Minilaparoscopic Cholecystectomy with ICG Cholangiography

A novel approach to improve safety and outcomes

BONG JAN JIN

MB ChB, MD, FRCS(Gen Surg), CCT

Consultant general and HPB surgeon
Kuala Lumpur, Malaysia
10.10.2014
Outlines of presentation

1. Evolution of cholecystectomy: status quo and the reasons for changing
2. My approach to cholecystectomy
3. Video of mini-laparoscopic surgery with ICG cholangiography
Evolution of laparoscopic surgery

• 1985 - First laparoscopic cholecystectomy – Erich Muhe in Germany, 1985

• 1998 – Gasless laparoscopic cholecystectomy
• 1999 - Mini laparoscopic surgery
• 2005 - Natural orifice transluminal endoscopic surgery (NOTES)
• 2008 - Single-incision laparoscopic cholecystectomy (SILS)
• 2009 - Mini laparoscopic surgery – second generation
Status quo of laparoscopic cholecystectomy – Why change?

• Does the new improvement brings advantages over the conventional method:

  • ? Better cosmesis
  • ? Less post-operative pain
  • ? Reduction in recovery time
  • ? New surgical techniques required – mechanical cluttering of instruments, less maneuverability, ambidexterity, restricted operative field
  • ? New costly instruments required (roticulating graspers, scissor)
  • ? Steep learning curve – more complications initially
  • ? Improved safety to reduce bile duct injury
Better cosmesis
Better Cosmesis (I): Postop wounds of conventional lap. cholecystectomy

Courtesy of
Mr. Hairol Othman
Better cosmesis (II) SILS

Hong et al, Surg Endoscop 2009
Better cosmesis (III) - minilaparoscopic cholecystectomy

Picture taken at 10 days postop
Better Cosmesis (IV): Post-operative wound complications

- Large specimen requires extension of wound for extraction eg. large stone, empyema GB
- Wound infection
- Hypertrophic/Keloid scar
- Incisional hernia
Better Cosmesis (V): Cultural or professionally unacceptable to have umbilical wound

Models
Modified approach to minilaparoscopic cholecystectomy

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Bikini minilap approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port A:</td>
<td>12mm</td>
<td>12mm</td>
</tr>
<tr>
<td>Port B: 12mm or 6mm</td>
<td>3mm</td>
<td>3mm</td>
</tr>
<tr>
<td>Port C/D: 6mm</td>
<td>3mm</td>
<td>3mm</td>
</tr>
</tbody>
</table>
Less post-operative pain
Meta-analysis of pain score and analgesia requirement: SILC vs Conventional lap chole

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Random, 95% CI Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsimoyiannis 2010</td>
<td>0.5</td>
<td>0.6</td>
<td>20</td>
<td>1.5</td>
<td>0.94</td>
<td>20</td>
<td>12.9%</td>
<td>-1.00 [-1.49, -0.51] 2010</td>
</tr>
<tr>
<td>Lee 2010</td>
<td>2.1</td>
<td>0.9</td>
<td>35</td>
<td>2.2</td>
<td>0.8</td>
<td>35</td>
<td>13.2%</td>
<td>-0.10 [-0.50, 0.30] 2010</td>
</tr>
<tr>
<td>Aprea 2011</td>
<td>2.2</td>
<td>1.3</td>
<td>25</td>
<td>2.8</td>
<td>1.3</td>
<td>25</td>
<td>12.1%</td>
<td>-0.60 [-1.32, 0.12] 2011</td>
</tr>
<tr>
<td>Bucher 2011</td>
<td>1</td>
<td>0.57</td>
<td>75</td>
<td>3</td>
<td>0.5</td>
<td>75</td>
<td>13.7%</td>
<td>-2.00 [-2.19, -1.81] 2011</td>
</tr>
<tr>
<td>Cao 2011</td>
<td>2.3</td>
<td>0.9</td>
<td>57</td>
<td>2.6</td>
<td>1.2</td>
<td>51</td>
<td>13.2%</td>
<td>-0.30 [-0.70, 0.10] 2011</td>
</tr>
<tr>
<td>Lirici 2011</td>
<td>3.75</td>
<td>2</td>
<td>20</td>
<td>3.15</td>
<td>2.25</td>
<td>20</td>
<td>9.3%</td>
<td>0.60 [-0.72, 1.92] 2011</td>
</tr>
<tr>
<td>Asakuma 2011</td>
<td>2.4</td>
<td>0.85</td>
<td>24</td>
<td>4.5</td>
<td>0.6</td>
<td>25</td>
<td>13.3%</td>
<td>-2.10 [-2.45, -1.75] 2011</td>
</tr>
<tr>
<td>Sinan 2012</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>12.3%</td>
<td>0.00 [-0.67, 0.67] 2012</td>
</tr>
</tbody>
</table>

Total (95% CI) 273        268 100.0% -0.75 [-1.46, -0.04]

Heterogeneity: Tau² = 0.95; Chi² = 156.04, df = 7 (P < 0.00001); I² = 96%
Test for overall effect: Z = 2.08 (P = 0.04)

