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Research Article

COMPARISON OF AVERAGE COST BETWEEN EARLY VERSUS DELAYED LAPAROSCOPIC CHOLECYSTECTOMY IN ACUTE CHOLECYSTITIS

¹Dr. Aamir Javid, ²Dr. Tajwer Zaman, ³Dr. Ayesha Gull

¹MBBS, FCPS Surgery, DHQ Hospital, Layyah, ²MBBS, Medical College, Bahawalpur, ³MBBS, Quaid-e-Azam Medical College, Bahawalpur.

Abstract:

Background: 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. Delayed laparoscopic cholecystectomy was considered as gold standard treatment of acute cholecystitis. Several randomized studies have shown that early open cholecystectomy for acute cholecystitis is as safe as delayed open cholecystectomy with reduced morbidity and hospital stay, lower costs, and rapid recovery. Objectives of study were to compare the average cost of early laparoscopic cholecystectomy versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis. **Materials and Methods:** It was a randomized controlled trial conducted at Surgical Unit II, Nishtar Hospital, Multan. Duration of study was 6 months. There were 100 patients enrolled with 50 in each group. Non-probability consecutive sampling was used. 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. All surgeries were done by surgeons with at least 5 year laparoscopic experience to avoid bias. Average cost was measured as 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]. All the data was recorded in the especially designed Proforma. **Results:** There were 100 patients in total. Males were 40 [40%] while females were 60 [60%]. Mean age was 51.81 ± 12.614 . Mean cost of pre-operative medication was 1828.20 ± 605.98 Rupees. Mean cost of preoperative investigations was 2197.35 ± 883.806 Rupees. Mean cost of surgical material was 3862.95 ± 728.08 . Mean cost of anesthesia was 2046.70 ± 725.89 rupees. Mean cost of post operative medication was 3124.42 ± 1307.62 . Mean for total cost was 13060.27 ± 4099.97 . In treatment group A, mean cost of preoperative medication, preoperative investigations, surgical material cost, anesthesia 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 and 17065.94 ± 837.45 rupees respectively [p-value < 0.0001]. **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, Acute Cholecystitis.

Corresponding author:

Dr. Aamir Javid,
MBBS, FCPS Surgery, DHQ Hospital, Layyah.

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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 immune-compromised 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 [3]. 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 [4]. Initial conservative treatment was challenged by early open cholecystectomy, first advocated by Essenhigh in 1966 [5]. Since then, several randomized studies have shown that early open cholecystectomy for acute cholecystitis is as safe as delayed open cholecystectomy with reduced morbidity and hospital stay, lower costs, and rapid recovery [6].

Initially, laparoscopic cholecystectomy was contraindicated in acute cholecystitis because of the fear increased morbidity and high rates [60%] of conversion to open cholecystectomy [7]; bile duct injury of 5.5% during laparoscopic cholecystectomy for acute cholecystitis was a major concern. In a study conducted by Garber SM, Korman J, patients were divided in two groups [8]. Group 1 underwent early laparoscopic cholecystectomy and group 2 underwent late laparoscopic cholecystectomy. The conversion rate was [1.8% versus 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 rates. This decreased conversion rate results in decreased length of procedure and hospital stay [9]. 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" [10]. There were no differences in group 1

versus group 2 in demographics, clinical severity of disease. Conversion rate [9% versus 6%], and complications rate [7% versus 9%].

OBJECTIVES:

To compare the average cost of early laparoscopic cholecystectomy [ELC] versus delayed laparoscopic cholecystectomy [DLC] in patients with acute cholecystitis.

