

# Single Port Access Laparoscopic Cholecystectomy (with video)

Pascal Bucher · François Pugin · Nicolas Buchs ·  
Sandrine Ostermann · Fadi Charara · Philippe Morel

Published online: 30 December 2008  
© Société Internationale de Chirurgie 2008

## Abstract

**Background** Single port access (SPA) surgery is a rapidly evolving field due to the complexity of NOTES (natural orifice transluminal endoscopic surgery). SPA combines the cosmetic advantage of NOTES and possibility to perform surgical procedure with standard laparoscopic instruments. We report a technique of umbilical SPA cholecystectomy using standard laparoscopic instruments and complying with conventional surgical principle and technique of minimally invasive cholecystectomy.

**Methods** Preliminary, prospective experience of SPA cholecystectomy in 11 patients (median age, 46 (range, 27–63) years) scheduled for cholecystectomy was evaluated. Diagnoses for cholecystectomy were: symptomatic gallbladder lithiasis ( $n = 7$ ), previous acute cholecystitis ( $n = 3$ ), and biliary pancreatitis ( $n = 1$ ).

**Results** SPA cholecystectomy was feasible in all patients (median body mass index, 24 (range, 20–34) kg/m<sup>2</sup>) who were scheduled for preliminary experience using conventional laparoscopic instruments. Median operative time was 52 (range, 40–77) minutes. Intraoperative cholangiography was performed in all patients, except one, and was considered normal. No peroperative or postoperative complications were recorded. Median hospital stay was less than 24 h.

**Conclusions** SPA cholecystectomy is feasible and seems to be safe when performed by experienced laparoscopic surgeons using standard laparoscopic instrumentation. SPA cholecystectomy may be safer than the NOTES approach at this time. It has to be determined whether this approach would benefit patients, other than cosmesis, compared with standard laparoscopic cholecystectomy.

## Introduction

Laparoscopic cholecystectomy is the “gold standard” for gallbladder removal [1, 2]. Attempts to decrease parietal trauma and improve cosmetic results, such as mini laparoscopic ports and lower ports number have illustrated patients’ preference for these techniques [3–6]. These advantages are the fundamentals of scarless surgery. In recent surveys, it has been shown that patients would largely favor NOTES (natural orifice transluminal endoscopic surgery) cholecystectomy compared with standard laparoscopic cholecystectomy, unless the risks of NOTES cholecystectomy drastically exceeded those of conventional laparoscopic approach [7, 8]. This illustrates the importance of cosmesis and should warrant surgeons to look for “scarless” surgical procedure [9].

Single port access (SPA) surgery is a rapidly evolving field [10]. SPA offers cosmetic advantage (as does NOTES) compared with standard multiple access laparoscopic procedure [11]. NOTES cholecystectomies have been performed through transvaginal or transgastric approaches with success but with adjunction of transparietal access [12–17]. Whereas SPA laparoscopy has been looked at as a possible derivative of NOTES, it has, at this time, the advantage of a lower complexity for clinical

---

**Electronic supplementary material** The online version of this article (doi:[10.1007/s00268-008-9874-4](https://doi.org/10.1007/s00268-008-9874-4)) contains supplementary material, which is available to authorized users.

---

P. Bucher (✉) · F. Pugin · N. Buchs · S. Ostermann ·  
F. Charara · P. Morel

Department of Surgery, University Hospital Geneva,  
24 rue Micheli-du-Crest, 1211 Geneva, Switzerland  
e-mail: [pascal.bucher@hcuge.ch](mailto:pascal.bucher@hcuge.ch)

application to allow the use of standard laparoscopic instruments [11, 18–20]. Its only complexities are represented by the necessity to operate in-axis and with low possibility of triangulation, which is similar to NOTES until now [9, 10, 21–24].

We report our experience of SPA cholecystectomy using a simple technique with standard laparoscopic instruments and complying with conventional surgical principle and technique of minimally invasive cholecystectomy.

