Day case laparoscopic cholecystectomy in patients with high BMI: Experience from a UK centre

A Tandon¹, G Sunderland¹, QM Nunes^{1,2}, N Misra¹, M Shrotri¹

¹Aintree University Hospital, Liverpool, UK

²Royal Liverpool & Broadgreen University Hospitals NHS Trust, UK

ABSTRACT

INTRODUCTION Symptomatic gall stones may require laparoscopic cholecystectomy (LC), which is one of the most commonly performed general surgical operations in the western world. Patients with a high body mass index (BMI) are at increased risk of having gall stones, and are often considered at high risk of surgical complications due to their increased BMI. We believe that day case surgery could nevertheless have significant benefits in terms of potential cost savings and patient satisfaction in this population. We therefore compared the outcomes of day case patients undergoing LC stratified by BMI, with a specific focus on the safety and success of the procedure in obese and morbidly obese groups.

METHODS We reviewed a database of day case procedures performed between January 2004 and December 2012, including all patients with symptomatic gall stone disease who underwent LC. The patients were divided in four BMI groups: less than 25 kg/m², 25–29 kg/m², 30–39 kg/m² and 40 kg/m² or above.

RESULTS The overall success rate for day case surgery was 78%. There were no significant differences in rates of intra-abdominal collection or readmission with increasing BMI. However, increasing BMI was associated with a significant increase in the rate of wound infection.

CONCLUSIONS LC in patients with a high BMI is safe and can be performed effectively as a day case procedure.

KEYWORDS

Body mass index – Laparoscopic cholecystectomy – Day case – Complications

Accepted 6 December 2015

CORRESPONDENCE TO

Ashutosh Tandon, E: drashutoshtandon@gmail.com

Laparoscopic cholecystectomy (LC) has replaced open cholecystectomy as the treatment of choice for symptomatic gallstones and is now one of the most commonly performed general surgical operations in western Europe and the USA. In 2012–13, more than 69,000 cholecystectomies were performed within the UK's National Health Service (NHS), while around 1.5 million were performed in the USA over the same period.^{1,2} LC offers multiple advantages to the patient over the open procedure, including reduced postoperative pain, faster recovery and improved cosmesis.^{3–5} There are further advantages to the surgeon and healthcare service, including improved surgical access in obese patients and shorter hospital stays.^{6–8}

Since the publication of the NHS plan in 2000, which recommended that 75% of all surgery should be carried out on a day-case basis, day case surgery has gained popularity in the UK.⁹ High body mass index (BMI) is a well-established risk factor for the formation of gallstones and, as a result, a large proportion of patients who require surgery for gallstone disease fall into the overweight (BMI 25–29 kg/m²), obese (BMI 30–39 kg/m²) or morbidly obese (BMI ≥40 kg/m²)

categories.¹⁰ While these patients have long been assumed to present additional anaesthetic risk, recent increases in the practice of bariatric surgery and the widening of the criteria for fitness for surgery has suggest that this risk may have been overestimated.^{8,11–15} Previous studies have shown similar rates of postoperative complications in obese and non-obese groups.^{7,14–21} Indeed, the only consistent difference between the groups has been increased operating time.^{22–26} The exclusion of patients from day case LC on the apparently arbitrary basis of having a high BMI may have a significant impact on the cost savings and patient satisfaction benefits associated with this procedure.

We compared the outcomes of day case LC in patients stratified by BMI, with a specific focus in the safety and success of the procedure in obese and morbidly obese groups.

Methods

A database of day case LC by a single surgeon in a university teaching hospital was prospectively maintained

between January 2004 and December 2012. The records of all patients with symptomatic gall stone disease undergoing day case LC were retrospectively analysed, with the OPCS Classification of Interventions and Procedures codes J18.3 for "total cholecystectomy" and Y75.2 for "laparoscopic approach to abdominal cavity" used to verify the completeness of case coverage.

The local eligibility criteria for day case surgery included the following: American Society of Anesthesiologists (ASA) physical status classification system grade 1 or 2 disease, or ASA grade 3 disease that is not incapacitating; the acceptability of the procedure to the patient; the patient living within an hour's travel of the hospital; the presence of an able-bodied adult to look after the patient for 24 hours post-discharge, and suitable accessible to toilet facilities at home; the satisfaction of general health criteria; and fitness for day case general anaesthesia/surgery at preoperative assessment.

The operative technique used in all patients was similar. A pneumoperitoneum was created using a Veress needle via a supra- or infraumbilical incision, which was also used to insert the first port. The position of the first port varied slightly depending on the distance between the umbilicus and the mid point of right costal margin. Where this distance was large, the first port was placed higher in the supraumbilical area to facilitate a better view of Calot's triangle. The remaining ports included an epigastric and two right upper quadrant ports.

