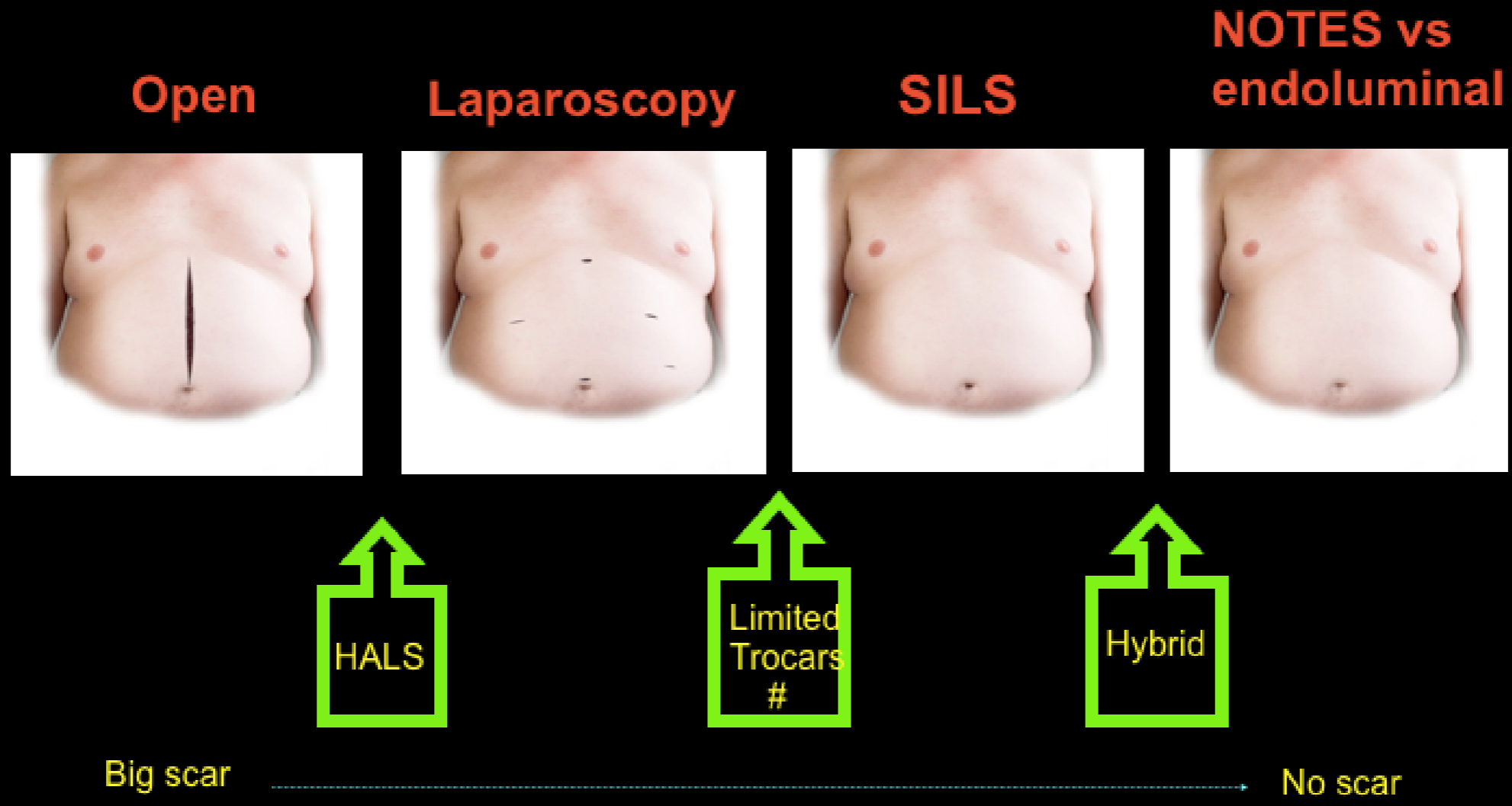


Laparoscopic vs SILS cholecystectomy Intraoperative Cholangiogram: Routine vs Selective

Alan A Saber, MD, FACS
Professor of Clinical Surgery
Cornell Medical College
Director of Bariatric & Metabolic
Surgery
Chief Minimally Invasive Surgery
The Brooklyn Hospital Center

Natural Progression of Abdominal Surgery

Incision ~ pain, convalescence, cosmesis



Field of SILS Surgery is Dynamic

WHY SILS ?

limiting the incision to the umbilicus

no visible scars

- Cosmetic
- Privacy
- Self-esteem
- Body image

Patient satisfaction

Single small incision

Less abdominal wall *trauma*

Avoids muscle penetration

Thin area of abdominal wall

- less pain ?
- Less analgesic ?
- Shorter hospital stay ?
- Quicker recovery ?

WHY SILS ?

- Avoiding lateral ports eliminates epigastric vessel injury
- Umbilicus is the thinnest part of abdominal wall; less torque effect of instruments/trocars
- Easy conversion to multiport laparoscopy (unlike lap.....open)
- A bridge to NOTES

Patient selection

Cosmesis/ Privacy/ Body image/ Self steam



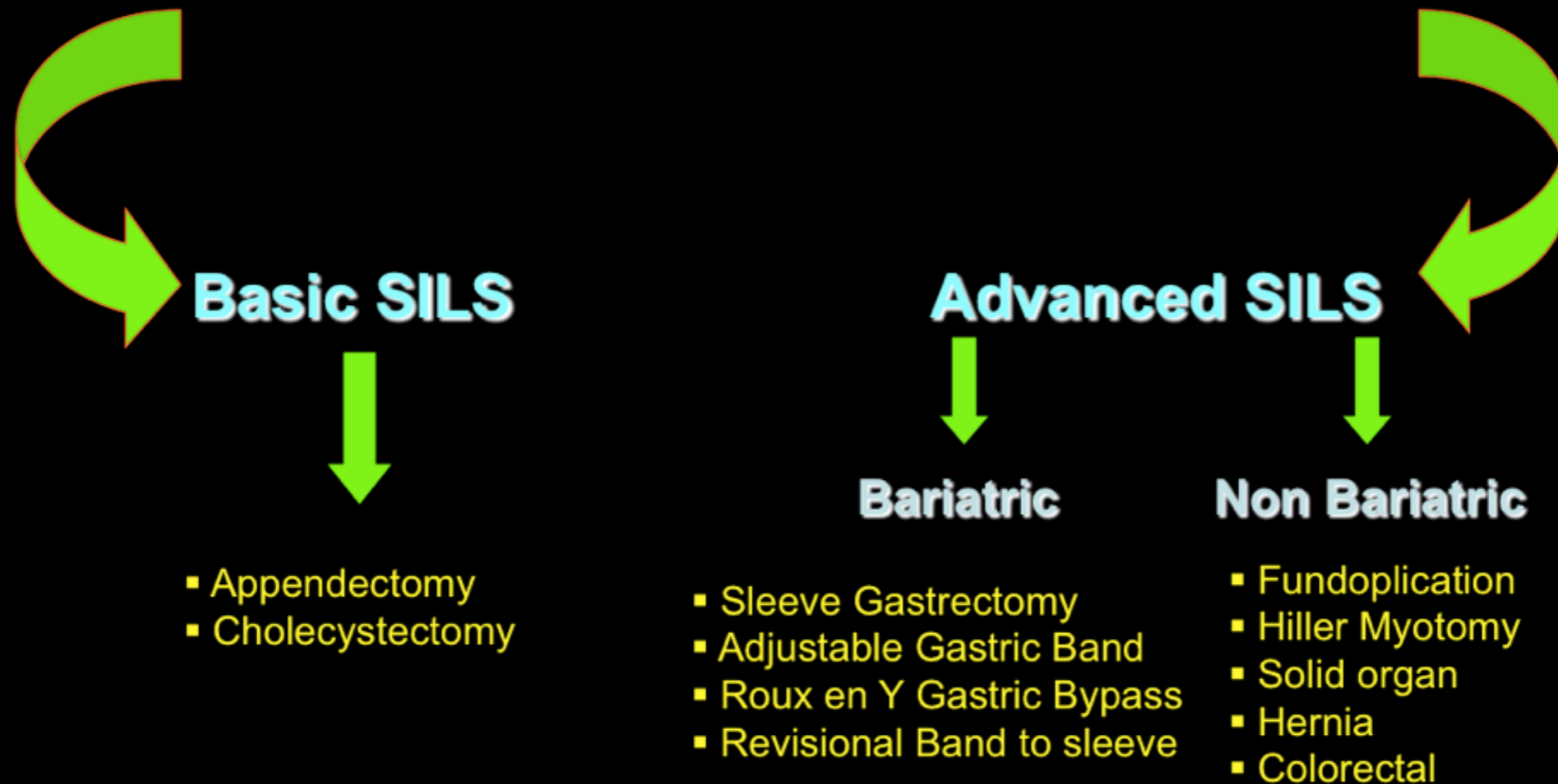
Before
e



After

SILS cholecystectomy

Single Incision Laparoscopic Surgery



Personal experience since March 2007 > 500 SILS

How Did We Develop SILS

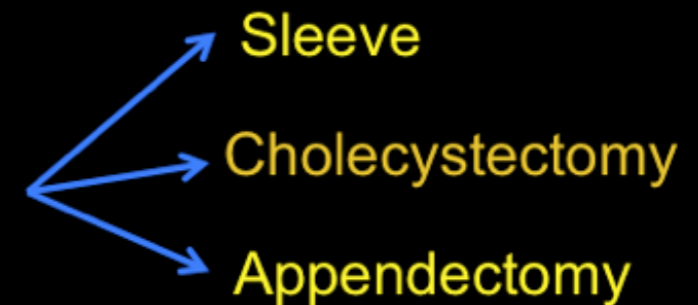
March of 2007

- Selective (Low risk)
- Rigid instruments

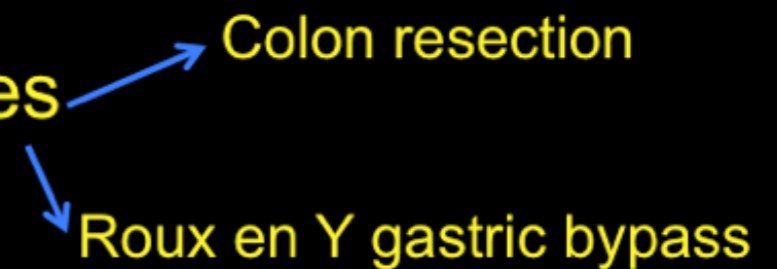


- Liberal (High risk)
- Flexible & Rigid

Resectional procedures
SILS band



Reconstructive procedures



Revisional surgery

Patient selection & Procedure selection

***Gradual
progression***



*32 yr
667 pounds
MBI 90
Metabolic syndrome
Lap chole
Medicare
for Robotic sleeve*