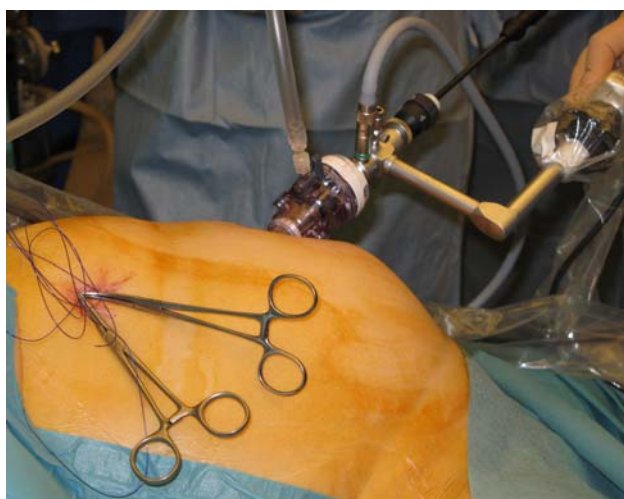
## Methods

Prospective preliminary experience with single port access cholecystectomy in 11 patients scheduled for laparoscopic cholecystectomy is presented. Indications for cholecystectomy were biliary colic ( $n = 7$ ), cholecystitis ( $n = 3$ ), and biliary pancreatitis ( $n = 1$ ). All patients were offered this approach after providing informed consent. All patients received information about surgical technique, and the risks associated with cholecystectomy, and were informed in particular that the complication rates of single port access cholecystectomy may be higher than those of standard laparoscopic cholecystectomy.

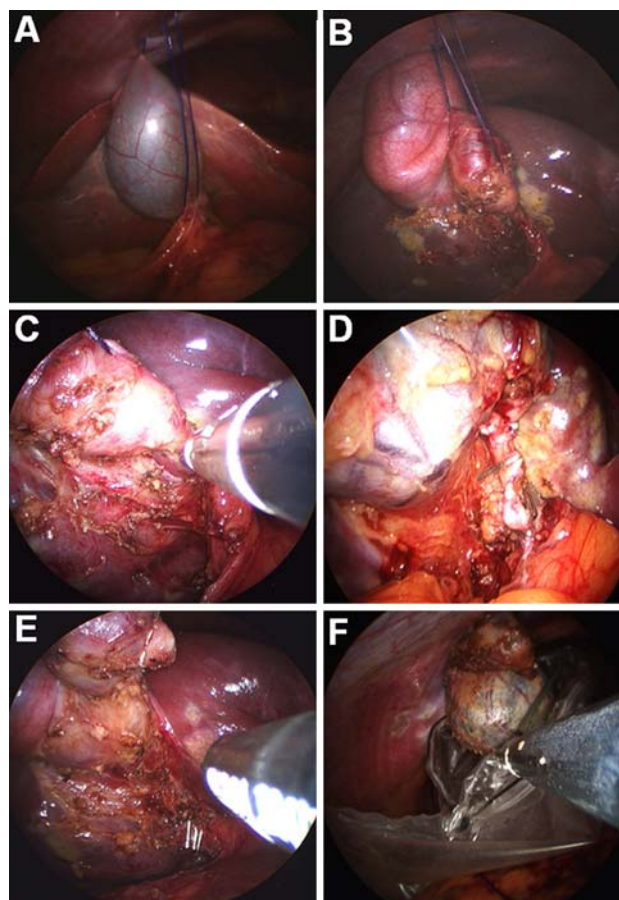
### Surgical technique

Single port access cholecystectomy was performed by using a surgical technique similar to standard laparoscopic cholecystectomy, except that it was conducted through a single umbilical port. A single 12-mm umbilical port (Endopath Xcel Trocar, Ethicon Endo-Surgery, Spreitenbach, Switzerland) was placed through open approach. A 10-mm

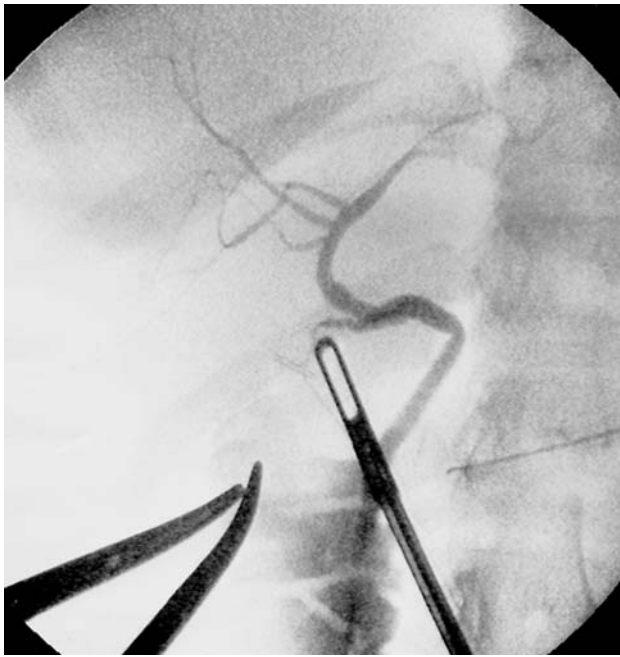
laparoscope (Ref: S26034AA; Richard Wolf GmbH, Knittlingen, Germany) with 6-mm working channel was used (Fig. 1). Gallbladder suspension and exposition was achieved by placing transperitoneal stitches (Vicryl 1/0 with modified ski needle) anchored in gallbladder wall as described by Navarra et al. [25], using a 5-mm Johann grasper (Ref: CEV 9625-1B, MicroFrance, Saint Aubin le Monial, France; Fig. 2 and online video). Two stitches were placed: one on the gallbladder fundus, and one on the infundibulum. Applying different tension to these two stitches enable correct exposition of the Calot triangle and gallbladder bed for dissection. Gentle traction on these stitches is mandatory to avoid gallbladder wall tears as described earlier for other procedures [10, 21]. Calot triangle dissection was conducted by using the technique described by Gigot [26]. For Calot triangle dissection, cystic artery,