The patients were divided into four groups based on their BMI: less than 25 kg/m²; 25–29 kg/m²; 30–39 kg/m²; and 40 kg/m² or above. An intraoperative cholangiogram was not performed in any of the patients.

The patients were followed up at 4–6 weeks postoperatively, either in the outpatient department by the operating surgeon or via a telephone call by a nurse specialist using a list of specified questions. Any patients with complications were subsequently seen in person in the outpatient department. Further follow up was only indicated on the basis of clinical need.

The primary endpoint was successful completion of the episode as a day case. Secondary endpoints were mortality, bile duct injury, conversion to open surgery, duration of surgery and postoperative complications, including infection, retained stones, port site hernia and readmission within 28 days. Data were also recorded on further procedures, including return to theatre, endoscopic retrograde cholangio-pancreatography (ERCP) and interventional radiological drainage of abdominal collection.

Data relating to patient BMI, operating time and intraoperative and immediate postoperative complications was collected retrospectively from scanned patient hospital records. The Clavien-Dindo classification was used to classify postoperative complications that occurred within 30 days of the primary procedure.²⁷

Statistical analysis of the data was performed using Minitab version 15 (Minitab Inc, State College, PA, USA). Continuous variables were analysed using the Mann-Whitney U test; categorical variables were analysed using the chi-squared test. $p < 0.05$ was considered significant.

Results

Data sets for all 571 patients who underwent LC between January 2004 and December 2012 were retrieved. The mean age was 42 years (range 16–78) and the male:female ratio was 1:4. There were no significant demographic differences between the four BMI groups.

Operating times, recorded from the knife-to-skin time to the completion of the surgical closure, ranged from 15 to 240 minutes, at a mean of 46 minutes and an interquartile range of 30. One hundred and forty four (25%) cases were performed by surgical trainees under consultant supervision. The mean operating time for trainee-performed operations was 57 minutes, with no significant difference from the mean operating times of consultant-performed procedures. However, the mean operating time increased significantly with increasing BMI (Table 1).

The overall success rate for day case surgery was 78%, and there were no significant differences in extension to overnight stay between the BMI groups (Table 1). In all, 125 patients stayed in hospital overnight. The reason for non-discharge as a day case was unclear from the records in the majority of cases ($n=51$, 40.8%), while 43 (34.4%) patients stayed overnight for pain control, 7 (5.6%) for observation after a difficult procedure and 7 (5.6%) for sedation. Three (2.4%) patients had bleeding from a port site, which required a return to theatre. The remaining patients stayed overnight for social reasons, or due to low blood pressure, tachycardia and low blood oxygen saturation.

There were no deaths, bile duct injuries or conversions to open surgery in this series. Seventy six complications were recorded and classified using the Dindo Clavien system. Wound infection was the most common postoperative complication, with rates increasing significantly with increasing BMI. There were, however, no significant differences in the rates of intra-abdominal collection nor in the rate of retained stones with increasing BMI (Table 1).

There were no significant differences in the need for incision and drainage nor in the use of antibiotics for wound infection with increasing BMI, and there was no association with radiological drainage of abdominal collection. Wound hernia repairs were significantly more common in the BMI ≥ 40 group, at 4.2% ($p=0.004$) (Table 2). All hernias that presented clinically were repaired surgically on an elective basis.

There was a non-significant increase in the readmission rate with increasing BMI, largely to the increased number of infections (Table 3).

Discussion

A Cochrane review published in 2008 concluded that day case laparoscopic surgery was safe and effective in selected patients.²⁸ This echoed the 1992 guidance from the Royal College of Surgeons, which, while appropriate for the time, takes a very conservative approach to patient selection by excluding patients with BMI >30 kg/m².²⁹ The 2002 NHS modernisation agency guidance recommends

Table 1 Characteristics of patients undergoing day case laparoscopic cholecystectomy

	BMI <25 n=122	BMI 25–29 n=176	BMI 30–39 n=225	BMI ≥40 n=48
Completed as day case	90 (73.7) Reference	135 (76.7) p=0.764	184 (81.8) p=0.364	37 (77.1) p=0.945
Mean duration of surgery (mins)	43 Reference	46 p=0.162	47 p=0.069	55 p=0.003
<i>Clavien Dindo classification of surgical complications</i>				
I	5 (4.1)	10 (5.7)	21 (9.3)	6 (12.5)
II	3 (2.5)	1 (0.6)	0	0
IIIa	3 (2.5)	3 (1.7)	7 (3.1)	0
IIIb	4 (3.3)	3 (1.7)	6 (2.7)	4 (8.3)
<i>Specific complications</i>				
Wound infection	8 (6.6) Reference	12 (6.8) p=0.929	23 (10.2) p=0.09	6 (12.5) p=0.012
Intra-abdominal collection	1 (0.8) Reference	1 (0.6) p=0.91	3 (1.3) p=0.62	0 –
Retained stones	3 (2.5) Reference	3 (1.7) p=0.662	6 (2.7) p=0.648	0 –