MATERIALS AND METHODS:

It was a randomized controlled trial conducted at Surgical Unit II, Nishtar Hospital, Multan. Duration of study was 6 months. There were 100 patients enrolled with 50 in each group. Non-probability consecutive sampling was used. Total 100 patients with acute cholecystitis fulfilling the inclusion and exclusion criteria were admitted from OPD and emergency department of Nishtar Hospital Multan. Inclusion criteria for patient's enrolment was patient with acute cholecystitis, age 13 – 75 years and either gender. Exclusion criteria was patients with history of previous upper abdominal laparotomy, patients with hemorrhagic tendency due to cirrhosis, patients with co-morbid conditions like diabetes, ischemic heart disease, congestive heart failure, jaundice, uremia and malignancy. 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. All surgeries were done by surgeons with at least 5 year laparoscopic experience to avoid bias. Average cost was measured as 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]. All the data was recorded in the especially designed Proforma.

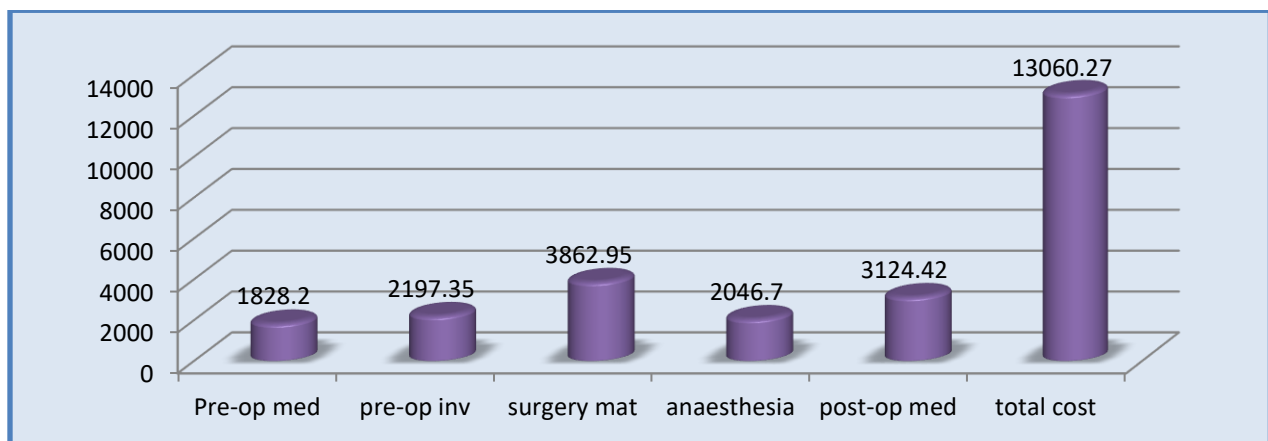
RESULTS:

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 were 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 anesthesia was 2046.70 ± 725.89 rupees ranging from a minimum of 1145 to a maximum of 5700. Mean cost of post operative medication were 3124.42 ± 1307.62 ranging from a minimum of 1150 to a

maximum of 5700. Mean for total cost was 13060.27 \pm 4099.97 [Graph 2, Table 3].

Table 3: Characteristics of the patient population.

Total Patients	100
Males	40 [40%]
Females	60 [60%]
Mean age	51.81 \pm 12.614
Mean cost of pre-operative medicines	1828.20 \pm 605.98
Mean cost of pre-operative investigations	2197.35 \pm 883.806
Mean cost of surgical material	3862.95 \pm 728.08
Mean cost of anaesthesia	2046.70 \pm 725.89
Mean cost of post operative medication	3124.42 \pm 1307.62
Mean for total cost	13060.27 \pm 4099.97



