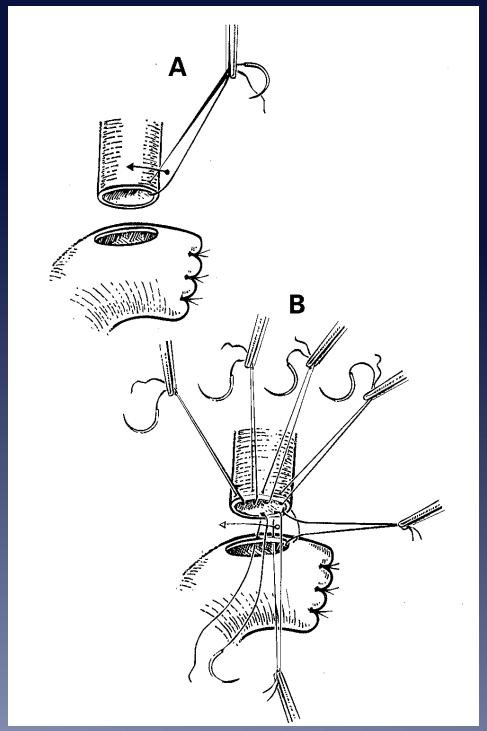
BDI, bile duct injury.

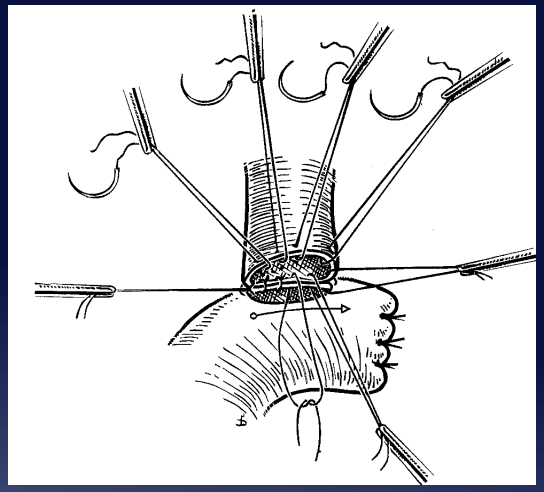
What type of repair?

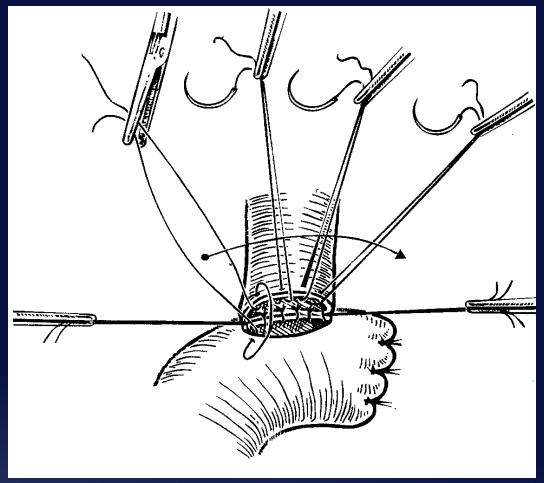
- End-to-end anastomosis
  - Late failure in up to 60%
  - Very seldom indicated or used
- Roux-Y hepaticojejunostomy
  - Used by virtually all specialized centres
  - Consistently good results

