ORIGINAL ARTICLE

EMERGENCY LAPAROSCOPIC CHOLECYSTECTOMY: IS DEDICATED HOT GALL BLADDER LIST COST EFFECTIVE?

Saad Ullah Khan, Jun Yi Soh*, Nazli Muhibullah, Aikaterini Peleki***, Muhammad Abdullah, Peter William Waterland**

General Surgery, Dudley Group NHS Foundation Trust, West Midlands, *University Hospitals of Birmingham, NHS Foundation Trust, Queen Elizabeth Hospital, **Russell's Hall Hospital, ***Nottingham City Hospital-United Kingdom

Background: Acute presentation of gall stone disease is a common emergency. Resource limitation often results in unnecessary long waiting times and repeat hospital admissions. The aim of this study was to investigate if funding a dedicated hot gall bladder list is justified. **Methods:** Patients with acute gall stone related complications between 1st January 2016 and 31st December 2017 were studied. Outcome measures included the number of acute admissions, length of hospital stay (LOS), approximate cost per patient. The length of stay was identified as a critical outcome measure. **Results:** Fourteen hundred and ninety-five (11%) out of 14189 acute surgical admissions were related to gall stone complications. These included acute cholecystitis 576 (39%), biliary colic 485 (32%), pancreatitis 405 (27%) and jaundice 34 (2%). Twelve hundred and twenty-two patients accounted for 1461 admissions. 182 (15%) patients had recurrent admissions (35%) and on average stayed 11.2 days in the hospital compared to 5.8 days for that of single presentation. The cost of emergency LC (£2053) was less than half of elective LC following single emergency admission (£5661) and less than one third of Elective LC following recurrent admissions (£7453). A trust can save £1,891,784 per year by achieving 80% target. The savings can be used to fund a dedicated hot gall bladder list, releasing hospital beds and additional benefit of reducing the workforce days lost to sickness in general. **Conclusion:** Emergency LC is cost effective and savings made for such a service is sufficient to fund a dedicated hot gall bladder list.

Keywords: Laparoscopic; Cholecystectomy; Laparoscopic cholecystectomy; Cost-Benefit Analysis; Hospital Costs; Cost Savings; Costs and Cost Analysis

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INTRODUCTION

Gallstone (GS) disease affects 10–15% of the adult population in the UK and over two third of these people are asymptomatic. A small proportion (about 20%) of these people will develop symptoms, ranging from simple biliary colics to life threatening acute Cholecystitis, cholangitis, pancreatitis and jaundice.[1] Asymptomatic stones found in a normal gallbladder and normal biliary tree do not need treatment. Laparoscopic cholecystectomy (LC) is curative treatment for symptomatic gall stone disease. About 66,660 cholecystectomies are performed every year in the UK, costing about £111.6 million.[1] Waiting time for the elective LC is generally long. Conservative treatment for acute cholecystitis followed by delayed LC may be associated with problems. After the initial attack has settled, 20–30% of patients develop recurrent symptoms requiring further hospital admissions with associated cost.[2] The anatomy may be unfavourable during subsequent operation.

National Institute for Health and Care Excellence (NICE) recommend that patients presenting with acute cholecystitis should have LC within a week, those with common bile duct stones (CBDS) causing jaundice have endoscopic retrograde cholangiopancreatography (ERCP) within 72 hours and those with CBDS who need emergency ERCP should have within 24 hours of diagnosis.[3] Gallstone related diseases account for about one third of emergency general surgery (EGS) admissions. The average length of stay for acute GS (gallstone) presentations to LC is approximately 7 days in some regions in the United Kingdom. There is a wide variation in management strategies for gall stone disease. Emergency cholecystectomy rates within 10 days following an attack of acute cholecystitis or pancreatitis range from 0.2–35% in acute hospital trusts.[4] There is evidence to suggest that patient with gallstone pancreatitis in less severe cases should have LC during the index admission.[5]

Emergency LC is safe, cost effective[6–8] and is associated with reduced hospital stays and no difference in rates of conversion to open cholecystectomy, morbidity, or mortality[9]. Resource limitation and organisational issues often result in unnecessarily long waiting times. This can result in repeat hospital admissions for recurrent symptoms. The aim of this study was to quantify the cost associated with delayed LC and to investigate if the potential cost savings of early LC are enough to justify resource allocation to a dedicated hot gallbladder operating list.