**FIGURE 5.** Forest plot and meta-analysis for the pain score at 24 hours postoperatively. CI indicates confidence interval.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Events</th>
<th>Total</th>
<th>Control Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio M-H, Random, 95% CI Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rašić 2010</td>
<td>1</td>
<td>48</td>
<td>3</td>
<td>50</td>
<td>4.2%</td>
<td>0.35 [0.04, 3.22] 2010</td>
</tr>
<tr>
<td>Tsimoyiannis 2010</td>
<td>9</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>24.8%</td>
<td>0.46 [0.29, 0.75] 2010</td>
</tr>
<tr>
<td>Cao 2011</td>
<td>13</td>
<td>57</td>
<td>11</td>
<td>51</td>
<td>19.3%</td>
<td>1.06 [0.52, 2.15] 2011</td>
</tr>
<tr>
<td>Lirici 2011</td>
<td>17</td>
<td>20</td>
<td>16</td>
<td>20</td>
<td>29.1%</td>
<td>1.06 [0.80, 1.41] 2011</td>
</tr>
<tr>
<td>Asakuma 2011</td>
<td>9</td>
<td>24</td>
<td>19</td>
<td>25</td>
<td>22.7%</td>
<td>0.49 [0.28, 0.87] 2011</td>
</tr>
</tbody>
</table>

Total (95% CI) 169         166 100.0% 0.69 [0.42, 1.13]

Total events 49           69

Heterogeneity: Tau² = 0.19; Chi² = 14.14, df = 4 (P = 0.007); I² = 72%
Test for overall effect: Z = 1.47 (P = 0.14)

**FIGURE 6.** Forest plot and meta-analysis for the analgesia requirements. CI indicates confidence interval.

Meta-analysis of post-operative pain: minilap vs. conventional lap chole

FIG. 3. Analysis of postoperative pain. Weighted mean differences (WMD) are shown with 95% confidence intervals (95% CI); sd, standard deviation.

Pooled data suggested significant decrease pain after minilap cholecystectomy (P=0.003)
Disadvantages of SILS

• Mechanical clustering and angulation of instruments
• Steep learning curve
• Costly “disposable” angulated instruments
• Safety of operation in “difficult gallbladder”
Mechanical clustering and angulation of instruments – steep learning curve

SILS ports – less ergonomic
Minimum learning curve required – Ports placement are identical to conventional lap cholecystectomy
**Modified approach to minilaparoscopic cholecystectomy**

<table>
<thead>
<tr>
<th>Port A: 12mm</th>
<th>Port A: 12mm or 6mm</th>
<th>Port C/D: 6mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>Bikini minilap approach</td>
<td>Sunway Medical Centre</td>
</tr>
</tbody>
</table>
Safety of new techniques: complications
Pooled adverse events: SILS vs conventional lap chole

The rate of adverse events were lower in conventional lap chole (P=0.98)

*Hao et al. Surg Laparosc Endosc Percutan Tech 2012*
Pooled adverse events: minilap vs conventional lap chole

The odds of adverse events were lower in minilap group, although this was not significant.

Single Incision Laparoscopic Cholecystectomy Is Associated With a Higher Bile Duct Injury Rate

A Review and a Word of Caution

Mark Joseph, MD, Michael R. Phillips, MD, Timothy M. Farrell, MD, and Christopher C. Rupp, MD

**Objective:** To compare the incidence of bile duct injuries during single incision laparoscopic cholecystectomy (SILC) in relation to the accepted historic rate of 0.4% to 0.5% for standard laparoscopic cholecystectomy (SLC).

**Background:** Technically, SILC is more challenging than SLC. The role and benefit of SILC in patient care has yet to be defined. Bile duct injuries have been reported in several series of SILC.

**Method:** A comprehensive database search of MEDLINE, EMBASE, CINAHL, and PubMed Central was performed to generate all reported cases of SILC to present. The search was limited to reports of 20 or more patients based on current literature of existing SILC learning curves. Data were analyzed using the Student t test and χ² analyses where appropriate.

**Results:** A total of 76 candidate studies were identified; 45 studies met inclusion criteria for an aggregate total of 2626 patients. Most SILCs were performed in the absence of acute cholecystitis (90.6%). The aggregate complication rate was 4.2%, and complications were graded according to the Dindo-Clavien Classification System. Nineteen bile duct injuries were identified for a SILC-associated bile duct injury rate of 0.72%.

**Conclusions:** There seems to be an increase in the rate of bile duct injuries during SILC when compared with historic rates during SLC. Because most SILCs are performed in optimal conditions, such as lack of acute inflammation, we urge caution in applying this technique to inflamed gallbladder pathology. Controlled trials are needed before conclusions are made regarding safety of SILC.