Technical challenges



General Challenges



- Conflict of instruments
- Lost triangulation



Bariatric-specific

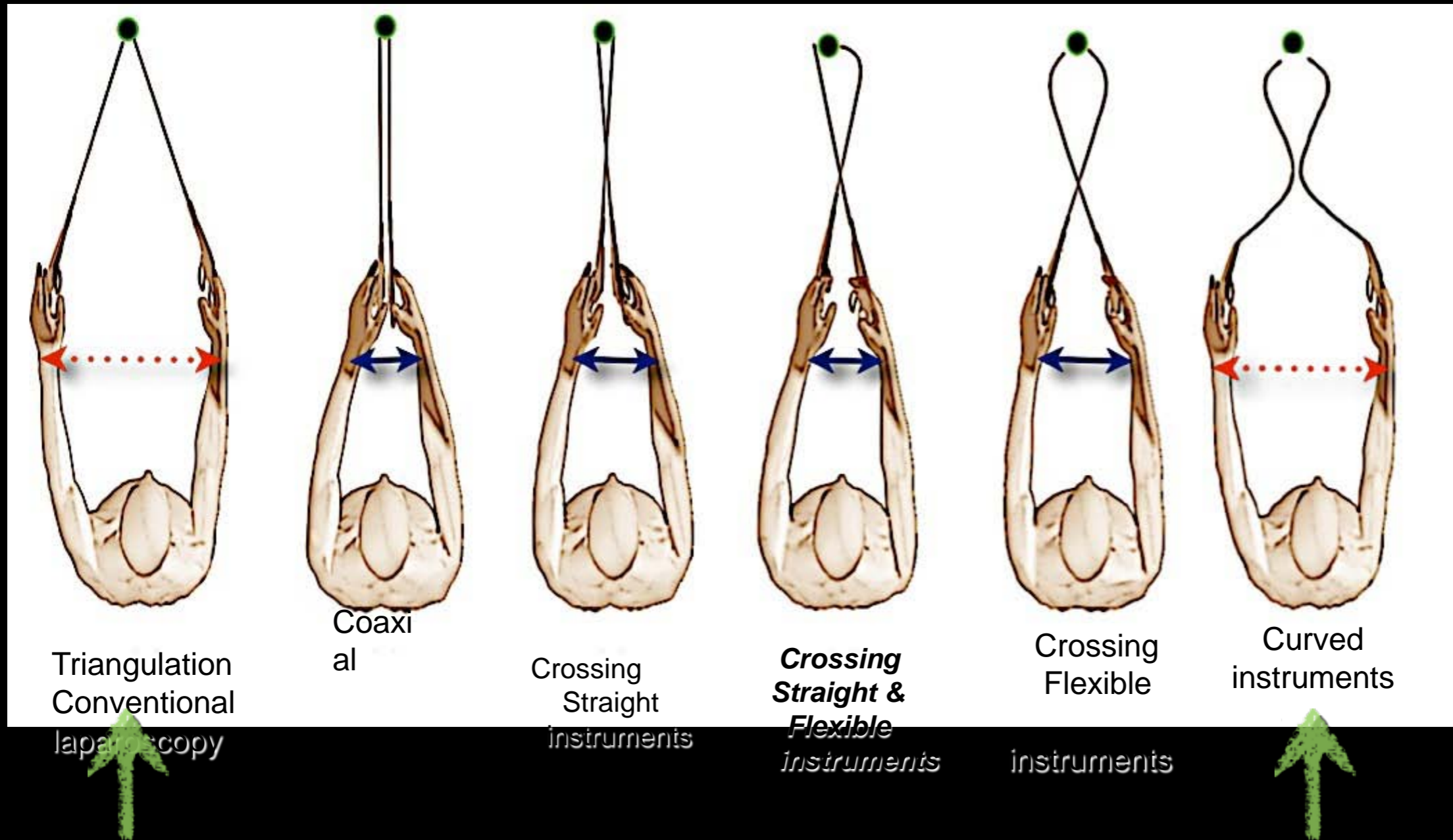


- Abdominal wall torque
- Umbilical recession

Instrument Manipulations

- Distance between your hands
 - * *Facial defect*
 - * *single big vs multiple small*
 - * *bigger better but watch for hernia*
 - * *Length of instruments (longer better)*
 - * *Straight vs flexible vs curved (flexible tip vs tip & handle)*
 - * *handling the handle*
- Crossing vs no crossing
- Think 3Ds not 2Ds
- Target

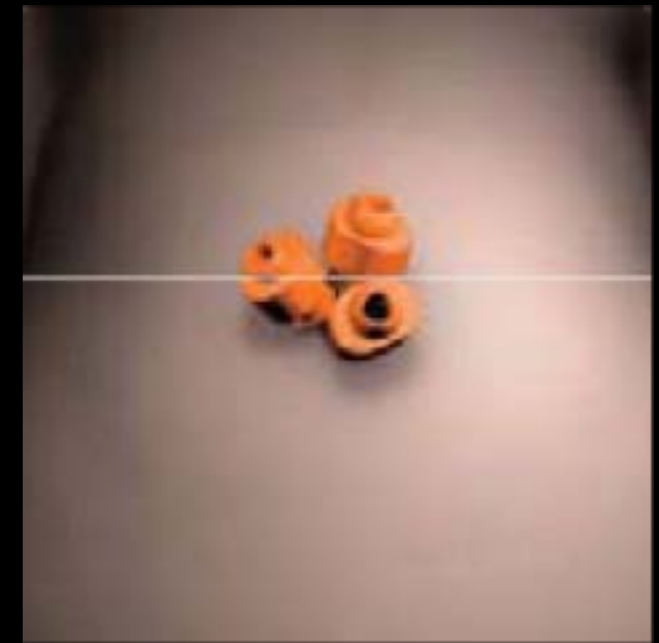
Patterns of Instrument Manipulations



Flexible- Curved Instrumentation



Multi-trocar approach *Head*



Single-Port

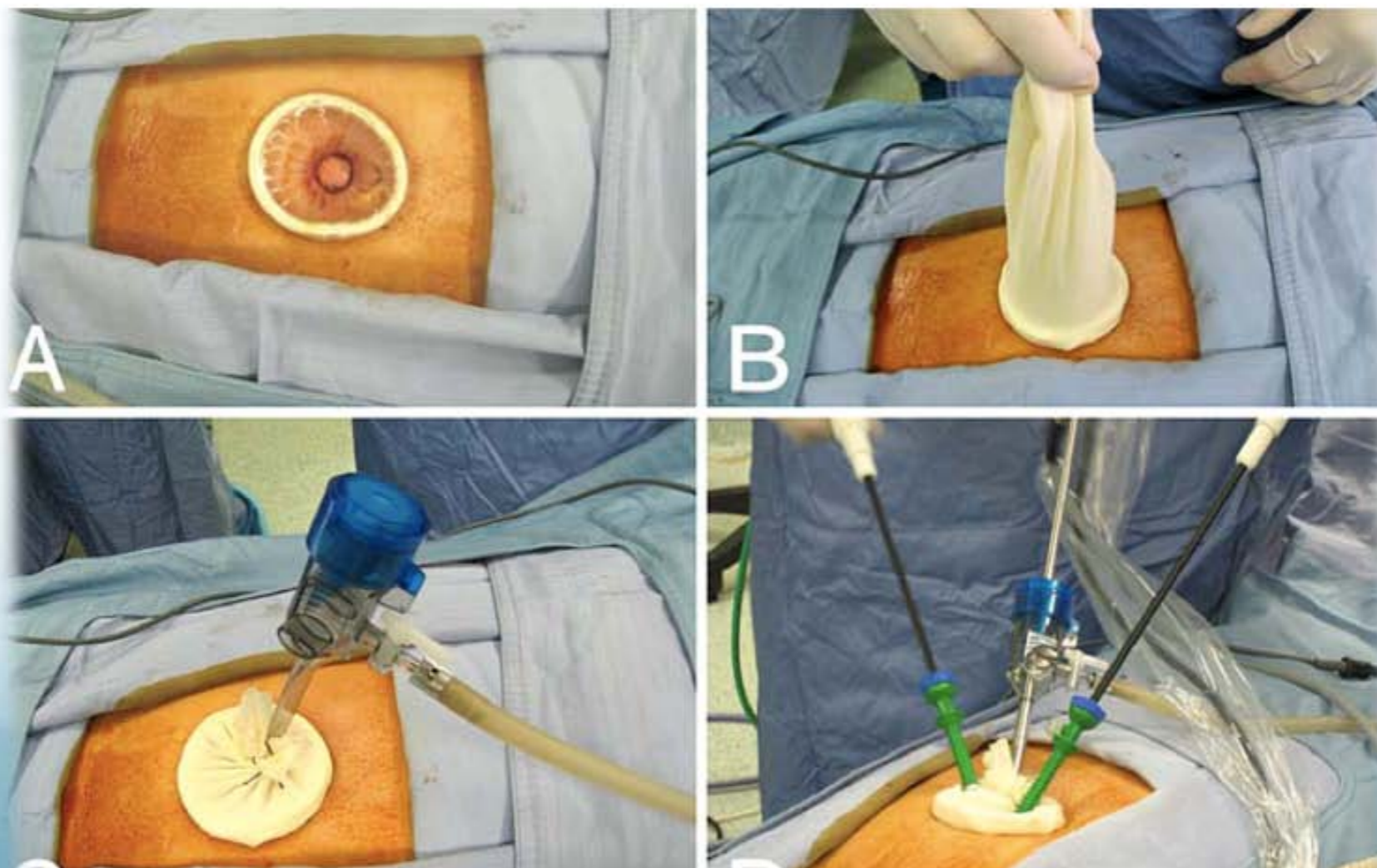


decrease
technical
challenges
? cost

TECHNIQUE

Homemade transumbilical port: an alternative access for laparoendoscopic single-site surgery (LESS)

