ORIGINAL ARTICLE

Comparison of Average Cost between Early Versus Delayed Laparoscopic Cholecystectomy in Acute Cholecystitis

MASOOD UR RAUF KHAN, ALI AKBAR, AAMIR JAVID, *MANZAR ALI*

ABSTRACT

Aim: To compare the average cost of early laparoscopic cholecystectomy versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis.
Study Design: Randomized control trial
Place and Duration of Study: 6 months, Surgical unit I, Nishtar hospital Multan
Methods: Total 100 patients with acute cholecystitis fulfilling the inclusion and exclusion criteria were admitted from OPD and emergency department of Nishtar Hospital Multan. Patients of acute cholecystitis were divided in two groups blindly by envelop method. Group A underwent early laparoscopic cholecystectomy while Group B underwent delayed laparoscopic cholecystectomy. Average cost was measured as the sum of total expenditure from day of admission to day of discharge
Results: There were 100 patients in total. Males were 40(40%) while females were 60(60%). Mean age was 51.81±12.614. In treatment group A, mean cost of preoperative medication, preoperative investigations, surgical material cost, anaesthesia medication cost, postoperative medicine cost and total mean cost were 1246.80±140.951, 1362±274.472, 3186.50±245.78, 1344.70±163.87, 1913. 40±479.33 and 9054.60±718.07 rupees while the costs in treatment group B were 2409.60±179.446, 3032.70+280.59,4539.40±277.08,2748.70±178.97,4335.44±481.56&17065.94±837.45 Rs. respectively
Conclusion: Early laparoscopic cholecystectomy is significantly cost-effective procedure as compared to late laparoscopic cholecystectomy and keeping in view similar safety profile and success rates of both procedures in the literature, early laparoscopic cholecystectomy should be the preferred treatment option for patients with acute cholecystitis.
Keywords: Early laproscopic cholecystectomy, delayed laparoscopic cholecystectomy,

INTRODUCTION

Acute cholecystitis is an acute inflammation of gallbladder. It is a major complication of gallstones and is diagnosed in 10% to 35% of patients admitted for cholecystectomy[1]. Other risk factors for acute cholecystitis include immunocompromised states, prolonged Total parenteral nutrition and sepsis. Complications of acute inflammation of gallbladder includes, chronic inflammation, empyema gallbladder, mucocele, perforation of gallbladder. The anatomy at Calot's triangle in acute cholecystitis is distorted due to adhesions, which makes delayed cholecystectomy somewhat difficult[2].

Treatment of acute cholecystitis includes, initial conservative treatment to "cool down" the inflamed gallbladder followed by delayed open cholecystectomy several weeks later[5]. Delayed laparoscopic cholecystectomy was considered as gold standard treatment of acute cholecystitis. Now trends are changing towards early open cholecystectomy due to less hospital stay, cost effectiveness and safety[9]. Initial conservative treatment was challenged by early open cholecystectomy, first advocated by Essenhigh in 1966[4]. Since then, several randomized studies have shown that early open cholecystectomy for acute cholecystitis is as safe as delayed open cholecystectomy[3] with reduced morbidity and hospital stay, lower costs, and rapid recovery[9 11].

Initially, laparoscopic cholecystectomy was contraindicated in acute cholecystitis because of the fear increased morbidity and high rates (60%) of conversion to open cholecystectomy[8]; bile duct injury of 5.5% during laparoscopic cholecystectomy for acute cholecystitis was a major concern[2]. In a study conducted by Garber SM, Korman J , patients were divided in two groups[6]. Group 1 underwent early laparoscopic cholecystectomy and group 2 underwent late laparoscopic cholecystectomy. The conversion rate was (1.8% vs 31.7%).Indications for conversion were inability to identify the anatomy secondary to inflammatory adhesions (68%), cholecystoduodenal fistula (18%), and bleeding (14%). The major complication rate was (2.7% versus 13%).The average number of postoperative hospital days was (5.5 +/- 2.7 days versus 10.8 +/- 2.7 days), and it was concluded that early laparoscopic cholecystectomy within 4 days of onset of symptoms to decrease major complications and conversion

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rates. This decreased conversion rate results in decreased length of procedure and hospital stay[6]. Another study conducted by Stevens KA, Chi A ended with the conclusion that Immediate, laparoscopic cholecystectomy for acute cholecystitis is safe and has become "our standard of practice"[7]. There were no differences in group 1 versus group 2 in demographics, clinical severity of disease. Conversion rate (9% vs 6%), and complications rate(7% vs 9%).