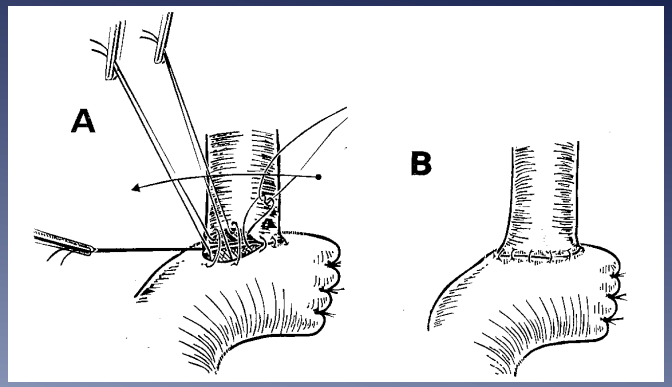
Anastomotic technique

Type 1 and 2 strictures



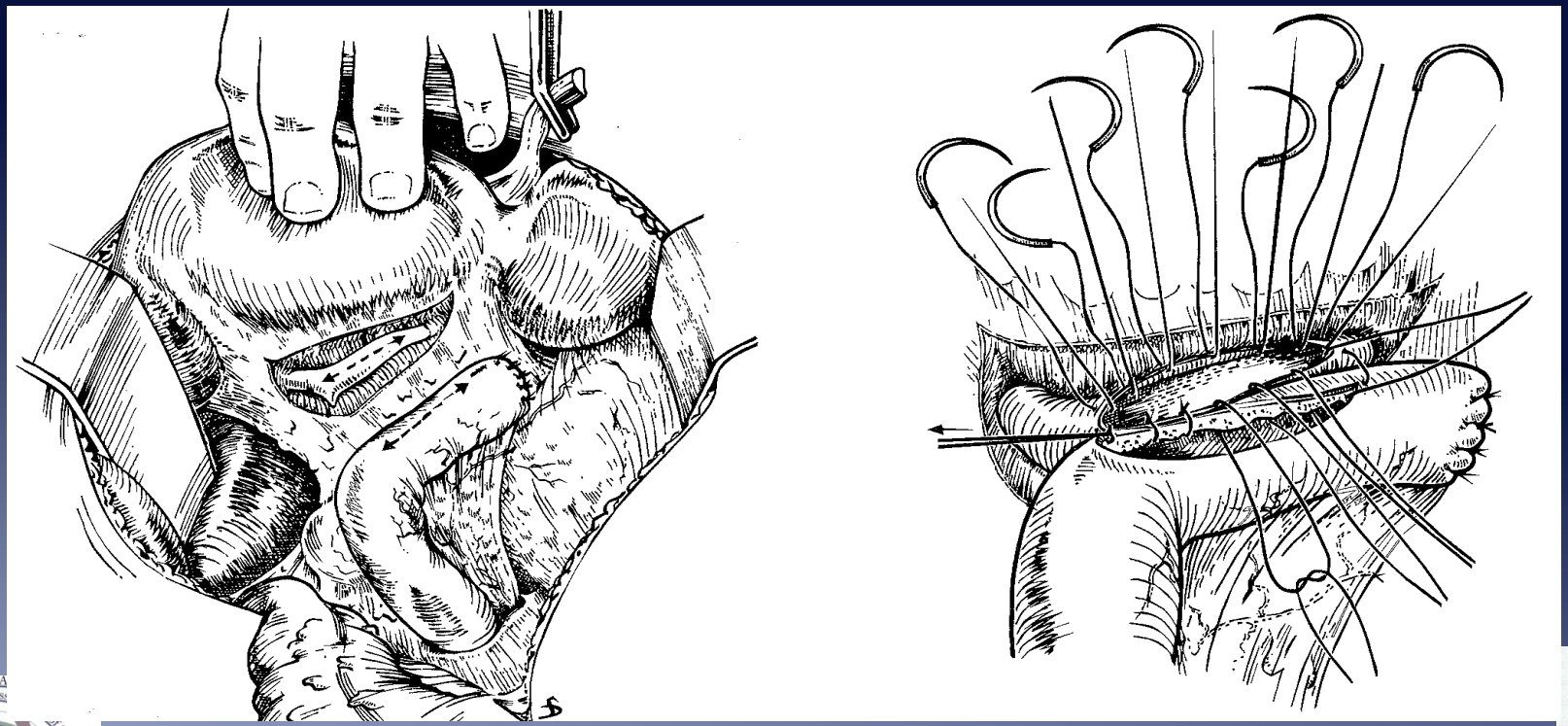


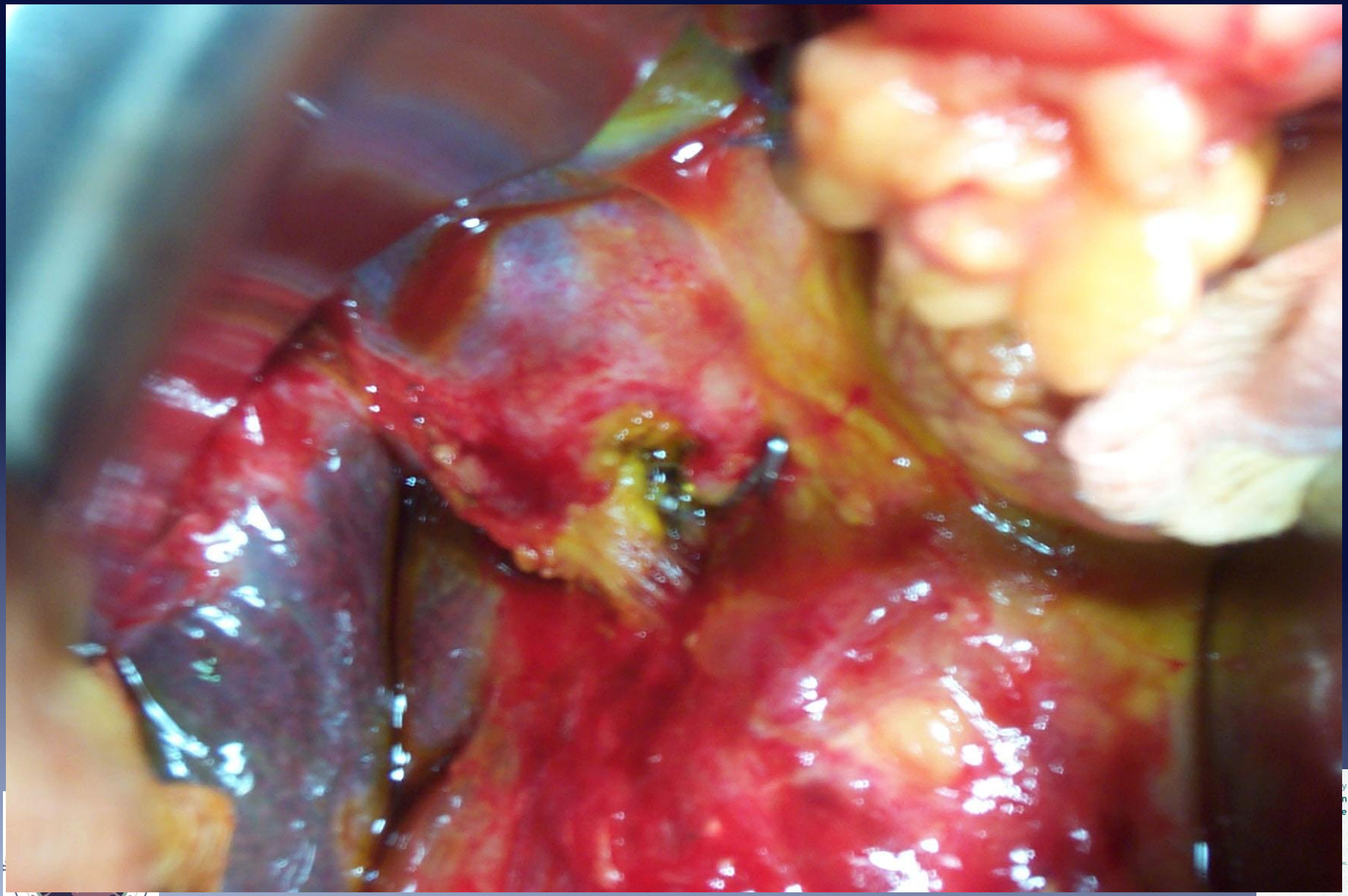


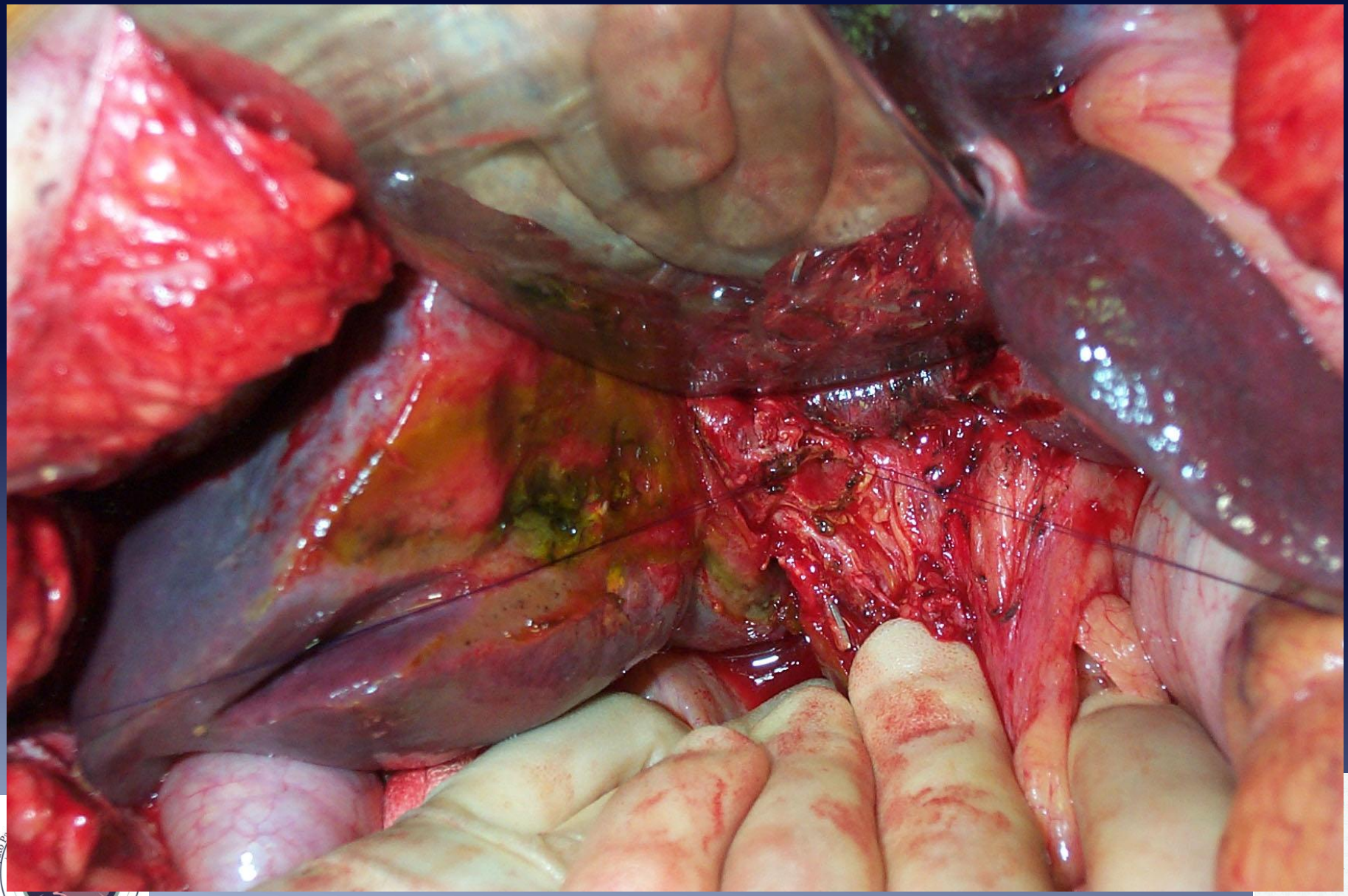


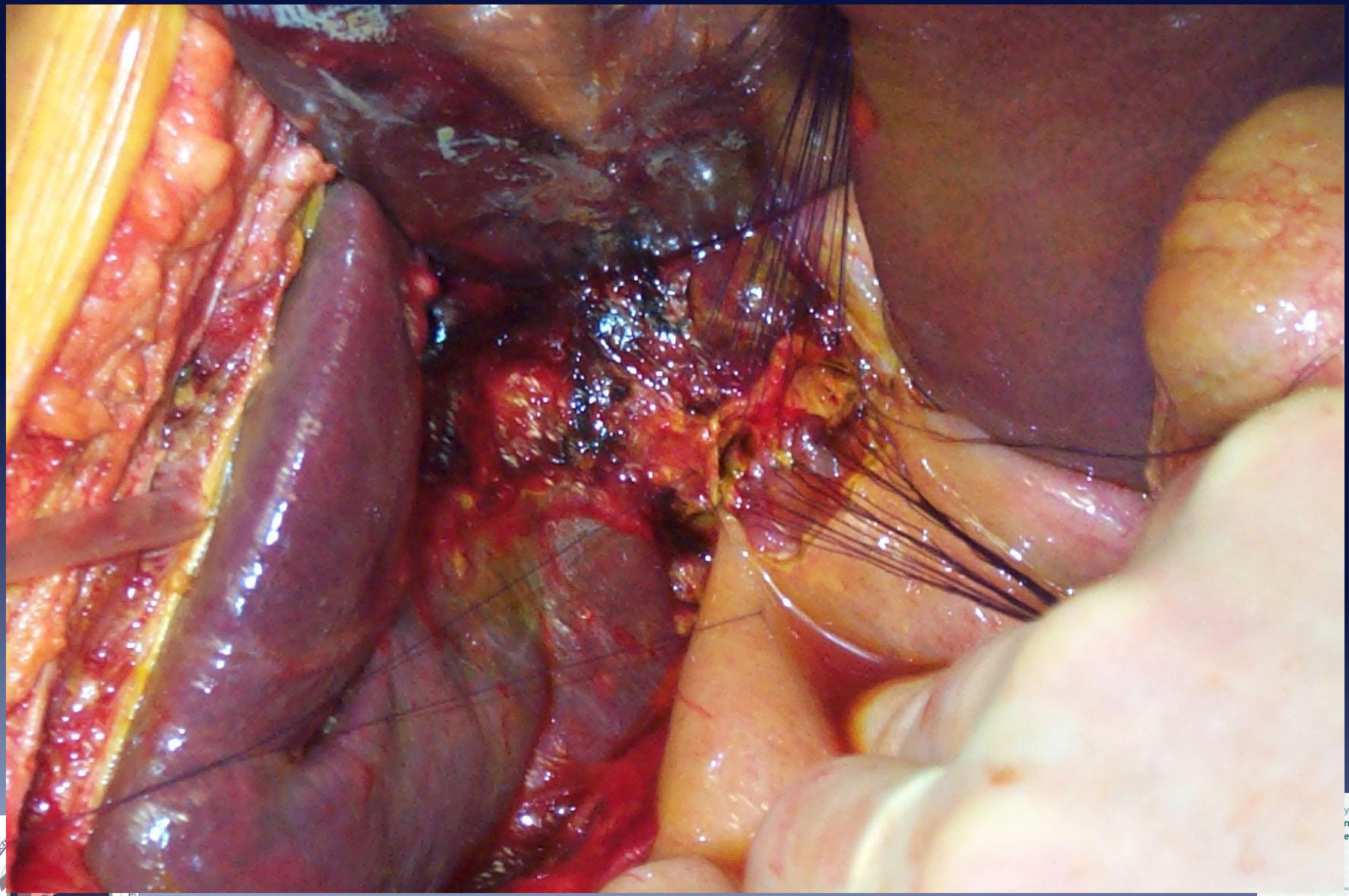
Anastomotic technique

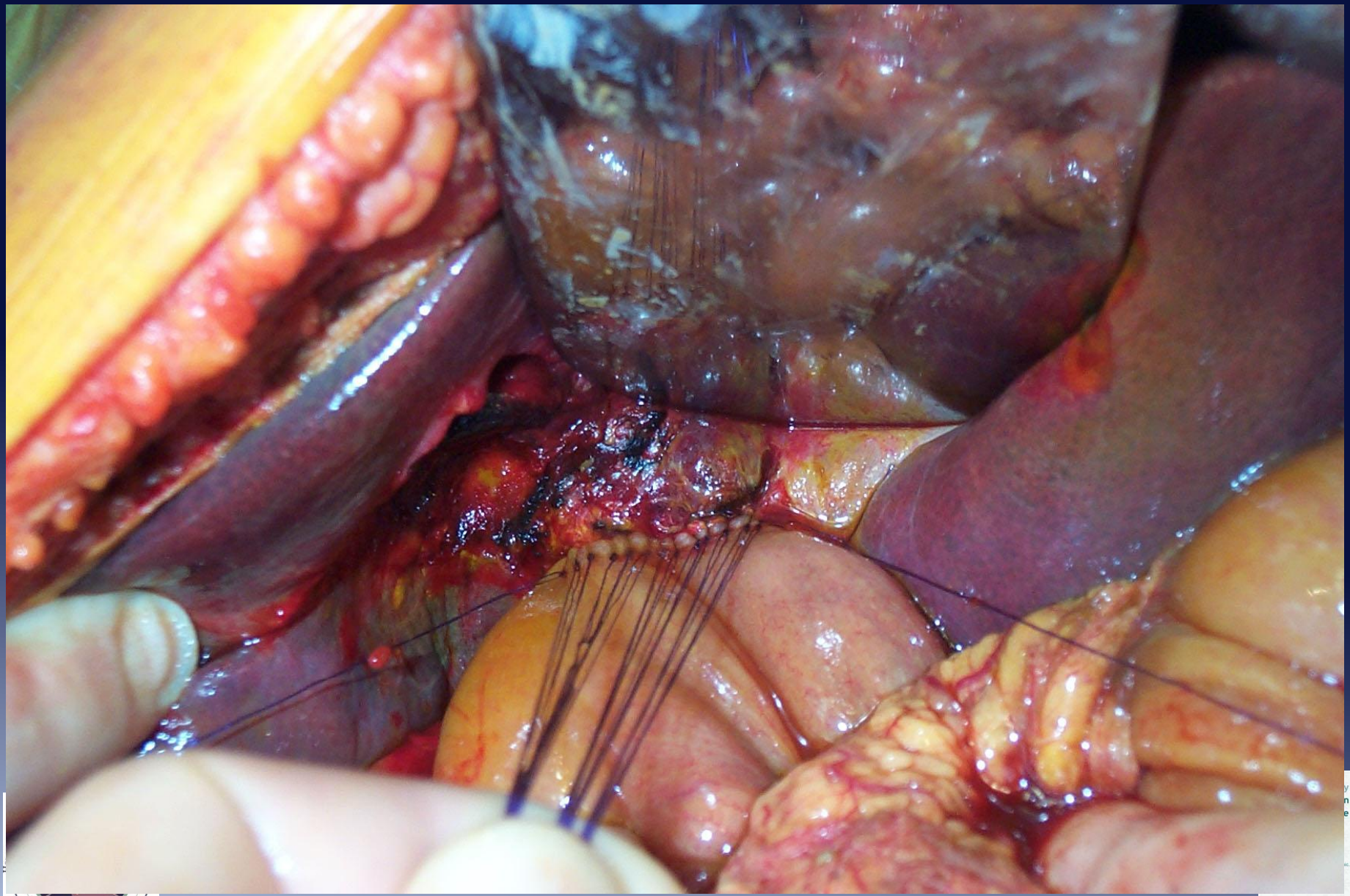
Type 3 and 4 strictures

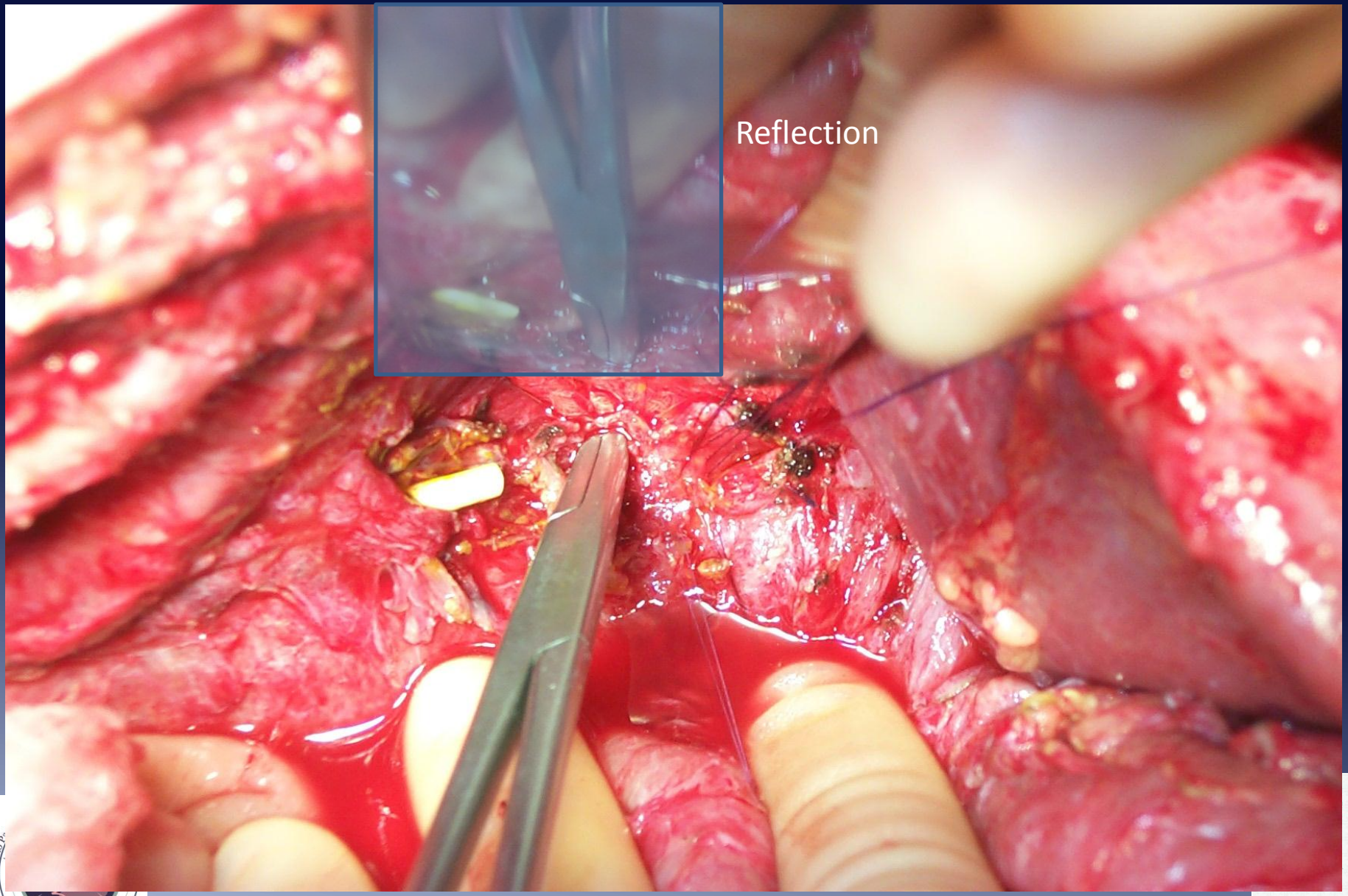


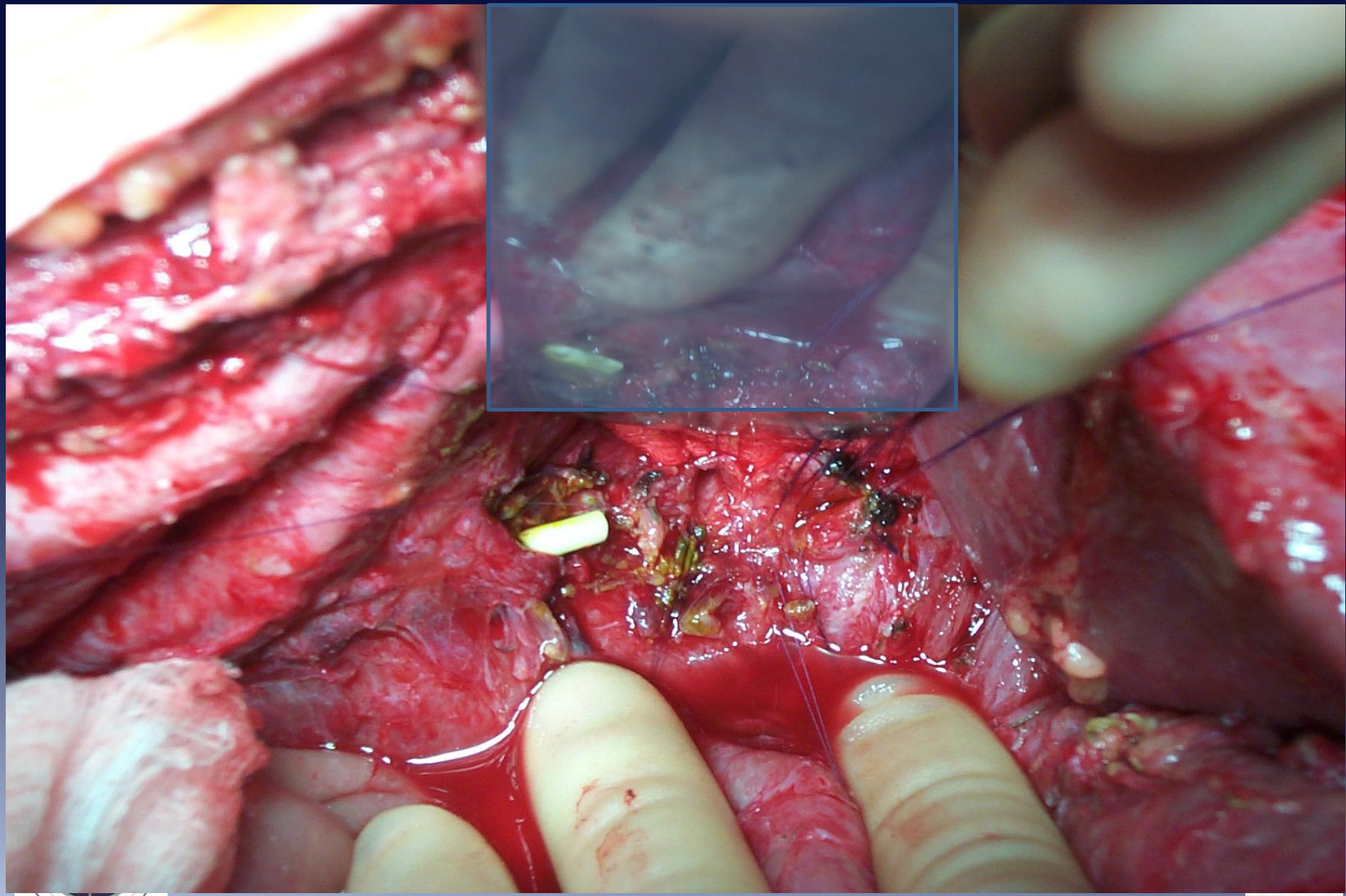









Reflection

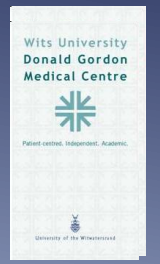


Complex repairs

- Reconstruction of the confluence