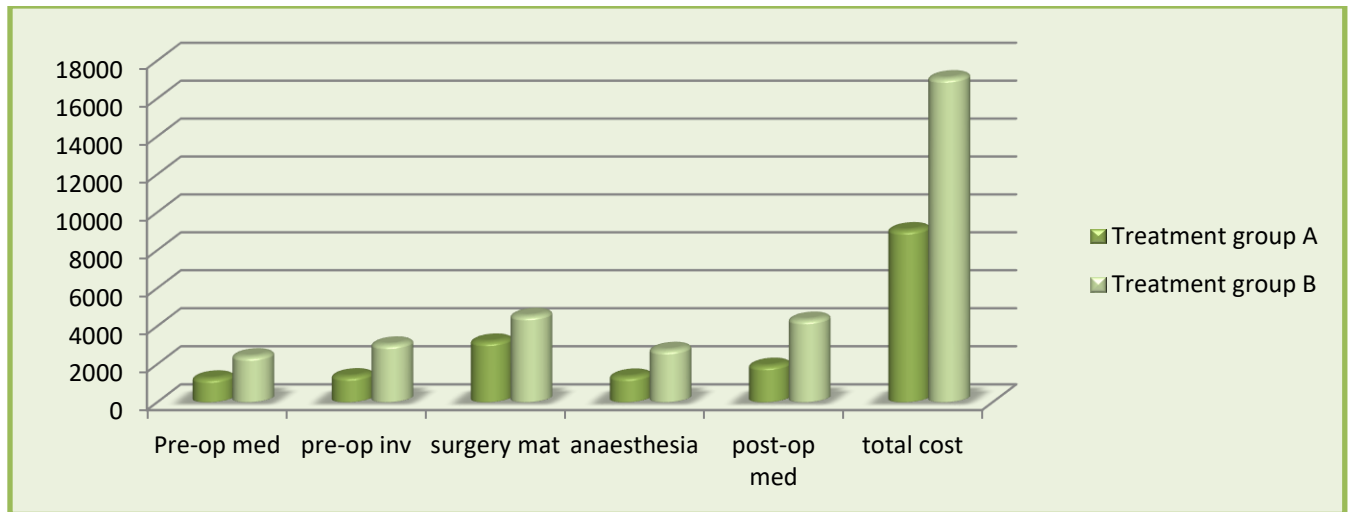
Graph 2: Means of various costs in the patient population.

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 \pm 12.69. Mean cost of preoperative medication was 1246.80 \pm 140.951. Mean cost of preoperative investigations was 1362 \pm 274.472. Surgical material cost was found out to be 3186.50 \pm 245.78, mean for anaesthesia medication cost was 1344.70 \pm 163.87 while postoperative medicine cost was 1913.40 \pm 479.33. Mean for total cost was 9054.60 \pm 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 \pm 12.43. Mean preoperative medicine cost was 2409.60 \pm 179.446, preoperative investigation cost was 3032.70 \pm 280.59, surgical material cost was 4539.40 \pm 277.08, anaesthesia medicine cost was 2748.70 \pm 178.97 and postoperative medication cost was 4335.44 \pm 481.56. Mean total cost for late laparoscopic cholecystectomy was found out to be 17065.94 \pm 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 $p\text{-value} < 0.0001$ [Table 4, Graph 3].

Table 4: Comparison of means of various costs between two treatment groups.

	Treatment Group A	Treatment Group B	p-value
Males	18/50 [36%]	22/50 [44%]	0.0001
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	

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

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 preoperative medicine cost was 1228.33 ± 137.936 , preoperative investigation cost was 1417.22 ± 291.60 , surgical material cost was 3181.11 ± 236.61 , anaesthesia medicine cost was 1347.22 ± 187.22 and postoperative medication cost was 1961.11 ± 507.11 . Mean total cost for early laparoscopic cholecystectomy was found out to be 9135 ± 674.99 . In treatment group B, there were 22 male patients, Mean preoperative medicine cost was 2365.91 ± 172.64 , preoperative investigation cost was 3076.36 ± 264.51 , surgical material cost was 4517.95 ± 322.89 , anaesthesia medicine cost was 2709.09 ± 168.62 and postoperative medication cost was 4397.50 ± 558.53 . Mean total cost for late laparoscopic cholecystectomy was found out to be 17067.05 ± 960.69 . When t-test was applied to compare means of total cost among males in