All values n (%) unless otherwise stated. Abbreviations: BMI, body mass index

Table 2 Management of complications following day case laparoscopic cholecystectomy

	BMI <25 (n=122)	BMI 25–29 (n=176)	BMI 30–39 (n=225)	BMI ≥40 (n=48)
Wound infections <7 days	5 (4.1) Reference	8 (4.5) p=0.85	13 (5.8) p=0.501	1 (2.1) p=0.522
Wound infections >7 days	3 (2.5) Reference	4 (2.3) p=0.917	10 (4.4) p=0.352	5 (10.4) p=0.027
Antibiotics for wound infection	5 (4.1) Reference	9 (5.1) p=0.673	8 (3.6) p=0.797	4 (8.3) p=0.261
Incision and drainage for wound infection	3 (2.5) Reference	3 (1.7) p=0.648	5 (2.2) p=0.453	2 (4.2) p=0.255
Antibiotics for abdominal collection	1 (0.8) Reference	1 (0.6) p=0.91	2 (0.9) p=0.79	0 –
Radiological drainage of abdominal collection	8 (6.6) Reference	12 (6.8) p=0.929	23 (10.2) p=0.092	0 –
ERCP	3 (2.5) Reference	3 (1.7) p=0.662	6 (2.7) p=0.648	0 –
Hernia repair	1 (0.8) Reference	1 (0.6) p=0.91	2 (0.9) p=0.79	2 (4.2) p=0.004

All values n (%). Abbreviations: BMI, body mass index; ERCP, endoscopic retrograde cholangio-pancreatography

that patients with BMI below 35 who do not have significant comorbidity should be considered as suitable for day case surgery.⁵⁰ The most up-to-date joint guidance from the Association of Anaesthetists of Great Britain and Ireland and the British Association of Day Surgery, published in 2011, recommends that patients' fitness for surgery

should be determined at the preoperative assessment and not be limited to assessment of BMI alone.¹² As a result, the proportion of surgeries performed in the UK as day case has grown from 8.8% to 35% over the last 5 years.¹

LC is a very commonly performed operation. Our study presents a large series of day case LCs, and is the first to

Table 3 Readmission within 28 days following day case laparoscopic cholecystectomy

	BMI <25 (n=122)	BMI 25–29 (n=176)	BMI 30–39 (n=225)	BMI ≥40 (n=48)
Readmissions	13 (10.6)	18 (10.2)	30 (13.3)	6 (12.5)
Infection	8 (6.6)	12 (6.8)	23 (10.2)	6 (12.5)
Pain (no cause identified)	–	2 (1.1)	–	–
Retained stones	3 (2.5)	3 (1.7)	6 (2.7)	–
Abdominal collection	1 (0.8)	1 (0.6)	3 (1.3)	–
All values n (%). Abbreviations: BMI, body mass index				

specifically assess the safety of this procedure in a morbidly obese cohort. We have found that day case LC is safe in obese and morbidly obese patients, with no significant increase in extension to overnight stay. Our investigation is limited to some degree by its retrospective design and by the unequal size of the groups studied, specifically the small number of morbidly obese patients (n=48).

The only significant differences witnessed with increasing BMI were in mean operating time, wound infections and wound hernias. Wound complications such as infection and hernia are more common in patients with high BMI in our series, and this reflects the results of studies of both of day case and inpatient LCs.^{18,31} The non-significant increase in readmission in patients with a high BMI is perhaps currently unavoidable in the NHS, as the majority of postoperative port site abscesses are treated with incision and drainage under a general anaesthetic. Wound infection rates are difficult to assess, as not every patient with a wound infection is admitted to hospital or followed up; indeed, the majority of patients are treated in the community with simple antibiotics. The coverage of complication rates from case notes and records of telephone follow-up may also be incomplete. Furthermore, the application of the Clavien-Dindo classification, which we used to classify postoperative complications, may be debatable in a day case scenario. For example, class IIIb complications included all incision and drainage procedures under general anaesthetic, thus potentially over-emphasising the seriousness of the complications.