Huai-Ching Tai · Chia-Da Lin · Chia-Chang Wu ·
Yao-Chou Tsai · Stephen Shei-Dei Yang



Scope S

L

connection



light
cord

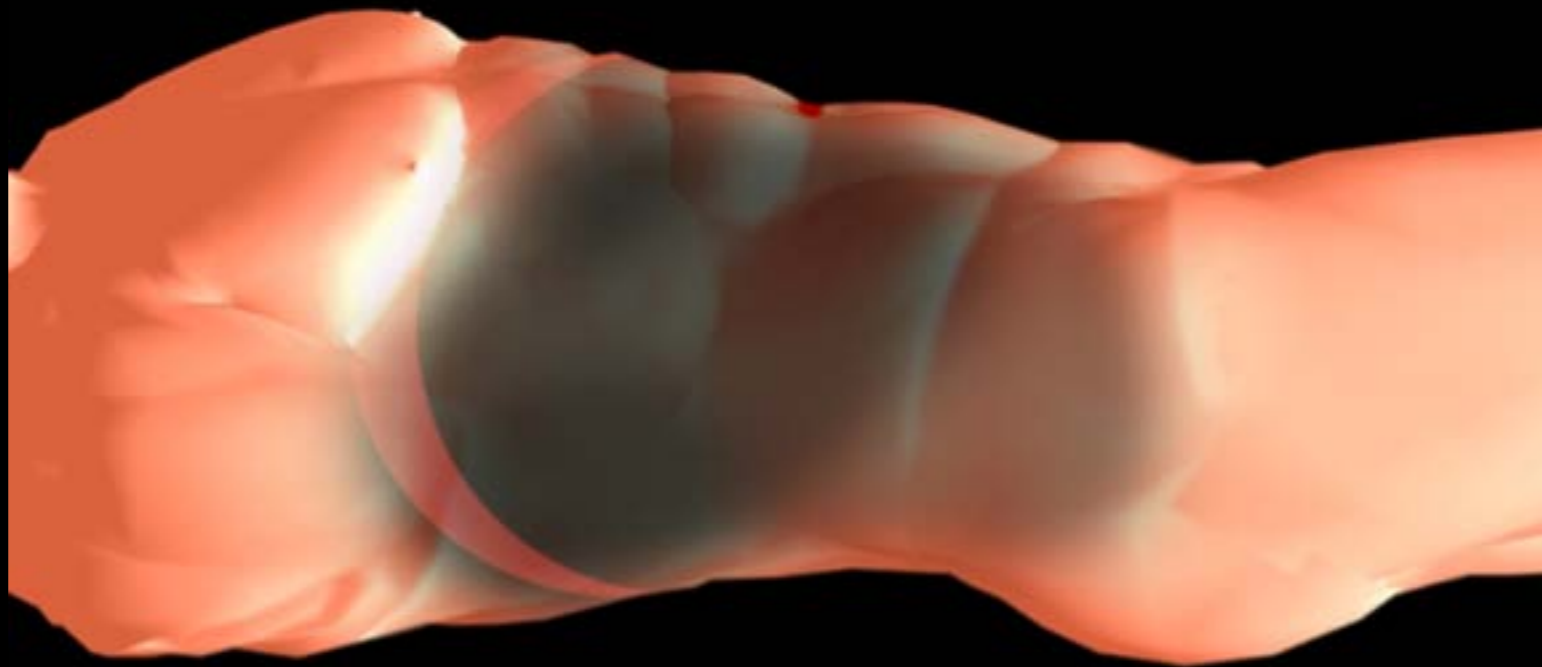
Ti
p



Umbilical Recession



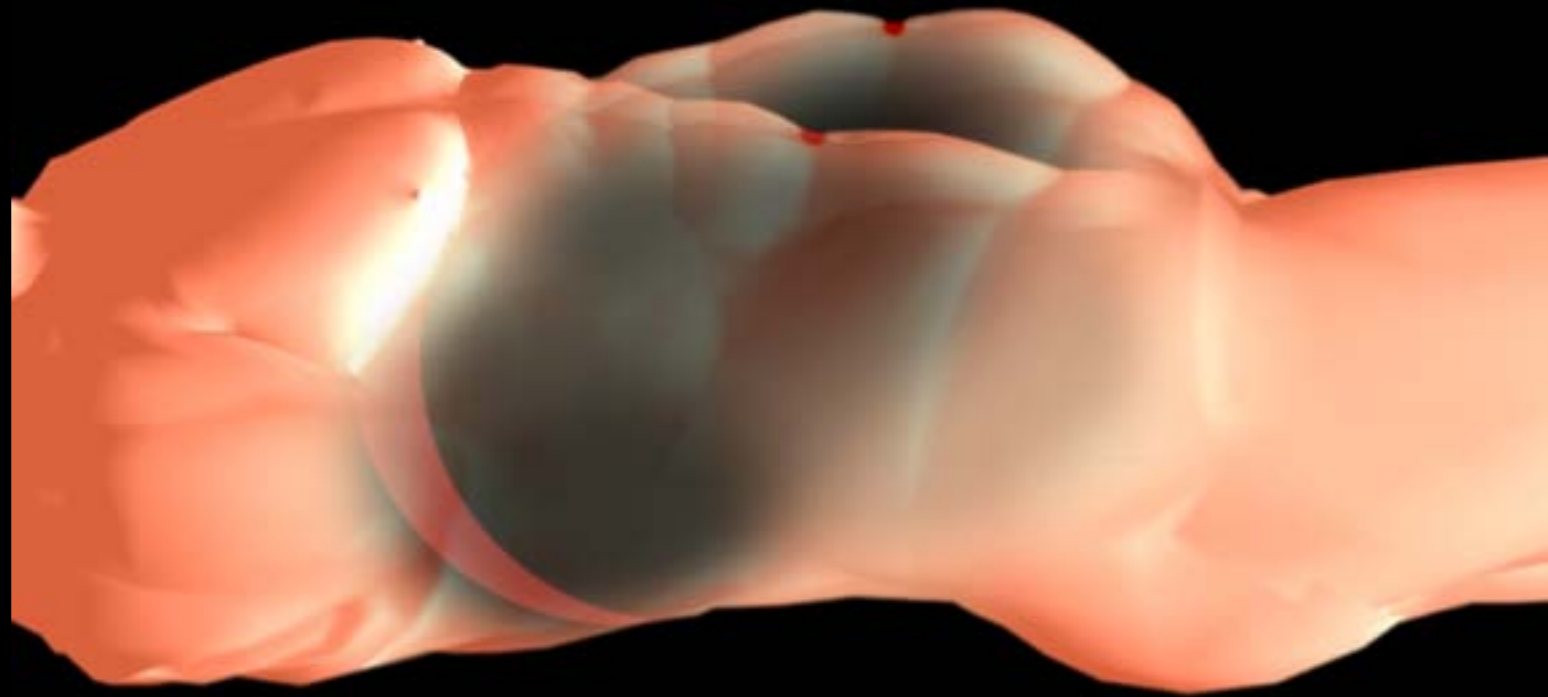