MATERIAL AND METHODS

Acute surgical admission patient data was collected retrospectively from a prospectively maintained electronic

medical record system (Soarian Clinical systems) in a busy district general hospital, serving a population of around 450,000 people. All patients admitted to the acute surgical admission unit from 1st January 2016 to 31st December 2017 were included for interrogation of data. Patients who presented with gall stone related complications, including, biliary colics, cholecystitis, obstructive jaundice and pancreatitis were selected for analysis. Patient's demographics, the number of hospital admission episodes, total length of hospital stay (LOS) were recorded. Elective LC patient data over the same 2-year period was also analysed for comparison. Outcome measures of interest included, the number of acute admission episodes, total LOS, estimated average cost per patient. The length of stay was identified as critical outcome; it is assumed that the extra cost of a delayed LC is mainly due to the additional length of stay. The average point of delivery cost and length of stay of all elective and non-elective laparoscopic cholecystectomies was calculated and a cost per bed day was estimated from Department of Health (DOH) reference cost 2015–16.[11] Using these fixed and bed day costs and the average length of stay, baseline costs for each operation are calculated. Statistical software SPSS version 19 and Microsoft Excel were used to store and analyse the above data. Variables were summarized as frequencies and percentages, means, medians, standard deviations and inter-quartile ranges as appropriate. Comparisons of means were examined using a t-test when normally distributed and the Mann-Whitney U test where data was non-parametric.

RESULTS

A total of 14189 acute surgical admissions over the study period were identified. Out of these, 1495 (11%) were associated with gall stone related complications. There were 556 (37%) males to 939 (63%) females with male to female ratio of 1:1.68 and the median age was 53 years. 571 (38%) presented with acute cholecystitis, 485 (32%) with biliary colic, 405 (27%) admissions with pancreatitis. Twenty-nine patients accounting for 34 (2%) admissions were relating to jaundice and they were not included in the calculations as the approach to the initial management of these patients is not uniform throughout the world. Detailed results are displayed in table-1.

Table-1: Gall stones related admissions

Diagnosis	Number of patients	Total admissions	LOS* in days
Acute Cholecystitis (n=571)			
Single admission	439	439	
2 admissions	51	102	
3 admissions	7	21	
4 admissions	1	4	
5 or more admissions	1	5	
Total recurrent admissions	60 (12%)	132 (23%)	
Total	499	571	
Average stay			7.0
Single presenters			6.6
Repeat presenters			10.3
Biliary Colic (n=485)			
Single admission	345	345	
2 admissions	46	92	
3 admissions	6	18	
4 admissions	2	8	
5 or more admissions	3	22	
Total recurrent admissions	57 (15%)	140 (29%)	
Total	402	485	
Average stay			3.1
Single admissions			3.0
Repeat admissions			3.6
Pancreatitis (n=405)			
Single admission	255	255	
2 admissions	53	106	
3 admissions	9	27	
4 admissions	3	12	
5 or more admissions	1	5	
Total recurrent admissions	66 (21%)	150 (37%)	
Total	321	405	
Average stay			10.1
Single admissions			8.2
Repeat admissions			17.5
Overall presentations			
Total	1222	1461	
Single admissions	1039 (85%)	1039	
2 admissions	150 (12%)	300	
3 admissions	22 (1.8%)	66	
4 admissions	6 (0.4%)	26	
5 or more admissions	4 (0.3%)	32	
Average stay			6.9
Single admissions			5.8
Repeat admissions			11.2

A total of 1222 patients accounted for 1461 admissions. One hundred and eighty-three (15%) patients presented at least twice during the 2-year study period and accounted for 422 admissions (35%) and on average stayed 11.2 days in the hospital compared to 5.8 days for patients that had single presentation and on average the LOS was 6.9 days. The interval between repeat admissions was 53.4 days for acute cholecystis, 32.7 days for biliary colics and 102.6 days for that of pancreatitis. Table-2 shows length of hospital stay in the study population and also waiting times for elective LC in the local region.

Out of 1222 patients, 35 acute admissions underwent emergency LC on a non-dedicated list due to chance availability of theatre space & staff. These patients had an average LOS of 3.6 days.

A sample population of elective LC over the study period was analysed, a total of 708 patients were operated on, out of these, 671 patients originated from emergency admissions as delayed elective LC. Average LOS for this group was 0.86 days. Table-3 shows approximate cost calculations at the point of delivery.

Table-2: Length of hospital stay and waiting times

Length of hospital stay	**Days**
Average	6.9
Single admission episode	5.8
Recurrent admissions	11.2
Elective LC during the study period (n = 708)	0.86
Non-dedicated emergency LC (n = 35)	3.6
World literature emergency LC	1.0
Interval between repeat admissions	
Average: (10.2 weeks)	72
1st to 2nd admission: (10.9 weeks)	76
Subsequent admissions: 63 (9.0 weeks)	63
Elective gallbladder surgery waiting times West Midlands[10]	
Russell's Hall Hospital: (18 weeks)	126
Rowley Regis Hospital: (18 weeks)	126
West Midlands Hospital*: (15 weeks)	105
Sandwell District General Hospital:(18 weeks)	126
Queen Elizabeth Hospital Birmingham: (23 weeks)	161
Heartlands Hospital: (20 weeks)	140
BMI, The Edgbaston Hospital*: (12 weeks)	84