- Separate anastomoses to left and right hepatic ducts
- Segment 3 bypass (Soupault)
- Hepatic resection
  - To better expose confluence
  - Resection of atrophied lobe for chronic cholangitis

What outcome can be expected?

- Morbidity 10-40%
  - Bile leaks
  - Abscess
  - Cholangitis
  - Haemorrhage
  - Later stricture
- Mortality 0-5%
- Overall success 80-100%
  - May require repeat surgery or PTC intervention



Classification of late outcome

Suggested Criteria for Assessing the Late Results of Biliary Stricture Management

Classification	Symptoms	Biochemistry *	Radiology †
Excellent	None	Normal	Normal
Good	None	± Elevated	± Abnormal
Fair	Improved	Elevated	Abnormal
Poor	Persistent/Worse	Elevated	Abnormal

Table 1 Long-term results in patients with postcholecystectomy benign bile duct strictures

References	N	Type III–V (%)	Overall failure (%)	Median follow-up (years)
Bottger and Junginger [70]	173	34	11	9.4
Chapman et al. [33]	130	61	21	7.2
Lillemoe et al. [32]	156	55	9.2	4.9
Sikora et al. [36]	300	51	5	7.5
deReuver et al. [21]	151	27	10	4.5
Winslow et al. [26]	113	44	4.4	4.9
Moossa [71]	81	24.6	27	2