Umbilical Recession



Umbilical Recession



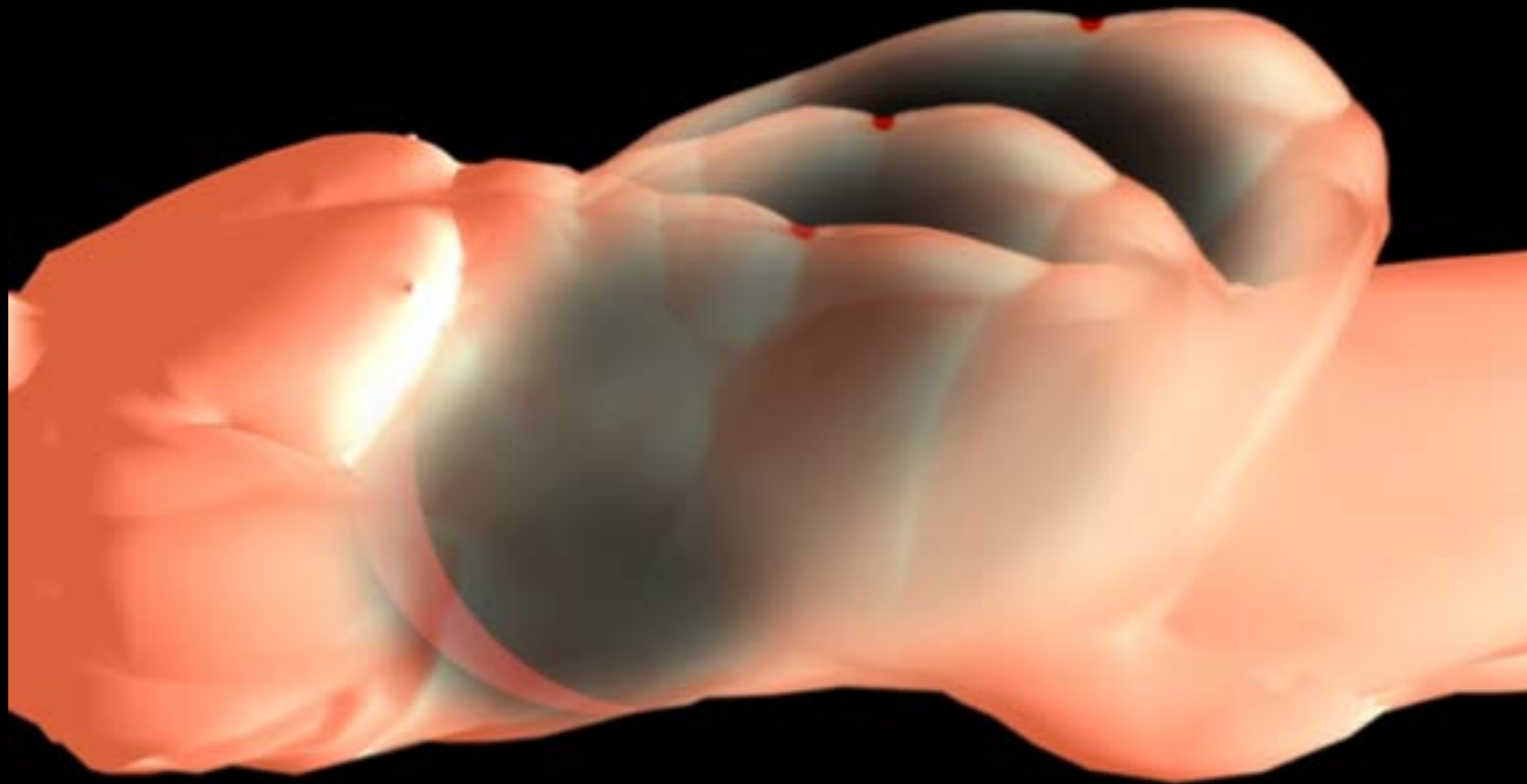
Umbilical Recession



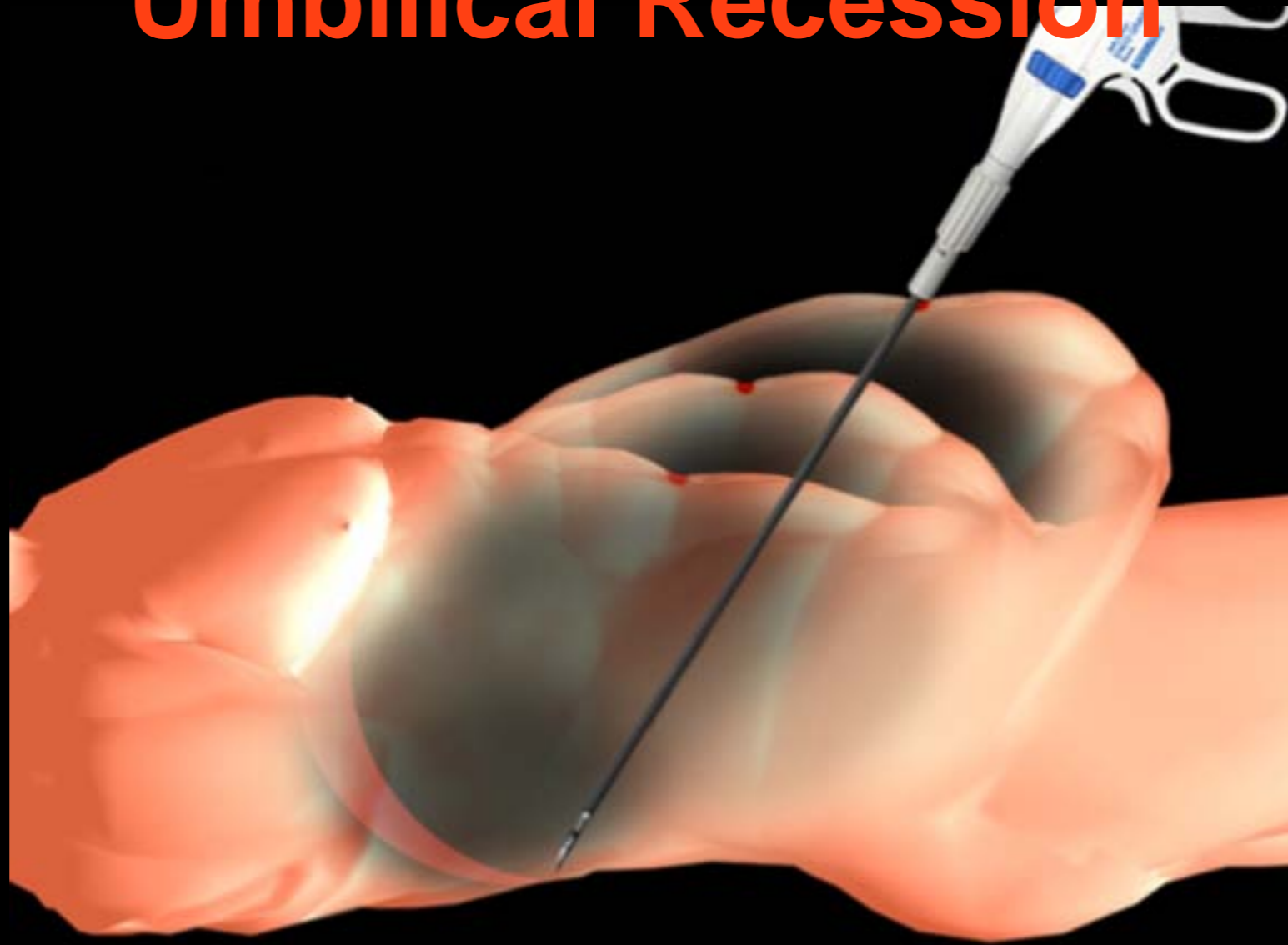
Umbilical Recession



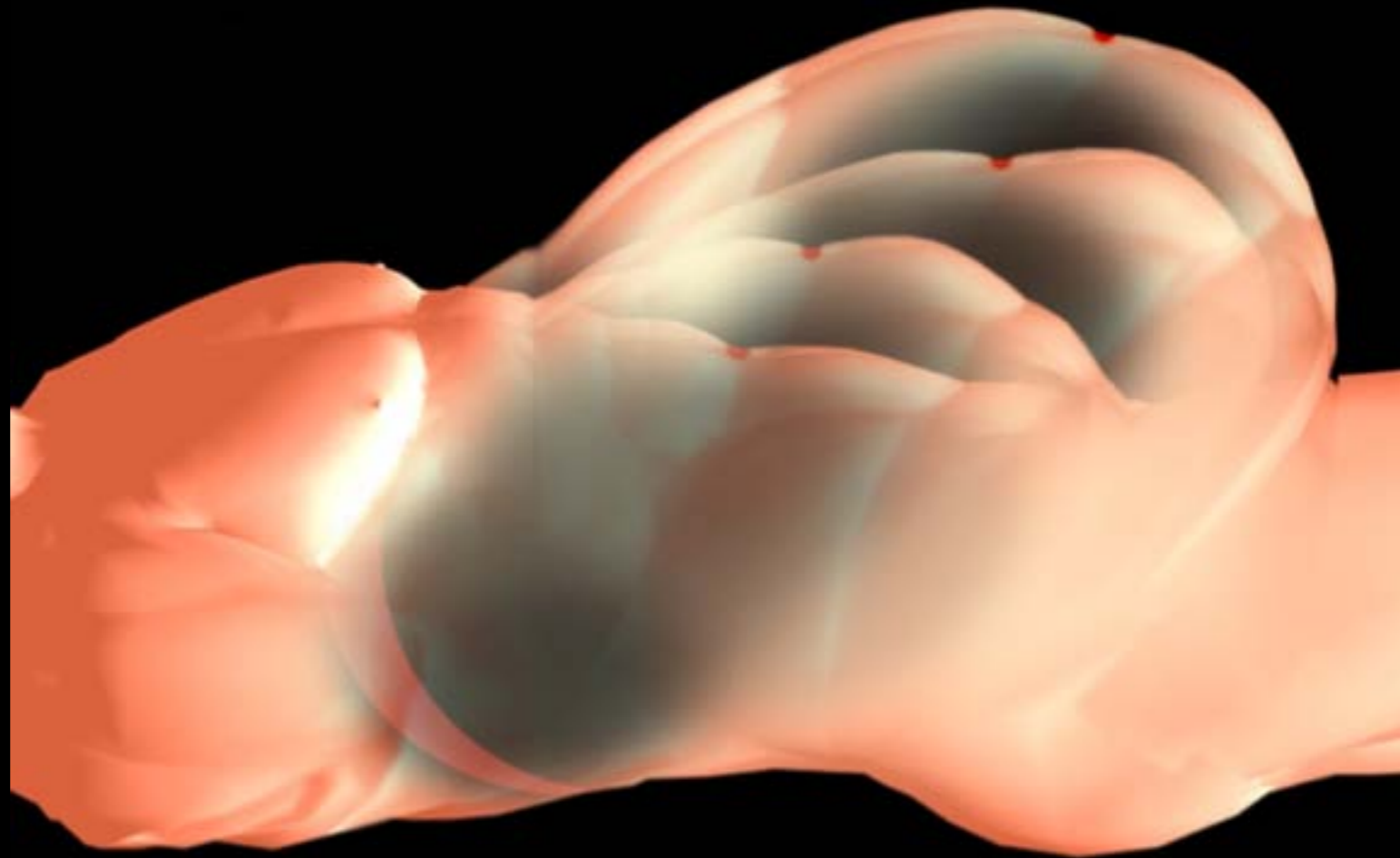
Umbilical Recession