The mean difference in operating times between the normal BMI and morbidly obese groups was 8 minutes, representing a 17% increase. In practical terms, this is unlikely to adversely affect the running of operating lists when one considers that surgical operating time accounts for only a fraction of the total operation duration. From our experience, this increase in operating time is largely due to difficulties encountered at port insertion and closing the port sites, resulting from increased subcutaneous fatty tissue. The cholecystectomy itself is no more difficult in obese patients, and a number of authors have suggested that the laparoscopic approach is better suited to patients with high BMIs than is the open approach.^{7,15,17,25}

The main advantages to performing LC as a day case, and therefore the driving force behind expansion of day case services, are improved patient satisfaction and improved recovery and reductions in the risk of hospital acquired infections and thromboembolic complications, as well as a reduction in the costs associated with hospital inpatient stay and the demand for inpatient beds.^{12,15,28} The total cost estimate obtained from the finance department in the trust is £1986 for a day case LC, which increases to £3006 in the event of an overnight stay. This is a considerable expenditure increase for a trust. A number of previous studies have quoted the cost reduction benefit of day case over inpatient cholecystectomy as ranging between 11% and 47%.^{32–35} An important factor to consider in the evaluation of this cost benefit is the increased expense associated with unplanned admissions, which adds up to 30% due to the increased length of stay.³⁴ We believe that, for the full benefit of these cost savings to be realised, day case services need to rolled out to the maximum possible number of patients.

The impact that a pressurised, target-driven day case practice has on surgical training opportunities and the training environment remains to be fully explored. A significant proportion (25%) of the cases within our series were performed by surgical trainees, who were, by and large, experienced and in their middle or later years of training. There was no significant difference in the operating times between consultant and trainees, or in safety of the procedure. We do not feel that this small increase in the operating time would have an impact on the running of the operating list. Previous studies have found comparable results and we therefore do not feel that the expansion of day case treatment should adversely affect surgical training.^{34,36}

Conclusions

LC in patients with a high BMI is safe and can be performed effectively as a day case procedure, which would be associated with substantial cost benefits. Operative and anaesthetic risk is multifactorial and a narrow view of fitness for surgery based on isolated and non-evidenced parameters, such as BMI, is not useful or appropriate. A

thorough preoperative assessment is crucial to identify candidates who are best-suited to day case surgery.

Funding

There is no funding received for this study.