(Ann Surg 2012;256:1–6)

SILS-associated bile duct injury rate of 0.72%, compared with 0.5% in conventional lap chole and 0.2% in open chole
Avoiding bile duct injury: Strasberg’s Critical View of Safety

- Short cystic duct
- Cystic artery
- Strasberg’s Critical View
- Aberrant posterior sectoral duct
- Tented CBD
ICG Near-Infrared Fluorescence Cholangiography

A

B

C

CHD
CD
CBD

CHD
CD
CBD

CHD
CD
CBD

SUNWAY MEDICAL CENTRE

Osayi et al. Surg Endosc 2014
Identification of biliary anatomy using ICG-Near infrared fluorescence cholangiography

<table>
<thead>
<tr>
<th>Table 3 Intent to treat comparison of successful identification of biliary structures after final dissection using NIRF-C and IOC (n = 82)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Procedure time (min)</td>
</tr>
<tr>
<td>RHD</td>
</tr>
<tr>
<td>LHD</td>
</tr>
<tr>
<td>CHD</td>
</tr>
<tr>
<td>CD-CHD junction</td>
</tr>
<tr>
<td>CD</td>
</tr>
<tr>
<td>CBD</td>
</tr>
</tbody>
</table>

NIRF-C near-infrared fluorescence cholangiography; IOC intraoperative cholangiogram; RHD right hepatic duct; LHD left hepatic duct; CHD common hepatic duct; CD cystic duct; CBD common bile duct

<sup>a</sup> Data include cases where IOC was unobtainable

<sup>b</sup> Cumulative time for performing NIRF-C at three time points
Advantages and disadvantages of SILS and minilap cholecystectomy

<table>
<thead>
<tr>
<th></th>
<th>SILS</th>
<th>Minilap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosmesis</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Reduction in postop pain</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Ergonomic</td>
<td>---</td>
<td>+++</td>
</tr>
<tr>
<td>Learning curve</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Safety</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Costs</td>
<td>--</td>
<td>-</td>
</tr>
<tr>
<td>Reduction in recovery time</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
My preference
Modified minilaparoscopic cholecystectomy: The suprapubic approach

The use of suprapubic incision for initial access and insufflation, an optical port, and specimen-retrieval port
Rationale for suprapubic minilap chole

- Better cosmesis
- Less pain
- Allow the best optical lens (10mm) for superior definition of operative field
- More ergonomic with increased freedom of movement
- Comfortable operating space for surgeon and assistance
- No limit on suprapubic wound extension
- No need for minilap wound closure – no fear of infection/herniation
- Suitable to tackle complex gallbladder pathology, (eg. Empyema) or big stone
Details of Bikini approach

Operative technique

• Open dissection / Hasson technique
• Optical access trocar - Optiview (Ethicon Endosurgery)
Initial view of the Bikini approach
Initial experience of suprapubic minilaparoscopic cholecystectomy

• Between 28/06/2013 to 28/09/2014
• 62 consecutive, unselected cases of minilap chole were performed using suprapubic approach
• Informed consent obtained in all patients
• Single-surgeon experience
• Tertiary referral centre
Operating room Set-up

- Full HD camera system
- 10.0mm 30° optical lens
- 2.7mm 30° optical lens
- One 12mm Optiview port (Ethicon)
- Three 3mm Carvalho ports
- Two minilap graspers
- One minilap hook
- One Maryland dissector
- One needle holder
- One suction

- Surgeon stands to the left of patient
- No urinary catheterization
- Table tilted reversed Trendelenburg position 15° and right–side up
- Temporary NG tube
Carvalho trocars
Standardized, post-operative analgesia

- Wound infiltration: 20 mls of 0.5% Marcaine Adrenaline
- Oral analgesia: 1g paracetamol + 120mg Arcoxia
- On demand: IM Pethidine 50mg
Initial experience of consecutive unselected cases (n=62)

- **Sex:** 28 Male (45%); 34 Female (55%)
- **Age:** Median 48, Range 29 – 75
- **Clinical Diagnoses:**
  - Biliary colic 31
  - Cholecystitis 20
  - Empyema 2
  - Mucocele 1
  - Gangrenous 1
  - Gallstone pancreatitis 3
  - Polyp 2
  - Gallbladder mass ?tumour 2
Overall median operative time = 51 minutes (18 – 128 mins)

- Elective operation median = 45 min (18 – 98)
- Emergency operation median = 73 min (38 - 128)
Results: complication

• No conversion
• No transfusion
• Complications:
  • Wound infection - 1 case
  • Infected intra-abdominal collection – percutaneous drainage
• Length of stay: Median 3d, Range 2-11d
Post-op appearances of minilap cholecystectomy using suprapubic approach
Potential limitation (I) of suprapubic technique: Blind spots

Sub-diaphragmatic space

Sub-hepatic space
Potential limitation (II) of the suprapubic approach: Intra-corporeal tying needed

Alternative option: 6mm port accepting 5mm instruments
Potential limitation (III): Morbid obesity

- Difficult, but possible using the suprapubic approach
- Need accurate placement of ports
- Use long optical lens
- Use optical zoom as last resort
- Extra rigidity of Carvalho ports helps!
Conclusion:

• Minilaparoscopic cholecystectomy via the suprapubic approach was technically feasible and safe

• Combines the ergonomic features of conventional laparoscopic approach with the cosmetic advantage of SILS
Thank you