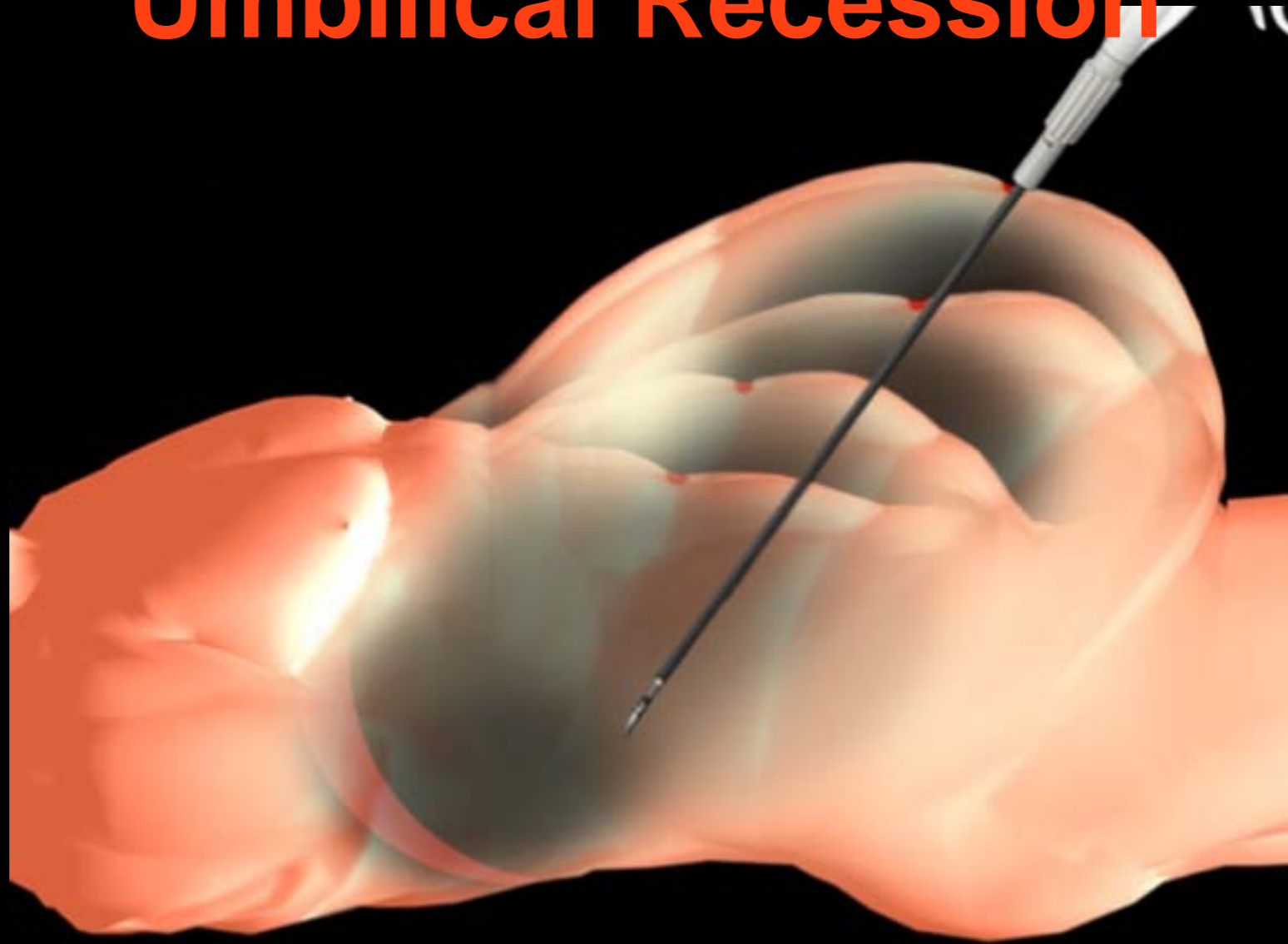
Umbilical Recession



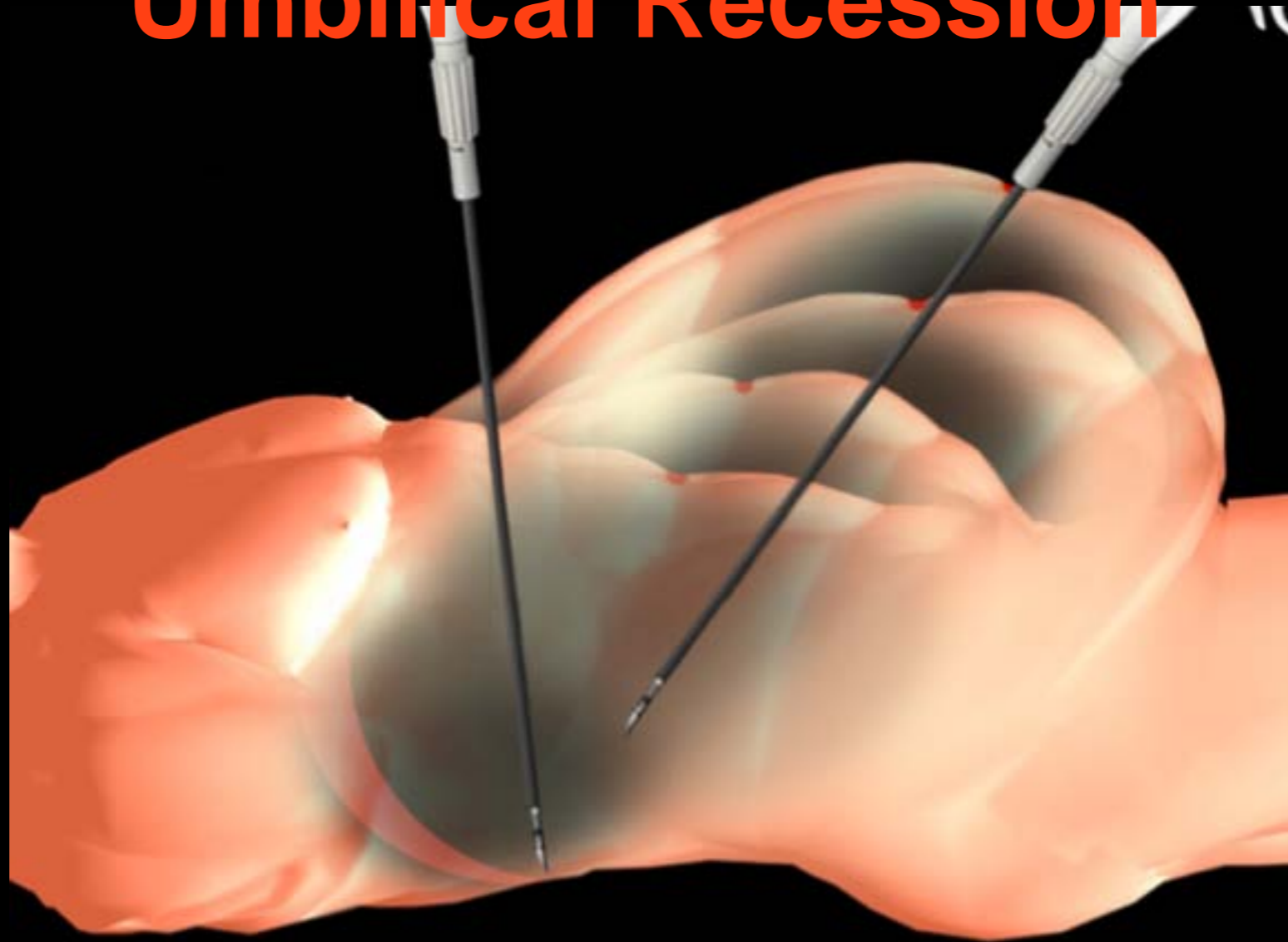
Umbilical Recession



Umbilical Recession

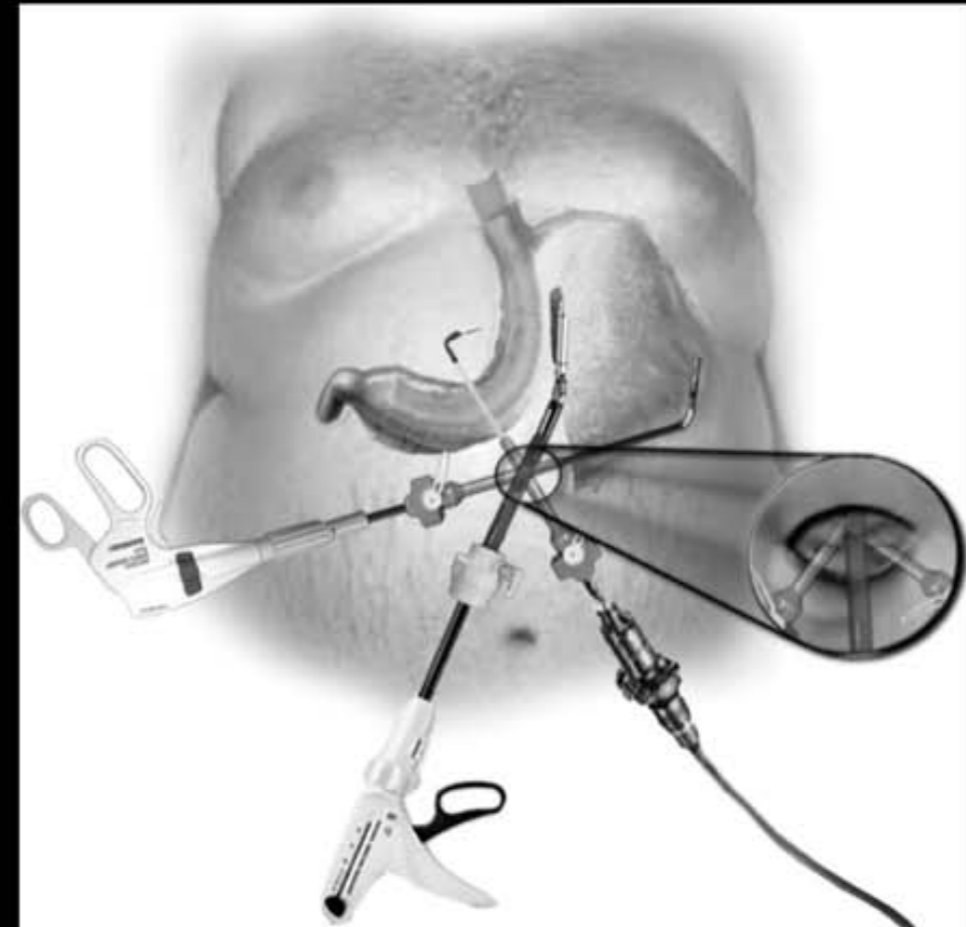
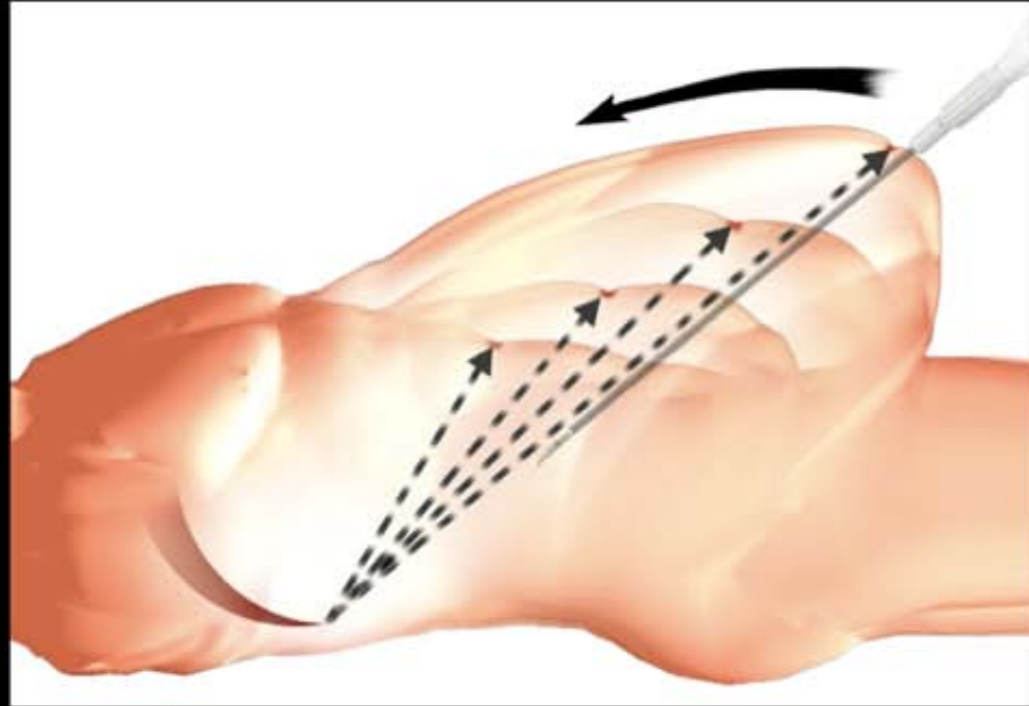