**Fig. 1** Single port access cholecystectomy installation, with single umbilical trocar and working channel optic as well as gallbladder suspension stitches in the right hypochondrium



**Fig. 2** Intraoperative views of single port access cholecystectomy. **a** Gallbladder suspension using transperitoneal stitches. **b** Calot's triangle exposition and dissection facilitated by gallbladder suspension. **c** Calot's triangle dissected with cystic duct exposed. **d** Cystic duct clipped after transcystic cholangiography (note the clips on cystic artery, left to cystic duct). **e** Cystic duct section, with three clips on the cystic duct remnant, and exposition of gallbladder bed for dissection. **f** Completely dissected gallbladder is recovered in a specimen bag for umbilical extraction



**Fig. 3** Intraoperative transcystic cholangiography showing normal biliary tree, without sign of common bile duct stone or operative lesion

and duct isolation, 5-mm laparoscopic monopolar hook dissector (Ref: 8384.423, Richard Wolf GmbH, Knittlingen, Germany), scissor (Ref: 3152, Microline PENTAX, Beverly, MA), and right angle dissector (Ref: 52155-07, Elmed Inc., Addison, IL) were used. Cystic artery control was achieved after isolation by using 5-mm laparoscopic clips (Ligamax EL5ML, Ethicon Endo-Surgery). Since the second case, intraoperative cholangiography was performed after placement of a cholangiography catheter inside the proximal cystic duct (REF: C-NFEP4.0-21-65-P-NS-OECS, Cook Ltd., Limerick, Ireland; Fig. 3). Cystic duct occlusion was achieved by using laparoscopic clips. Gallbladder bed dissection was performed by using a hook dissector. After the cholecystectomy was completed, the gallbladder was extracted in a specimen bag (Endocatch<sup>TM</sup>, Tyco Healthcare, Wollerau, Switzerland) that was introduced through the umbilical port.

## Results

Single port access cholecystectomy was feasible in all patients scheduled for preliminary experience using conventional laparoscopic instruments (Table 1). Cystic artery control and cystic duct occlusion was achieved in all cases using standard laparoscopic clips. Median operative time was 52 (range, 40–77) min. Cholangiography was performed successfully in all patients, except one, and was

**Table 1** Patient characteristics

	Cases ( <i>n</i> = 11)
Diagnosis	
Biliary colic	7
History of cholecystitis	3
History of biliary pancreatitis	1
Median BMI	24 (20–34)
Median operative time (min)	52 (40–77)
Morbidity/mortality	0/0
Median hospital stay (day)	1 (0–1)

*BMI* body mass index

considered normal, with absence of bile duct lesion. Cholangiography was not attempted in the first patients. No intraoperative or postoperative complications were recorded. Median hospital stay was less than 1 (range, 0–1) day.

## Discussion

We describe a new surgical technique for single port access laparoscopic cholecystectomy. Transumbilical single port access cholecystectomy was feasible using standard laparoscopic instruments and offers cosmetic advantage compared with standard laparoscopic approach. Because this surgical approach only reproduced standard cholecystectomy, it may be, until now, safer than NOTES cholecystectomy and it allows intraoperative cholangiography to be performed.

Minimally invasive surgery has become the “gold standard” for cholecystectomy and patient’s choice because of less postoperative pain, better cosmetic results, faster recovery, and earlier return to normal activity [2, 3, 5, 27]. Recent surveys have shown that patients’ favor NOTES cholecystectomy compared with standard laparoscopic cholecystectomy [7, 8]. This may urge us to consider the importance of body image trauma associated with surgical procedure and look for “scarless” surgical procedure [9]. Besides cosmesis, scarless surgery—NOTES or SPA—may decrease parietal trauma, thus decreasing postoperative pain and accelerate recovery.