MATERIAL AND METHOD

The study was conducted after taking permission from ethical committee of Nishtar Hospital Multan Total 100 patients with acute cholecystitis fulfilling the inclusion and exclusion criteria were admitted from OPD and emergency department of Nishtar Hospital Multan. Patients of acute cholecystitis were divided in two groups blindly by envelop method. Group 1 underwent early laparoscopic cholecystectomy while group 2 underwent delayed laparoscopic cholecystectomy. All surgeries were done by surgeons with at least 5 year laparoscopic experience to avoid bias. Average cost was measured from the sum of total expenditure from day of admission to day of discharge (pre op medicine and post op medicine, investigations and surgical material used). For group 1,after admission, all the patients were operated on next available list after necessary investigations and were kept on iv medicines and were discharged on second post operative day on oral medicines for three days. For group 2, after admission, all the patients were investigated and were keep on iv medicines till symptoms free and precisely were operated on 7^{th} day of admission after repeating necessary investigations, were kept on iv medicines post operatively and were discharged on second post operative day on oral medicines. For both groups same iv medicines and same oral medicines were prescribed so that exact expenditure was calculated. Data was entered and analysis was done through SPSS version 17. Mean±SD were calculated for numeric variables like age (years), treatment cost (PKR). Independent t-test was used to assess average treatment expenditure (PKR) between ELC & DLC groups. Confounders (age & gender) were controlled by stratification accordingly. P-value $\leq$ 0.05 was considered as statistically significant.

RESULTS

There were 100 patients in total. Males were 40/100 (40%) while females were 60/100 (60%) (Graph 1). Mean age was 51.81±12.614 ranging from a minimum of 20 to a maximum of 70 years. Mean cost of pre-operative medication was 1828.20±605.98 ranging from a minimum of 1000 to a maximum of 2660 Rupees. Mean cost of preoperative investigations was 2197.35±883.806 Rupees ranging from a minimum of 1050 to a maximum of 3830 Rupees. Mean cost of surgical material was 3862.95±728.08 ranging from a minimum of 2930 to a maximum of 5170 Rupees. Mean cost of anaesthesia was 2046.70±725.89 rupees ranging from a minimum of 1145 to a maximum of 5700. Mean cost of post operative medication was 3124.42±1307.62 ranging from a minimum of 1150 to a maximum of 5700. Mean for total cost was 13060.27±4099.97 (Graph 2, Table 1).

Graph 1: Gender distribution in the patient population.

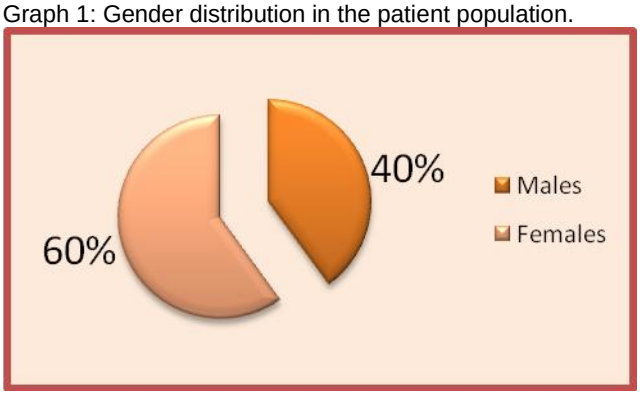


Table 1: Characteristics of the patient population (n=100)

Males	40 (40%)
Females	60 (60%)
Mean age	51.81±12.614
Mean cost of pre-operative medicines	1828.20±605.98
Mean cost of pre-operative investigations	2197.35±883.806
Mean cost of surgical material	3862.95±728.08
Mean cost of anaesthesia	2046.70±725.89
Mean cost of post operative medication	3124.42±1307.62
Mean for total cost	13060.27±4099.97