Umbilical Recession



*or long
instruments*

Umbilical Recession



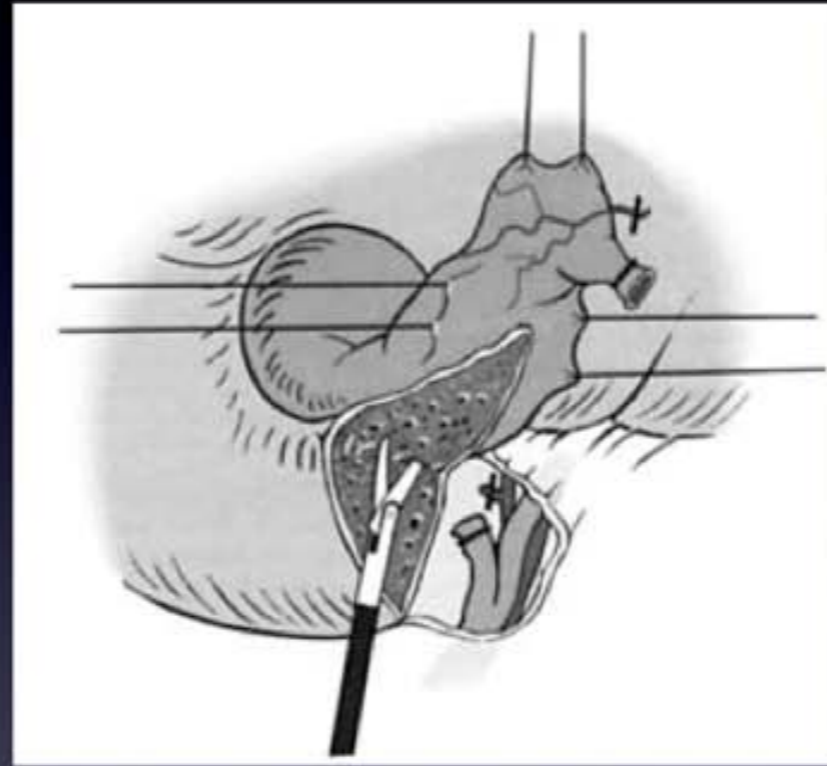
In the morbidly obese patient umbilicus is usually **far** from the GEJ.

- **Long** instruments and equipment (dissectors, staplers, scope, clip appliers)
- Epigastric entry point

Reproduced with permission from: Saber AA. In: Deitel, Gagner, Dixon, Madan, Himpens (Eds), Handbook of Obesity Surgery. Toronto:FD-communications 2010



Retraction Techniques



Don't compromise the outcome for the approach

Jeff Ponsky

Tips to overcome Challenges

Why: The instruments, trocars and laparoscope are introduced adjacent to each other whether parallel or crossing..... ***fighting***

How to improve maneuverability (minimize clinching)

Single-port with multichannel access

5 mm very low profile trocars

Different levels of trocars heads

Different length of instruments

Flexible instruments +_ rigid instrument

Flexible tip 5-mm laparoscopes.

Coordination between the surgeon and the camera

Movement of one can affect the other

Flexible camera holder !

Frequent realignment of instruments and 5 mm scope

Tips to overcome Challenges

- **Learning curve**, navigating instruments within a limited range of motion, be patient !

2007 start.....everything rigid

We were developing the technique

Think about it

Refine the technique

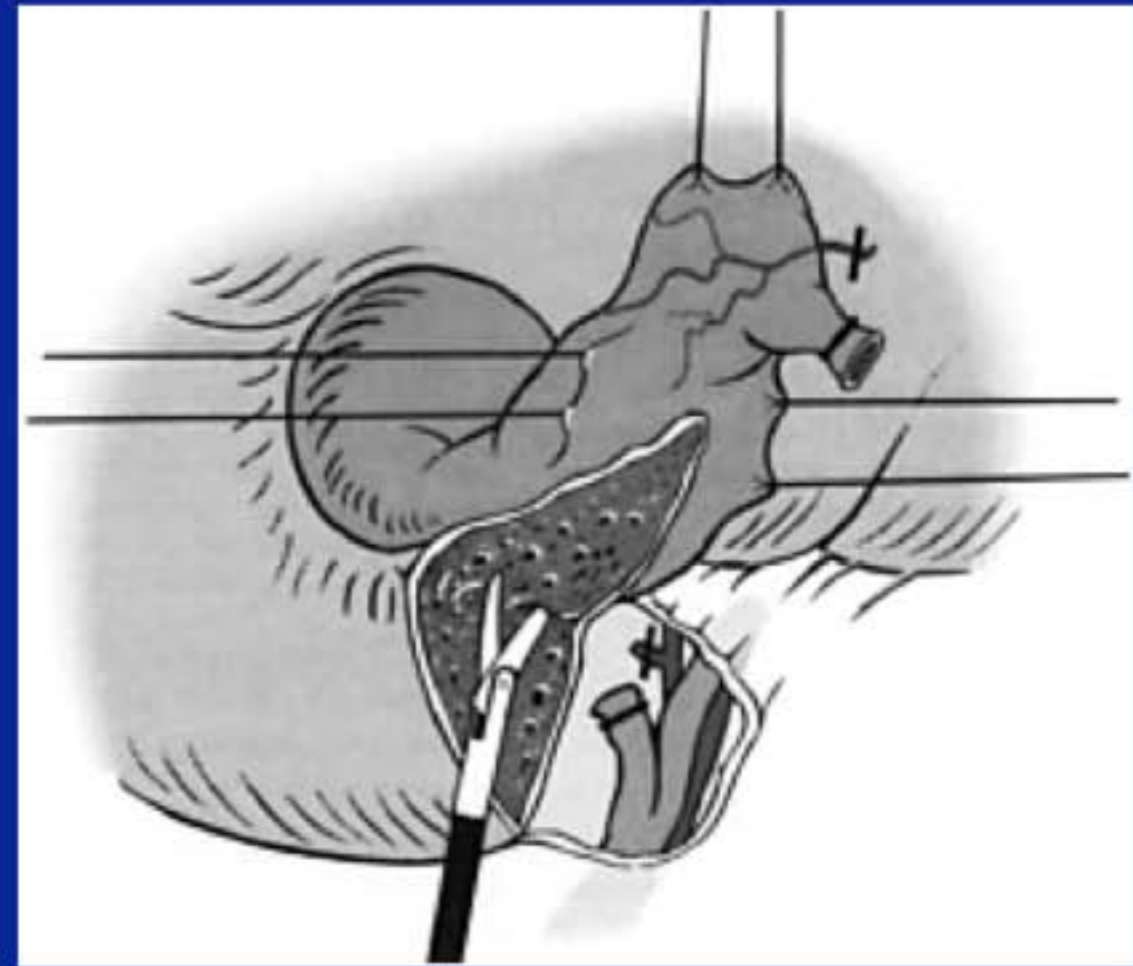
Confident, **multiport laparoscopic skills** are critical to safely introduce this new technique without added complications.

Our evolution was gradual with one change made each time

Low threshold for conversion, if you have a difficulty, just add trocars

One-wound laparoscopic cholecystectomy

- G. Navarra
- British J Surgery 1997
- 30 patients
- No conversion to open
- OR time 123min



Literature review of Single Incision Laparoscopic Cholecystectomy

Author	Year	#	Technique				OR time	LOS (days)	Complication and Follow up	
			Incision site and size	Trocars	GB retraction	Inst.				Scope
Navarra G	1997	30	2-cm Umbilical	2X 10mm	3 sutures	-	10mm 0° alternating with 30°	123"	1-8	1 wound infection
Piskun G	1999	10	2X 5-mm Umbilical (connected)	2X 5mm	2 sutures	5mm	5mm 0° alt with 30°	-	<1	-
Cuesta MA	2007	10	2 longit. umbilical (connected)	2X 5mm	Kirschner wire hook	2X 5mm	5mm 30°	70"	<1	1 Bile leakage By traction
Nguyen NT	2008	1	3X 5-mm Umbilical	3X 5mm alt with 12mm	Grasper	5mm	5mm flexible tip	70"	<1	-
Gumbs AA	2008	2	2-cm Umbilical	3X 5mm	Grasper	1 5mm Rg 1 5mm Fx	5mm Deflecting tip	<60"	<1	-
Merchant AM	2008	21	1-1.5-cm Umbilical	Gelport Device*	Grasper	2X 5mm	10mm 30°	40" - 90"	<1	-
Romanelli 	2008	1	3.4-cm umbilical	TriPort System**	1 suture	rotating, end articulating	5mm 30°	68"	-	-

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Is single-incision laparoscopic cholecystectomy safe? Results of a systematic review and *meta-analysis*

Alberto Arezzo, Gitana Scozzari, Federico Famiglietti, Roberto Passera, Mario Morino

- Surg Endosc (2013)
- systematic review and meta-analysis to compare SILC with conventional multiincision laparoscopic cholecystectomy (MILC)
- Data from randomized, controlled trials
- published up to December 2011
- 12 trials (996 patients)
- **Mortality was nil** in both treatment groups

Exclusion criteria

- Age younger than 18 years
- Obesity (BMI 28, 30, 40, and 45 kg/m²)
- Emergency presentations (retained CBDs, pancreatitis, cholecystitis)
- Poor general condition (ASA score of [III).