NOTES cholecystectomies have been successfully performed around the world through transvaginal or transgastric approach [12–17]. In all cases, except one [16], at least one transparietal access was necessary to perform the cholecystectomy [13–16]. In this regard, umbilical SPA cholecystectomy is not more invasive than NOTES because it does not involve an additional transluminal access [28, 29].

SPA cholecystectomy could be performed by using standard straight laparoscopic instruments, which have



been used for decades; whereas for the NOTES procedure, it is urgent for adapted instruments to be developed [9, 28, 30]. This represents a safety concern, as use of standard laparoscopic instruments enable to conform to surgical principles of standard cholecystectomy, which have to be bypassed during NOTES cholecystectomy and may expose patients to additional risk [31]. Moreover, the NOTES procedure implicates the use of newly developed instrument being investigated, whereas the widespread diffusion of SPA cholecystectomy will not be restrained due to material concerns [14, 31, 32].

During NOTES or single port transumbilical cholecystectomy, intraoperative cholangiographies have never been reported [12–17, 28, 29, 31, 33, 34], whereas with the present technique of SPA cholecystectomy, cholangiography was easily performed. Whether routine intraoperative cholangiography should be performed is matter of debate [26, 35, 36]. However, because the risk of biliary tree lesion could be higher with these new approaches, SPA and NOTES cholecystectomies and intraoperative cholangiography should probably be performed to detect accidental biliary tract lesions to avoid dramatic postoperative complications [26, 31].

While surgeons develop techniques for scarless cholecystectomies through NOTES or SPA approach, concern should focus on the safety of these new surgical procedures [9, 30, 32, 37]. In this regard, SPA cholecystectomy according to the present technique seems to be appropriate for routine clinical application in the near future and may represent a step toward NOTES diffusion in clinical practice.

## Conclusions

Single port access cholecystectomy is feasible and seems to be safe using the described technique when performed by experienced laparoscopic surgeons. SPA cholecystectomy may have the advantage compared with the NOTES approach to offer the safety of laparoscopic cholecystectomy. It has to be determined whether this approach would benefit patients, other than cosmesis, compared with standard laparoscopic cholecystectomy.