In treatment group A there were 50 patients in total. Males were 18/50 (36%) while females were 32/50 (64%). Mean age of the patients was 53.50±12.69. Mean cost of preoperative medication was 1246.80±140.951. Mean cost of preoperative investigations was 1362±274.472. Surgical material cost was found out to be 3186.50±245.78, mean for anaesthesia medication cost was 1344.70±163.87 while postoperative medicine cost was 1913.40±479.33. Mean for total cost was 9054.60±718.07 rupees. In treatment group B there

were 50 patients in total, males were 22/50(44%) while females were 28/50(56%). Mean age of the patients was 50.12±12.43. Mean preoperative medicine cost was 2409.60±179.446, preoperative investigation cost was 3032.70+280.59, surgical material cost was 4539.40±277.08, anaesthesia medicine cost was 2748.70±178.97 and postoperative medication cost was 4335.44±481.56. Mean total cost for late lap. cholecystectomy was found out to be 17065.94±837.45. When students t test was applied to compare total cost of two groups it was found that t=-51.4, sdev=780, degrees of freedom=98 and p-value <0.0001 (Table 2, Graph 3).

Graph 2: Means of various costs in the patient population.

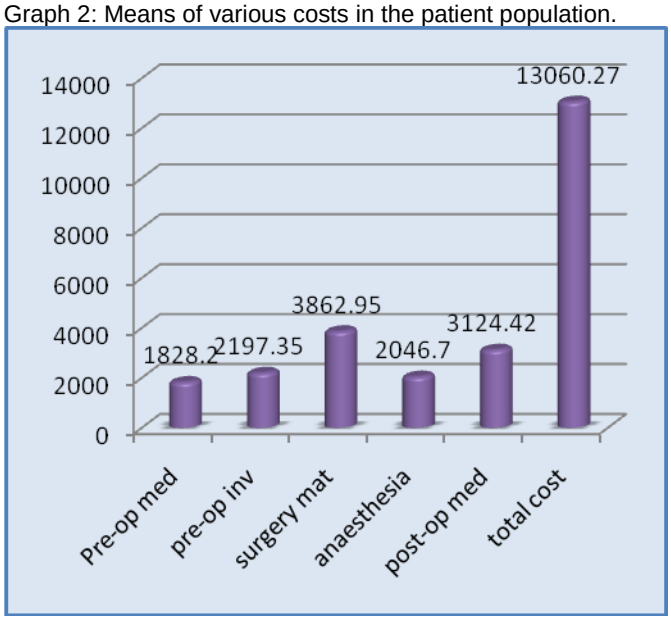
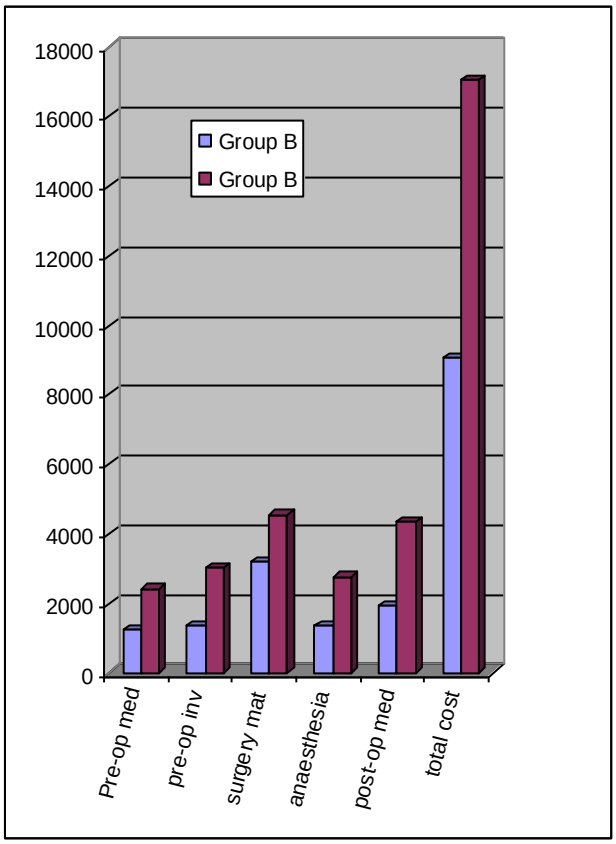


Table 2: Comparison of means of various costs between two treatment groups.