Study	Study period	Study design	Country	MILC technique	SILC device	No. of patients SILC	MILC
Lee 2010 [7]	2008–2009	RCT	Taiwan	4 ports	QuadraPort Laparoscopic Access Device	35	35
Tsimoyiannis 2010 [22]	NA	RCT	Greece	4 ports	3 VersaStep trocars Covidien through single skin incision	20	20
Aprèa 2011 [4]	2009–2010	RCT	Italy	3 ports	TriPort Laparoscopic Access Device	25	25
Asakuma 2011 [5]	2009	qRCT	Japan	4 ports	Surgical glove port	24	25
Bucher 2011 [19]	2009–2010	RCT	Switzerland	4 ports	TriPort Advanced Surgical Concepts	75	75
Cao 2011 [20]	2010	RCT	China	3 ports	3 trocars through single skin incision	57	51
Lai 2011 [21]	2009–2010	RCT	China	4 ports	SILS port Covidien	24	27
Lirici 2011 [8]	2009	Multicenter RCT	Italy	4 ports	TriPort Olympus America	20	20
Ma 2011 [6]	2009–2010	RCT	USA	4 ports	TriPort Advanced Surgical Concepts	21	22
Phillips 2012 [18]	NA	Multicenter RCT	USA, UK, Italy	4 ports	SILS port Covidien	117	80
Vilallonga 2011 [24]	2009–2010	Multicenter qRCT	Spain, Turkey	3 ports, 4 ports ^b	TriPort Advanced Surgical Concepts and SILS port Covidien ^c	69	71
Zheng 2012 [23]	2008–2010	RCT	China	3 ports	TriPort Advanced Surgical Concepts	28	30

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Primary outcome

- overall morbidity (11.0 %) in 11 studies
- Global complications was 9.0 MILC vs 12.8 % in SILC
- Biliary complications: two bile leaks in each group, treated conservatively

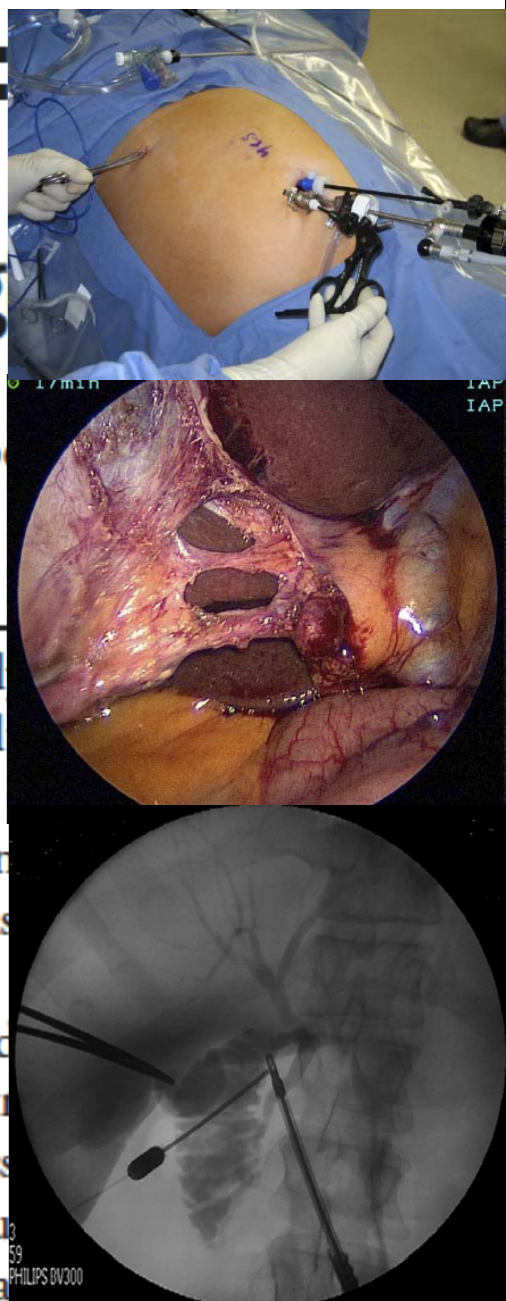
Secondary outcomes

- Parietal access–related: 5.5 in MILC vs **8.3 % for SILC**
 - port site incisional hernias: 6 in SILC vs 3 in MILC
 - wound infection: 7 in SILC vs 5 in MILC
- Mean OR time **47.2 min** for MILC and **58.1 min** for SILC
- Mean **hospital stay was similar**: 2.16 vs. 2.13 days for MILC and SILC
- Mean Visual Analog Scale pain score showed a trend toward **lower postoperative pain**, resulting 2.96 after MILC and 2.34 after **SILC**
- **Cosmetic** outcome scored **better in the SILC** group treatment groups (2.16 vs. 2.13 days for MILC and SILC)

Conclusions In selected patients, SILC has similar overall morbidity compared with MILC; further, it results in better cosmetic satisfaction and reduced postoperative pain despite longer operative time.

Single-Incision Laparoscopic Cholecystectomy: Initial Experience with Critical View of Safety Dissection and Routine Intraoperative Cholangiography

Arthur Rawlings, MD, Steven E Hodgett, MD, Brent D Matthews, MD, Steven M Strasberg, MD, Mary Quasebarth, RN, L Michael Brunt, MD



BACKGROUND: Single-incision laparoscopic cholecystectomy (SILC) is emerging as a potentially alternative to standard laparoscopic cholecystectomy and natural orifice transluminal endoscopic surgery cholecystectomy. As this technique is more widely used, it is important to maintain well-established practices of the critical view of safety (CVS) dissection and routine intraoperative cholangiography (IOC). We present our initial experience with SILC using CVS dissection and routine IOC.

STUDY DESIGN: Fifty-four patients with biliary colic were offered SILC, which was performed through a single umbilicus. CVS with photo documentation was attained before clipping and transection of the cystic structures. IOC was done using various needle puncture techniques. Assessment of IOC was carried out by independent surgeon review of operative still photos or videos using a 3-point grading scale: visualization of only 2 ductal structures entering the gallbladder; absence of Calot; and separation of the base of the gallbladder from the cystic plate.

RESULTS: SILC was performed in 54 patients (15 male and 39 female). Six patients required 1 supplementary 3- or 5-mm port. Complete IOC was successful in 50 of 54 patients (92.6%). CVS was achieved at the time of operation in all 54 patients. Photo documentation review confirmed 3 of 3 CVS criteria in 32 (64%) patients, 2 of 3 in 12 patients (24%), 1 of 3 in 3 patients (6%), and 0 in 3 patients (6%).

CONCLUSIONS: As laparoscopic cholecystectomy becomes less invasive, proven safe dissection techniques should be maintained. Dissection to obtain the CVS should be the goal of every patient and IOC can be accomplished in a high percentage of patients. This approach places patient safety considerations foremost in the evolution of minimally invasive cholecystectomy. (J Am Coll Surg 2010;211:1-7. © 2010 by the American College of Surgeons)

Conclusion

With appropriate patient selection, attention to technical details single incision laparoscopic cholecystectomy is safe, feasible and reproducible in experienced hands.

Don't compromise the outcome for the approach

Intraoperative Cholangiogram: Routine vs Selective

Bile duct injury (BDI)

- A bile duct injury rate 0.2 % in open cholecystectomy vs 0.4% in LC
- the risk of laparoscopic BDI is approximately twice what it was in the OC era
- real danger during the learning curve
- Even in the hands of competent surgeons:
 - inflammation..... distorts the anatomy
 - anatomic variation
- Misidentifying CBD for the cystic duct remains a common mechanism of injury
- Preventable complication

Bile duct injury (BDI)

- approximately **750,000 LCs** are performed annually in the USA.
- If we accept that 0.4 % of all LCs are associated with BDI
- **> 3,000** patients will suffer a BDI every year
- Mortality following BDI is **6 %** in the year after BDI, six times greater than the mortality of lap cholecystectomy without BDI
- The total costs of BDI in the USA each year can be estimated to one billion dollars, half of which is absorbed in litigation, and the other half in care of the patient with BDI.
- budgetary constraints in healthcare, **comprehensive national education program for BDI prevention**

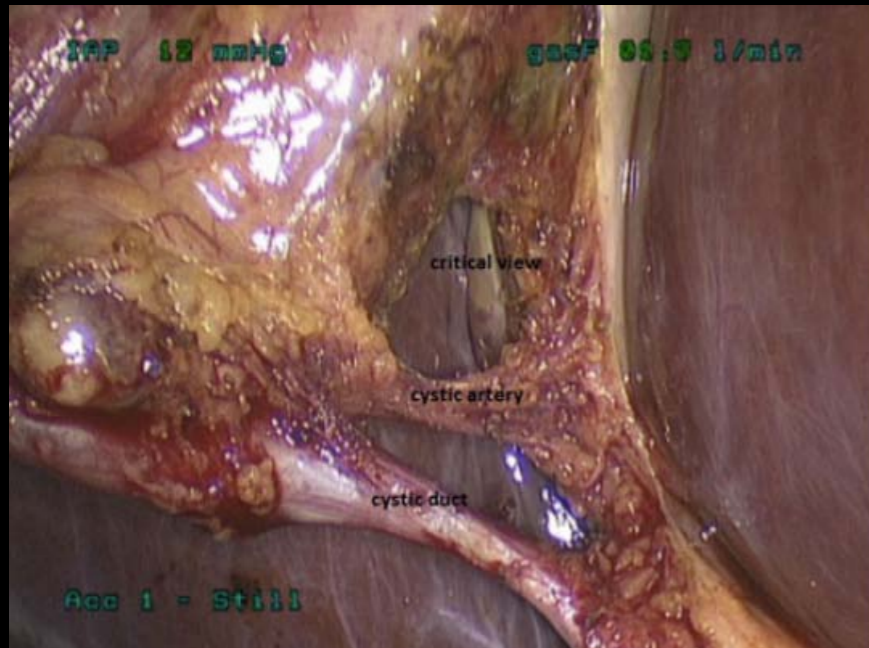
[Berci G](#), [Hunter J](#), [Morgenstern L](#), [Arregui M](#), [Brunt M](#), [Carroll B](#), [Edye M](#), [Fermelia D](#), [Ferzli G](#), [Greene F](#), [Petelin J](#), [Phillips E](#), [Ponsky J](#), [Sax H](#), [Schwaitzberg S](#), [Soper N](#), [Swanstrom L](#), [Traverso W](#).