References

1. Tuech JJ, Regenet N, Hennekinne S *et al.* Laparoscopic colectomy for sigmoid diverticulitis in obese and nonobese patients: a prospective comparative study. *Surg Endosc* 2001; **15**: 1427–1430.
2. Gurusamy KS, Koti R, Fusai G *et al.* Early versus delayed laparoscopic cholecystectomy for uncomplicated biliary colic. *Cochrane Database Syst Rev* 2013; **6**: CD007196.
3. Keus F, de Jong JA, Gooszen HG *et al.* Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. *Cochrane Database Syst Rev* 2006; CD006231.
4. Dubois F, Berthelot G, Levard H. Coelioscopic cholecystectomy: experience with 2006 cases. *World J Surg* 1995; **19**: 748–752.
5. McMahon AJ, Russell IT, Baxter JN *et al.* Laparoscopic versus minilaparotomy cholecystectomy: a randomised trial. *Lancet* 1994; **343**: 135–138.
6. Schirmer BD, Dix J, Edge SB *et al.* Laparoscopic cholecystectomy in the obese patient. *Ann Surg* 1992; **216**: 146–152.
7. Miles RH, Carballo RE, Prinz RA *et al.* Laparoscopy: the preferred method of cholecystectomy in the morbidly obese. *Surgery* 1992; **112**: 818–22; discussion 822.
8. Smith I. Laparoscopic cholecystectomy in the obese day case patient: Is there a problem. *Journal of One-day Surgery* 2004; **14**: 32–34.
9. Kamoun S, Alves A, Bretagnol F *et al.* Outcomes of laparoscopic colorectal surgery in obese and nonobese patients: a case-matched study of 180 patients. *Am J Surg* 2009; **198**: 450–455.
10. Erlinger S. Gallstones in obesity and weight loss. *Eur J Gastroenterol Hepatol* 2000; **12**: 1347–1352.
11. Atkins M, White J, Ahmed K. Day surgery and body mass index: results of a national survey. *Anaesthesia* 2002; **57**: 180–182.
12. Kumar C, Page R, Smith I *et al.* Day case and short stay surgery: 2. *Anaesthesia* 2011; **66**: 417–434.
13. Vaughan J, Gurusamy KS, Davidson BR. Day-surgery versus overnight stay surgery for laparoscopic cholecystectomy. *Cochrane Database Syst Rev* 2013; **7**: CD006798.
14. Paajanen H, Kakela P, Suuronen S *et al.* Impact of obesity and associated diseases on outcome after laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech* 2012; **22**: 509–513.
15. Chang WT, Lee KT, Huang MC *et al.* The impact of body mass index on laparoscopic cholecystectomy in Taiwan: an oriental experience. *J Hepatobiliary Pancreat Surg* 2009; **16**: 648–654.
16. Simopoulos C, Botaitis S, Karayiannakis AJ *et al.* The contribution of acute cholecystitis, obesity, and previous abdominal surgery on the outcome of laparoscopic cholecystectomy. *Am Surg* 2007; **73**: 371–376.
17. Harju J, Juvonen P, Eskelinen M *et al.* Minilaparotomy cholecystectomy versus laparoscopic cholecystectomy: a randomized study with special reference to obesity. *Surg Endosc* 2006; **20**: 583–586.
18. Sperlongano P, Pisaniello D, Parmeggiani D *et al.* Laparoscopic cholecystectomy in the morbidly obese. *Chirurgia italiana* 2001; **54**: 363–366.
19. Ammori BJ, Vezakis A, Davides D *et al.* Laparoscopic cholecystectomy in morbidly obese patients. *Surg Endosc* 2001; **15**: 1336–1339.
20. Gatsoulis N, Koulas S, Kiparos G *et al.* Laparoscopic cholecystectomy in obese and nonobese patients. *Obes Surg* 1999; **9**: 459–461.
21. Phillips EH, Carroll BJ, Fallas MJ *et al.* Comparison of laparoscopic cholecystectomy in obese and non-obese patients. *Am Surg* 1994; **60**: 316–321.
22. Zdichavsky M, Bashin YA, Blumenstock G *et al.* Impact of risk factors for prolonged operative time in laparoscopic cholecystectomy. *Eur J Gastroenterol Hepatol* 2012; **24**: 1033–1038.
23. Subhas G, Gupta A, Bhullar J *et al.* Prolonged (longer than 3 hours) laparoscopic cholecystectomy: reasons and results. *Am Surg* 2011; **77**: 981–984.
24. Angrisani L, Lorenzo M, De Palma G *et al.* Laparoscopic cholecystectomy in obese patients compared with nonobese patients. *Surg Laparosc Endosc* 1995; **5**: 197–201.
25. Unger SW, Unger HM, Edelman DS *et al.* Obesity: an indication rather than contraindication to laparoscopic cholecystectomy. *Obes Surg* 1992; **2**: 29–31.
26. Unger SW, Scott JS, Unger HM *et al.* Laparoscopic approach to gallstones in the morbidly obese patient. *Surg Endosc* 1991; **5**: 116–117.
27. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004; **240**: 205–213.
28. Gurusamy KS, Junnarkar S, Farouk M *et al.* Day-case versus overnight stay in laparoscopic cholecystectomy. *Cochrane Database Syst Rev* 2008; CD006798.
29. Commission on the Provision of Surgical Services. *Guidelines for Day Case Surgery. A Report of the Royal College of Surgeons of England, revised edition.* London: Royal College of Surgeons of England, 1992.
30. NHS Modernisation Agency. *National Good Practice Guidance on Pre-Operative Assessment for Inpatient Surgery.* London: The Stationery Office, 2003.
31. Comajuncosas J, Hermoso J, Gris P *et al.* Risk factors for umbilical trocar site incisional hernia in laparoscopic cholecystectomy: a prospective 3-year follow-up study. *Am J Surg* 2014; **207**: 1–6.
32. Prasad A, Foley RJ. Day case laparoscopic cholecystectomy: a safe and cost effective procedure. *Eur J Surg* 1996; **162**: 43–46.
33. Rosen MJ, Malm JA, Tarnoff M *et al.* Cost-effectiveness of ambulatory laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech* 2001; **11**: 182–184.
34. Jain PK, Hayden JD, Sedman PC *et al.* A prospective study of ambulatory laparoscopic cholecystectomy: training economic, and patient benefits. *Surg Endosc* 2005; **19**: 1082–1085.
35. Victorzon M, Tolonen P, Vuorialho T. Day-case laparoscopic cholecystectomy: treatment of choice for selected patients? *Surg Endosc* 2007; **21**: 70–73.
36. Skattum J, Edwin B, Trondsen E *et al.* Outpatient laparoscopic surgery: feasibility and consequences for education and health care costs. *Surg Endosc* 2004; **18**: 796–801.