	Group A	Group B
Males	18/50 (36%)	22/50 (44%)
Females	32/50 (64%)	28/50 (56%)
Mean age	53.50±12.69	50.12±12.43
Mean cost of preoperative medication	1246.80±140.95	2409.60±179.44
Mean cost of preoperative investigations	1362±274.47	3032.70+280.59
Surgical material cost	3186.50±245.78	4539.40±277.08
mean cost for anaesthesia medication cost	1344.70±163.87	2748.70±178.97
postoperative medicine cost	1913.40±479.33	4335.44±481.56
Mean total cost	9054.60±718.07	17065.94±837.45

P value: 0.0001

Graph 3: Comparison of means of various costs between two treatment groups.



DISCUSSION

Acute cholecystitis is encountered in approximately one-fifth of all admissions with gallbladder disease. Urgent open cholecystectomy has proved to be beneficial for the management of acute cholecystitis in terms of reducing the morbidity rate and shortening the hospital stay compared with conventional conservative treatment with subsequent interval open cholecystectomy.[12] However, initial reports of early laparoscopic cholecystectomy for Acute Cholecystectomy often showed greater morbidity rates, prolonged operation time and higher conversion rates to open surgery compared with late laparoscopic cholecystectomy.[13] Therefore, acute cholecystitis was considered to be a relative contraindication to early laparoscopic cholecystectomy, and conservative management followed by a late laparoscopic cholecystectomy was the accepted practice in the early 1990s.[14]

The management of acute cholecystitis has evolved with the increase in laparoscopic experience.[15,16] Early laparoscopic cholecystectomy for Acute Cholecystitis can now be performed safely with low rates of morbidity and conversion to open

surgery, and with significantly shorter postoperative hospital stay compared with open surgery[17]. A number of randomized controlled trials that evaluated the role of early laparoscopic cholecystectomy in comparison with delayed laparoscopic cholecystectomy have demonstrated the safety and feasibility of the 'early' approach with its added benefit of shorter hospital stay.[18] Despite this, 'early' laparoscopic cholecystectomy for acute cholecystitis is often difficult to implement due to logistical reasons related to the availability of emergency theatre and accessibility to an experienced surgeon. In addition, a proportion of surgeons may be deterred by possible increase in technical difficulty and operative risk, thus preferring to adopt the approach of 'delayed' laparoscopic cholecystitis.

However, the policy of 'delayed' laparoscopic cholecystectomy for acute cholecystitis suffers from drawbacks. Up to 26% of patients may not respond to the initial conservative treatment and require urgent cholecystectomy. Furthermore, 23-29% of patients scheduled for 'delayed' laparoscopic cholecystitis require earlier re-admission with recurrent acute cholecystitis[19]. This policy clearly prolongs the overall hospital stay and increases costs. Taking into consideration the logistical difficulties and the 'common' surgeons' apprehensions towards 'early' laparoscopic cholecystectomy (i.e., within 72 hours), and in an attempt to overcome the drawback of the 'delayed interval' laparoscopic cholecystitis approach (i.e. 6-8 weeks later) it would seem reasonable to explore the potential applicability and cost-effectiveness of an early laparoscopic cholecystectomy.

In our study there were 100 patients in total. Males were 40/100 (40%) while females were 60/100 (60%). Mean age was 51.81±12.614. There was a gross difference in the mean cost of all the aspects we studied like in those with early laparoscopic cholecystectomy mean cost of pre-operative medication, preoperative investigations, surgical material, cost of anaesthesia, post operative medication was 1246.80±140.951, 1362±274.472, 3186.50±245.78, 1344.70±163.87, 1913.40±479.33 in treatment group A while it was 2409.60±179.446, 3032.70±280.59, 4539.40±277.08, 2748.70±178.97, 4335.44±481.56 in treatment group B respectively. Mean for total cost was 9054.60±718.07 rupees in treatment group A while it was 17065.94±837.45 rupees in treatment group B respectively. When students t test was applied to compare total cost of two groups it was found that the difference was statistically significant with a p-value < 0.0001.