## References

- Kreus F, Werner J, Gooszen H et al (2008) Randomized clinical trial of small-incision and laparoscopic cholecystectomy in patients with symptomatic cholelithiasis. *Arch Surg* 143:371–377
- Purkayastha S, Tilney H, Georgiou P et al (2007) Laparoscopic cholecystectomy versus mini-laparotomy cholecystectomy: a meta-analysis of randomised control trials. *Surg Endosc* 21:1294–1300
- Novitsky Y, Kercher K, Czerniach D et al (2005) Advantages of mini-laparoscopic vs conventional laparoscopic cholecystectomy: results of a prospective randomized trial. *Arch Surg* 140:1178–1183
- Yuan R, Lee W, Yu S (1997) Mini-laparoscopic cholecystectomy: a cosmetically better, almost scarless procedure. *J Laparoendosc Adv Surg Tech A* 7:205–211
- Lomanto D, De Angelis L, Ceci V et al (2001) Two-trocar laparoscopic cholecystectomy: a reproducible technique. *Surg Laparosc Endosc Percutan Tech* 11:248–251
- Ramachandran C, Arora V (1998) Two-port laparoscopic cholecystectomy: an innovative new method for gallbladder removal. *J Laparoendosc Adv Surg Tech A* 8:303–308
- Varadarajulu S, Tamhane A, Drelichman E (2008) Patient perception of natural orifice transluminal endoscopic surgery as a technique for cholecystectomy. *Gastrointest Endosc* 67:854–860
- Li W, Xiao J (2008) Investigation for acceptance of natural orifice transluminal endoscopic surgery by inpatients with digestive disease. *Gastrointest Endosc* 67:AB120
- Bucher P, Pugin F, Morel P et al (2008) Scarless surgery: myth or reality through NOTES? *Rev Med Suisse* 4:1550–1552
- Bucher P, Pugin F, Morel P (2008) Single port access laparoscopic right hemicolectomy. *Int J Colorectal Dis* 23:1013–1016
- Kaouk J, Haber G, Goel R et al (2008) Single-port laparoscopic surgery in urology: initial experience. *Urology* 71:3–6
- Forgione A, Maggioni D, Sansonna F et al (2008) Transvaginal endoscopic cholecystectomy in human beings: preliminary results. *J Laparoendosc Adv Surg Tech A* 18:345–351
- Zorron R, Maggioni L, Pombo L et al (2008) NOTES transvaginal cholecystectomy: preliminary clinical application. *Surg Endosc* 22:542–547
- Zornig C, Mofid H, Emmermann A et al (2008) Scarless cholecystectomy with combined transvaginal and transumbilical approach in a series of 20 patients. *Surg Endosc* 22(6):1427–1429
- Bessler M, Stevens P, Milone L et al (2008) Transvaginal laparoscopic cholecystectomy: laparoscopically assisted. *Surg Endosc* 22(7):1715–1716
- Scott D, Tang S, Fernandez R et al (2007) Completely transvaginal NOTES cholecystectomy using magnetically anchored instruments. *Surg Endosc* 21:2308–2316
- Marescaux J, Dellemagne B, Perretta S et al (2007) Surgery without scars: report of transluminal cholecystectomy in human being. *Arch Surg* 142:823–826
- Bucher P, Pugin F, Morel P (2008) Minimally invasive necrosectomy for infected necrotizing pancreatitis. *Pancreas* 36:113–119
- Ponsky J, Cherullo E, Sawyer M et al (2008) Single access site laparoscopic radical nephrectomy: initial clinical experience. *J Endourol* 22:663–666
- Pearl J, Ponsky J (2007) Natural orifice transluminal endoscopic surgery: a critical review. *J Gastrointest Surg* 12(7):1293–1300
- Bucher P, Pugin F, Morel P (2008) Single port access laparoscopic radical left colectomy in humans. *Dis Colon Rectum* (in press)
- Kaouk J, Palmer J (2008) Single-port laparoscopic surgery: initial experience in children for varicelectomy. *BJU Int* 102(1):97–99
- Desai M, Rao P, Aron M et al (2008) Scarless single port transumbilical nephrectomy and pyeloplasty: first clinical report. *BJU Int* 101:83–88
- Ates O, Hakguber G, Olguner M et al (2007) Single-port laparoscopic appendectomy conducted intracorporeally with the aid of a transabdominal sling suture. *J Pediatr Surg* 42:1071–1074
- Navarra G, Ascanelli S, Sortini D et al (2002) Laparoscopic transabdominal suspension suture. *Surg Endosc* 16:1378

26. Gigot J (2007) Bile duct injury during laparoscopic cholecystectomy. *J Chir* 144:383–384
27. Keus F, De Jong J, Gooszen H et al (2006) Laparoscopic versus open cholecystectomy for patients with symptomatic cholelithiasis. *Cochrane Database Syst Rev* 2006 Oct 18; CD006231
28. Cuesta M, Berends F, Veenhof A (2008) The “invisible cholecystectomy”: a transumbilical laparoscopic operation without a scar. *Surg Endosc* 22:1211–1213
29. Navarra G, Ascanelli S, Sortini D et al (1997) One-wound laparoscopic cholecystectomy. *Br J Surg* 84:695
30. ASGE, SAGES (2006) ASGE/SAGES Working Group on Natural Orifice Translumenal Endoscopic Surgery White Paper 2005 *Gastrointest Endosc* 63:199–203
31. Palanivelu C, Rajan P, Ranqarajan M et al (2008) Transumbilical flexible endoscopic cholecystectomy in humans: first feasibility study using hybrid technique. *Endoscopy* 40:428–431
32. Pomp A (2008) Notes on NOTES: the emperor is not wearing any clothes. *Surg Endosc* 22:283–284
33. Aftinos J, Forrester G, Binenbaum S et al (2008) Single incision laparoscopic cholecystectomy using flexible endoscopy: saline infiltration gallbladder fossa dissection technique. SAGES abstract book 325
34. Osborne D, Boe B, Rosemurgy A et al (2005) Twenty-millimeter laparoscopic cholecystectomy: fewer ports results in less pain, shorter hospitalization, and faster recovery. *Am Surg* 71:298–302
35. Nickkholgh A, Soltaniyekta S, Kalbasi H (2006) Routine versus selective intraoperative cholangiography during laparoscopic cholecystectomy: a survey of 2130 patients undergoing laparoscopic cholecystectomy. *Surg Endosc* 20:868–874
36. Ludwig K, Bernhardt J, Lorenz D (2002) Value and consequences of routine intraoperative cholangiography during cholecystectomy. *Surg Laparosc Endosc Percutan Tech* 12: 154–159
37. Buess G, Cuschieri A (2007) Raising our heads above the parapet: ES not NOTES. *Surg Endosc* 21:835–837