*Non-NHS provider

Table-3: Cost analysis: Point of delivery

Point of delivery	**2015-16 (£)[1]**
Day case	733
Elective inpatient (excluding excess bed days)	3,749
Non-elective inpatient (excluding excess bed days)	1,609
Excess bed day	306
Outpatient attendance	117
A&E attendance	13
Cost per patient:	**Cost (£)**
• 1st timers' cost (5.8 day stay), no LC	1,913
• 1st timers' cost + elective LC (1 day stay	5,661
• Repeat cost (2 times) (11.2 day stay)	3,704
• Repeat cost (2 times) + elective LC	7,453
• Dedicated Emergency LC (1 day stay)	2,053
• Savings per year from repeat presenters	2,364,730
Running cost of operation theatre[12]	**Cost (£)**
• Per hour (average)	1,200
• Per 4-hour session	4,800
• Weekly session per year	249,600
• 3 sessions a week per year	748,800
Medical and Nursing staff Pay[13–15]	**Cost (£)**
• Consultant Surgeon	76,761–103,490
• Consultant Anaesthetist	76,761–103,490
• Registrar	45,750
• Core trainee	36,100
• Foundation year	26,350–30,350
• Nurse band 1-6	15,404–35,577

DISCUSSION

Early LC for acute presentation of gall stone disease was initially fraught with fear of higher morbidity and conversion rate but the current evidence is clearly in favour of early procedure, a reduction in the hospital stay of around 4 days have been reported.[16] Conservative treatment of acute cholecystitis followed by delayed LC puts around one third of patients at the risk of having other acute episode and further delay in having the elective operation. Within

the National Health Service of the UK, the adoptability of early LC for acute gall stone disease is extremely variable. The most important factors responsible for the poor take of emergency LC are variation in the workforce, organisational and operational problems.[17]

The most common issue seems to be the lack of availability of theatre space and the workforce due to categorisation of emergency cases. This puts the LC cases back in the queue with resultant unacceptably long waits amid uncertainty of exact timing of operation. As a result, most clinicians are reluctant to list such patients on the emergency lists. The most feasible solution is a dedicated list for emergency LC commonly called "Hot gall bladder list". Royal College of Surgeons (RCS) in October 2016 set a standard to aim for 80% of eligible, admitted patients to receive their cholecystectomy within 8 days of presentation at hospital, in line with NICE guidance.[18]

Our data suggests that, on average 15% of the patient with gall stone related problem will have recurrent admissions, notably pancreatitis having the highest recurrent admission rate (21%). Approximate interval between recurrent admissions is around 10 weeks. As the data was captured in a fixed time period, the number could be higher at the extremes of data collection period. We performed 35 emergency and 708 elective LCs during the study period, out of which 671 cases originated from emergency admissions as delayed LC. This suggests around 95% of gall stone related complication present as emergencies at least in our trust. This leaves 37 (5%) patients who are direct referrals from General Practioners (GP) to the elective surgical clinics. One hundred and eighty-two (15%) patients have recurrent episodes amounting to 35% of the emergency admissions causing additional burden on an already strained system. This all leads to a snow ball effect with tremendous pressure on hospital beds and extremely high financial impact on NHS budget.

The cost of Emergency LC (£2053) on a dedicated hot gall bladder list is estimated to be less than half of the elective LC following first time emergency admission (£5661) and less than one third of the elective LC following recurrent emergency admissions (£7453). By achieving 80% target of emergency LC, the trust can save £1,891,784 (£2,364,730 total saving/year) which is sufficient to fund a dedicated weekday theatre team running every other day for providing such service in addition to cost savings and ease on hospital beds. There is also additional benefit of reducing the workforce days lost to sickness in general.

CONCLUSIONS

Emergency LC on a dedicated hot gall bladder list is cost effective. All acute hospitals should routinely perform emergency LC as soon as possible on acute presentation rather than conservative treatment followed by elective LC.

"*A stitch in time saves nine*" - doing emergency LC on a dedicated list reduces the number of recurrent admissions thus reducing bed days loss, and reduces the workforce lost days to sickness. Furthermore, the cost savings for the hospital could go into funding extra staff to alleviate inadequate staff issues.

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Human rights statements and informed consent: local Institutional board for the clinical audit standards and effectiveness board were informed of the study, ethical approval was not required.

AUTHORS' CONTRIBUTION

SUK: Substantial contribution to conception, design, interpretation of data, drafting, revising, and final approval to be published. JYS: Substantial contribution to design, interpretation of data, drafting, and revising the manuscript. NM: Substantial contribution to design, interpretation of data, drafting, and revising the manuscript. AP: Substantial contribution to design, interpretation of data, drafting, and revising the manuscript. MA: Substantial contribution to design, interpretation of data, drafting, and revising the manuscript. PWW: Substantial contribution to conception, design, interpretation of data, drafting and revising the manuscript.