When the effect of gender was noted it was found that in treatment group A, there were 18 male patients in treatment group A, mean cost of pre-operative medication, preoperative investigations, surgical material, cost of anaesthesia, post operative medication and total cost were all significantly lower than those in treatment group B with delayed laparoscopic cholecystectomy approach as the values were 1228.33±137.936, 1417.22±291.60, 3181.11±236.61, 1347.22±187.22 and 1961.11±507.11 and 9135±674.99 for treatment group A while among 22 males in treatment group B, the costs were 2365.91±172.64, 3076.36±264.51, 4517.95±322.89, 2709.09±168.62, 4397.50±558.53 and 17067.05±960.69 rupees respectively. When t-test was applied to compare means of total cost among males in treatment group A and B the difference was statistically significant with a p-value < 0.001. Similarly in 32 females in treatment group A all the costs were lower than in treatment group B. The mean cost of pre-operative medication, preoperative investigations, surgical material, cost of anaesthesia, post operative medication and total cost were 1257.19±143.73, 1330.94±263.96, 3189.53±254.47, 1343.28±152.08, 1886.56±469.13, 9009.38±747.87 for treatment group A females while among females in treatment group B these were 2443.93±180.218, 2998.39±292.73, 4556.25±239.94, 2779.82±183.67, 4286.68±415.47 and 17065.07±744.93 rupees respectively. When student's t-test was applied to compare mean total cost among females in treatment groups A and B the difference was statistically significant with a p-value < 0.001.

When the effect of age was noted it was found that in those with age $\leq$ 50 years in treatment group A the costs of all the aspects were lower as compared to those in treatment group B. Mean cost of pre-operative medication, preoperative investigations, surgical material, cost of anaesthesia, post operative medication and total cost in treatment group A were 1202.94±167.39, 1368.24±321.54, 3164.12±255.39, 1345.88±150.32, 1874.12±427.11 and 8955.29±726.39 while in treatment group B the costs were 2374.75±205.50, 3064±296.96, 4581.50±323.94, 2762.75±181.46, 4406.50±532.48 and 17189.50±905.74 respectively. When t-test was applied to compare the mean total cost in patients with age $\leq$50 years in treatment groups A and B the difference was statistically significant with a p-value < 0.001. Similarly among those in treatment group A with age group > 50 years the costs were lower than those in treatment group B. Mean cost of pre-operative medication, preoperative investigations, surgical material, cost of anaesthesia, post operative medication and total cost mean were 1269.39±121.91, 1358.79±252.25, 3198.03±243.89, 1344.09±172.69, 1933.64±509.28 and 9105.76±719.59 rupees while in treatment group B,

the values were 2432.83±159.19, 3011.83±272.26, 4511.33±242.76, 2739.33±179.78, 4288.07±447.50 and 16983.57±793.69. When t test was applied the difference was found to be statistically significant with p-value < 0.001.

In the UK, the average age of the patient at the time of cholecystectomy is 51 years[20] which is similar to that observed in our study. Only 8% of patients undergoing cholecystectomy are 75 or more years of age[21]. These observations suggest that the majority of the patients undergoing cholecystectomies for acute cholecystitis will be fit for laparoscopic surgery and the results of our study appear applicable in majority of the patients with acute cholecystitis. Surgical expertise varies from one centre to another and a standard model of workforce planning is therefore unlikely. However, our cost-utility analysis provides a robust input to a development of an ELC service, which has been shown to be feasible and safe in the NHS setting[20,21].

Systematic reviews and meta-analysis of randomized controlled trials has demonstrated that early laparoscopic cholecystectomy is at least as safe as delayed laparoscopic cholecystectomy (DLC)[22]. Although there was no difference in the surgical or disease-related morbidity between Early versus late cholecystectomy, Early approach has the advantage of fewer hospital admissions, shorter hospital stays, and fewer days lost from work[22]. However, implementation of early approach requires surgeons with adequate experience in performing laparoscopic cholecystectomy during acute cholecystitis.

CONCLUSION

Early laparoscopic cholecystectomy is significantly cost-effective procedure as compared to late laparoscopic cholecystectomy and keeping in view similar safety profile and success rates of both procedures in the literature, early laparoscopic cholecystectomy should be the preferred treatment option for patients with acute cholecystitis.

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