McDonald et al. [67]	45	31	40	4.6
Raute et al. [66]	48	43.7	18	7.4

HPBASA

Indian J Surg (January–February 2012) 74(1):22–28

Causes of failed repair, M&M

- proximal stricture (Bismuth type 3 and 4)
- multiple prior attempts at repair
- portal hypertension
- hepatic parenchymal disease (cirrhosis or fibrosis)
- end to end anastomosis
- surgeon inexperience
- intra-hepatic or multiple strictures
- concurrent cholangitis or liver abscess
- intrahepatic stones
- internal or external biliary fistula
- intra-abdominal abscess or bile collection
- hepatic lobar atrophy
- advanced age or poor general health

QOL and consequences after bile-duct injury

- Melton et al *Annals of Surgery 2002;235(6):888-895*
  - QOL in 89 repaired pts vs 100 matched LC pts
  - Physical, psychological and social QOL
  - Results similar except in those pts pursuing lawsuits
- Flum et al *JAMA. 2003;290:2168-2173*
  - Medicare database
  - 7911/1570361 (0.5%) had BDI after LC
  - In 9.2yr follow-up 33% of pts had died
  - 55% without injury alive vs 19.5% of those who had BDI
  - Hazard ratio for death 2.79 if pts had BDI

Summary

- Most bile duct injuries are fortunately minor and do not require surgery
- Type of injury and anatomy thereof must be fully determined
- Repair should be done at a referral centre and not by primary surgeon
- Repair should usually be delayed until conditions are optimal
- Surgical repair will require hepatico-jejunostomy in majority of cases
- Long-term outcome is successful in most cases *if the correct repair is done in the right unit* – important as we are dealing with benign disease
- QOL after successful repair is very good

Recommendations for the primary surgeon w.r.t suspected BDI

- If unclear anatomy at time of Lap Chole
  - Convert to open cholecystectomy
  - Partial cholecystectomy and drain
  - Refer if bile leak or other complications
- If BDI suspected at time of Lap Chole
  - Do not clip, suture or burn any further structures!
  - Place adequate sized drain in GB fossa
  - Refer
- If BDI suspected after Lap Chole
  - Percutaneous drain if biloma present
  - Refer

Comment

Truly multidisciplinary disease

- Gastro-enterology
- Surgery
- Radiology
- Anaesthesiology
- Intensive care
- Pathology
- Transplantation