Laparoscopic cholecystectomy: first, do no harm; second, take care of bile duct stones. Surg Endosc. 2013

Strategies to minimize CBD injury during laparoscopic cholecystectomy

- Infundibular technique ↓ ↓ ↓
- achieving **CVS** ↑ ↑ ↑ ↑ ↑
- Routine cholangiography ↓ ↓

Critical View of Safety



- Strasberg in 1995.
- Calot's triangle dissected free of fat & fibrous tissue
- only two tubular structures (cystic duct and artery) entering gallbladder directly
- The surface of the liver bed clearly visible.
- This confirms absence of abnormal regional anatomy & reduces the risk of CBD injury.
- CVS increasingly attempted prior to clipping and transection of the cystic duct

IOC

The role for IOC in preventing bile duct injury, has been debated since the introduction of the technique

Advocates for IOC

IOC clarifies the biliary anatomy and promotes protection against transection of CBD or at least helps to reveal injury intraoperatively; when identification of structures has been faulty & accidental injury has occurred.

Opponents of IOC

1. Question the protection influence of IOC
2. IOC prolongs OR time & increases cost.
3. CVS substitutes the need for IOC

Within the context of this controversy CBD injury continue to occur with or without IOC

Contribution of intraoperative cholangiography to incidence and outcome of CBD injuries during laparoscopic cholecystectomy

⑩ [Ludwig K, et al](#)

⑩ Surg Endosc, 2002

• **meta-analysis** of all the studies comparing BDI rates with and without IOC

⑩ 26 of 2104 reports were enrolled for analysis

⑩ Results

○ Routine IOC: 0.21% BDI injury and intraop diagnosis in 87%

○ Selective IOC: 0.43% BDI injury and intraop diagnosis in 44%.

• *Routine use of IOC halved the rate of CBD injury.*

• *However, the identification and interpretation of anatomy on IOC was subjective, and when unclear, the potential for inadvertent placement of a cholangiocatheter directly into the CBD could cause a CBD injury, rather than avoid it, although complete transection would be avoided.*

In contrast, other data suggest that

- IOC may **not prevent bile duct injury**
- IOC is **not a substitute for careful surgical technique**, such as obtaining the critical view of safety.
- Unfortunately, IOC may be performed even in cases where a bile duct injury is sustained, and **cholangiogram interpreted incorrectly**, which emphasizes that **its use is not equivalent with absolute prevention of bile duct injury.**

Way LW, Stewart L, Gantert W, et al. Causes and prevention of laparoscopic bile duct injuries: analysis of 252 cases from a human factors and cognitive psychology perspective. Ann Surg 2003;237(4): 460– 469.

- **IOC may be associated with creation of a bile duct injury in rare cases**
- occurring at the same frequency as bile duct injury in large series (0.4%)

Ohtani T, Kawai C, Shirai Y, et al. Intraoperative ultrasonography versus cholangiography during laparoscopic cholecystectomy: a prospective comparative study. J Am Coll Surg 1997;185(3): 274–282.

A recent analysis of national patterns of the use of IOC suggests that

- IOC is **not utilized at all** in some hospitals performing cholecystectomy
- associated with **> \$ 700** additional charges per case
- making it **not cost-effective** to prevent bile duct injury

Livingston EH, Miller JA, Coan B, et al. Costs and utilization of intraoperative cholangiography. J Gastrointest Surg 2007;11(9): 1162– 1167.

Costs and utilization of intraoperative cholangiography

Livingston EH, et al.

J Gastrointest Surg 2007

- The 2001 National Inpatient Survey database was assessed for IOC utilization and charges.
- Results
 - 18% of cholecystectomies were performed in hospitals that never perform IOC
 - 11% of hospitals perform routine IOC
 - 71% of hospitals perform selective IOC
- IOCs were associated with US \$706–739 additional hospital charges
- \$371,356 to prevent a single bile duct injury by using routine IOC
- Conclusion
 - only a minority of hospitals performs cholecystectomies with routine IOC
 - Because of the significant amount of hospital charges attributable to IOC, routine IOC is not cost-effective as a preventative measure against CBD injury during cholecystectomy.

Association between cholecystectomy with vs without intraoperative cholangiography and risk of common duct injury

- JAMA Aug 2013

- [Sheffield KM](#), [Riall TS](#), [Han Y](#), [Kuo YF](#), [Townsend CM Jr](#), [Goodwin JS](#)

- The University of Texas

- Retrospective study of all Texas Medicare claims data from 2000 through 2009

- To estimate the association between use IOC & CBD injury

Association between cholecystectomy with vs without intraoperative cholangiography and risk of common duct injury

- 40.4% of 92,932 patients undergoing laparoscopic cholecystectomy with IOC
- CBD injury occurred in 0.21% of patients with IOC vs 0.36% of patients without
- After adjustment for unmeasured confounders using instrumental variable analysis,
the association between cholecystectomy performed without IOC and CBD injury was no longer significant (OR, 1.26 [95% CI, 0.81-1.96]; P = .31).

More recent studies have questioned the role of routine IOC when the critical view technique is employed and have argued for the use of selective IOC in cases when the critical view cannot be achieved

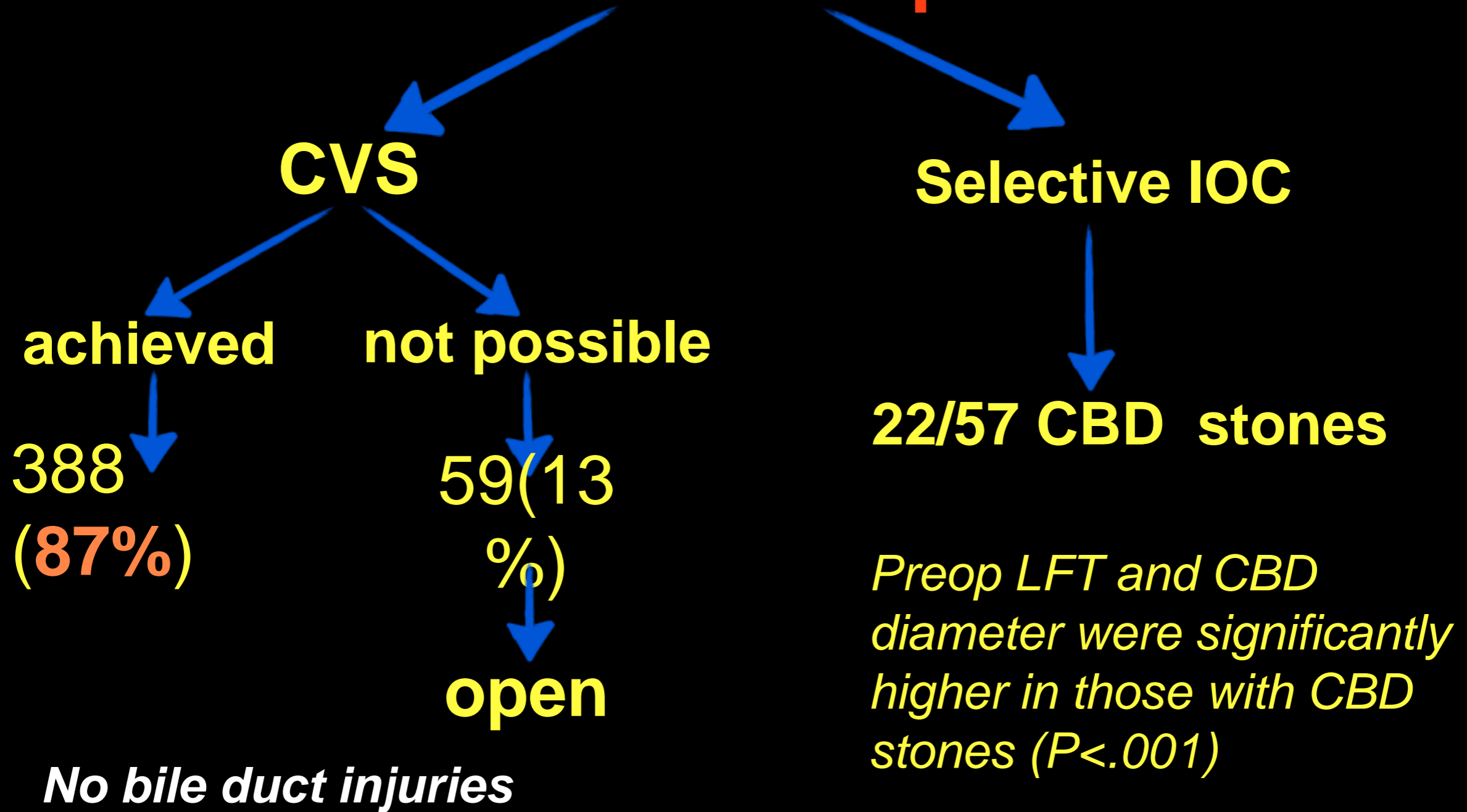
Chapman WC, Abecassis M, Jarnagin W, et al. Bile duct injuries 12 years after the introduction of laparoscopic cholecystectomy. *J Gastrointest Surg* 2003;7(3): 412– 416.

Sanjay P, Fulke JL, Exon DJ. ‘Critical view of safety’ as an alternative to routine intraoperative cholangiography during laparoscopic cholecystectomy for acute biliary pathology. *J Gastrointest Surg* 2010;14(8): 1280– 1284.

Critical View of Safety (CVS) as an Alternative to Routine Intraoperative Cholangiography During Laparoscopic Cholecystectomy for Acute Biliary Pathology

- Sanjay P, et al UK
- Gastrointest Surg 2010
- A policy of
 - **routine CVS** to identify biliary anatomy
 - **selective IOC** for patients with suspected CBD stone
- **Retrospective** study
- **447** consecutive, same admission laparoscopic cholecystectomies

447 consecutive lap chole



- *CVS clarify the anatomy of Calot's triangle & is a suitable alternative to routine IOC*
- *Selective IOC should be employed when preop LFT & CBD diameter suspect CBD stones.*

Conclusion

- **The true effect of intraoperative cholangiography on the safety of laparoscopic cholecystectomy remains controversial**
- **IOC is not a substitute for careful surgical technique , such as obtaining the critical view of safety**
- **Critical view of safety is an alternative to routine IOC.**