REFERENCES

1. National Institute of Health and Care Excellence. Gallstone disease: diagnosis and management: Clinical guideline. [Internet]. 2014 [cited 2018 May 30]. Available from: https://www.nice.org.uk/guidance/cg188/chapter/1-Recommendations#diagnosing-gallstone-disease
2. Papi C, Catarci M, D'Ambrosio L, Gili L, Koch M, Grassi GB, *et al*. Timing of cholecystectomy for acute cholecystitis: a meta-analysis. Am J Gastrointerol 2004;99(1):147–55.
3. National Institute for Health and Care Excellence, Gallstone disease: Quality standard. [Internet]. 2015 [cited 2018 Jun 9]. Available from: https://www.nice.org.uk/guidance/qs104
4. Pathway for the Management of Acute Gallstone Diseases. [Internet]. 2015 [cited 2018 May 15]. Available from: http://www.augis.org/wp-content/uploads/2014/05/Acute-Gallstones-Pathway-Final-Sept-2015.pdf
5. Besselink M, van Santvoort H, Freeman M, Gardner T, Mayerle J, Vege SS, *et al*. IAP/APA evidence-based guidelines for the management of acute pancreatitis guideline. Pancreatology 2013;13(4, suppl 2):E1–15.
6. Gurusamy K, Samraj K, Gluud C, Wilson E, Davidson BR. Meta-analysis of randomized controlled trials on the safety and effectiveness of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg 2010;97(2):141–50.
7. Lu J, Cheng Y, Xiong XZ, Lin YX, Wu SJ, Cheng NS. Two-stage vs single-stage management for concomitant gallstones

and common bile duct stones. World J Gastroenterol 2012;18(24):3156–66.
8. Kerwat D, Zargaran A, Bharamgoudar R, Arif N, Bello G, Sharma B, *et al*. Early laparoscopic cholecystectomy is more cost-effective than delayed laparoscopic cholecystectomy in the treatment of acute cholecystitis. Clinicoecon Outcomes Res 2018;10:119–25.
9. Gurusamy KS, Samraj K. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Cochrane Database Syst Rev 2006;18(4):CD005440.
10. National Health Service. Choices: your health, your choices. Gallbladder surgery. [Internet]. 2018 [cited 2018 May 28]. Available from: https://www.nhs.uk/service-search/Gallbladder-surgery/dy12lu/Results/373/-2.11953806877136/52.5042877197266/1370/0?distance=25
11. National Health Service reference costs 2015 to 2016 - GOV.UK [Internet]. [cited 2018 May 29]. Available from: https://www.gov.uk/government/publications/nhs-reference-costs-2015-to-2016
12. NHS, Institute for Innovation and improvement. Improving quality and efficiency in the operating theatre - a lifeline for financial leaders. [Internet]. 2009 [cited 2018 Jun 30]. Available from: http://harmfreecare.org/wp-content/files_mf/Improving-quality-and-efficiency-in-the-operating-theatre.pdf
13. BMA - Pay scales for consultants in England 2017-18. [Internet]. [cited 2018 May 29]. Available from: https://www.bma.org.uk/advice/employment/pay/consultants-pay-england
14. BMA - Pay scales and guidance for medical academics. [Internet]. [cited 2018 May 29]. Available from: https://www.bma.org.uk/advice/employment/pay/medical-academics-pay
15. Royal college of Nursing. National Health Service Pay scale 2017-18. [Internet]. [cited 2018 July 2]. Available from: https://www.rcn.org.uk/employment-and-pay/nhs-pay-scales-2017–18
16. Gurusamy KS, Nagendran M, Davidson BR. Early versus delayed laparoscopic cholecystectomy for acute gallstone pancreatitis. Cochrane Database Syst Rev 2013;(9):CD010326.
17. Nuffieldtrust, Evidence for better health care. Emergency general surgery: challenges and opportunities. [Internet]. 2016 [cited 2018 May 10]. Available from: http://www.nuffieldtrust.org.uk/publications/emergency-general-surgery-challenges-and-opportunities
18. Royal College of Surgeons. Cholecystectomy Quality Improvement Collaborative (Chole-QuIC) [Internet]. [cited 2018 Jun 10]. Available from: https://www.rcseng.ac.uk/standards-and-research/standards-and-guidance/service-standards/emergency-surgery/cholecystectomy-quality-improvement-collaborative/

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Address for Correspondence:

Saad Ullah Khan, Consultant, General and Upper GI Surgeon, Dudley Group NHS Foundation Trust, Pensnett Road, DY1 2HQ-UK
Email: saadk86@hotmail.com