treatment group A and B the p-value was found out to be < 0.001 [Table 5, Graph 4]. In treatment group A there were 32 females. Mean preoperative medicine cost was 1257.19 ± 143.73 , preoperative investigation cost was 1330.94 ± 263.96 , surgical material cost was 3189.53 ± 254.47 , anaesthesia medicine cost was 1343.28 ± 152.08 and postoperative medication cost was 1886.56 ± 469.13 . Mean total cost for early laparoscopic cholecystectomy was found out to be 9009.38 ± 747.87 . In treatment group B there were 28 female patients in total, mean preoperative medicine cost was 2443.93 ± 180.218 , preoperative investigation cost was 2998.39 ± 292.73 , surgical material cost was 4556.25 ± 239.94 , anaesthesia medicine cost was 2779.82 ± 183.67 and postoperative medication cost was 4286.68 ± 415.47 . Mean total cost for late laparoscopic cholecystectomy was found out to be 17065.07 ± 744.93 . When student's t-test was applied to compare mean total cost among females in

treatment groups A and B the p-value came out to be <0.001 [Table 6, Graph 4].

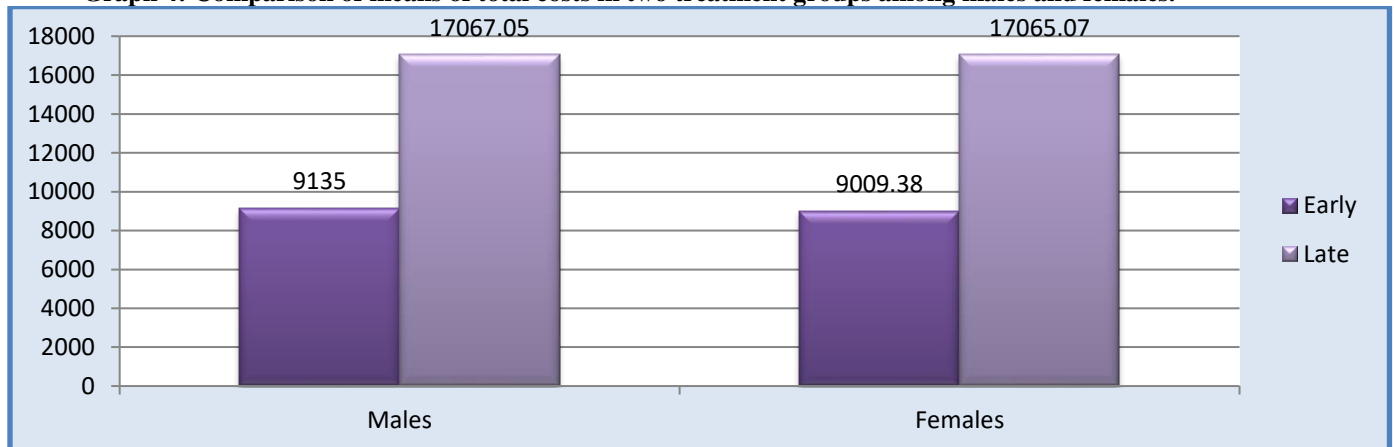
Table 5: Comparison of means of various costs in two treatment groups among males.

	Males Group A [n=18]	Males Group B [n=22]	p-value
Mean cost of preoperative medication	1228.33 ± 137.936	2365.91 ± 172.64	< 0.001
Mean cost of preoperative investigations	1417.22 ± 291.60	3076.36 ± 264.51	
Surgical material cost	3181.11 ± 236.61	4517.95 ± 322.89	
mean for anaesthesia medication cost	1347.22 ± 187.22	2709.09 ± 168.62	
postoperative medicine cost	1961.11 ± 507.11	4397.50 ± 558.53	
Mean total cost	9135 ± 674.99	17067.05 ± 960.69	

Table 6: Comparison of means of various costs in two treatment groups among females.

	Females Group A [n =32]	Females Group B [n = 28]	p-value
Mean cost of preoperative medication	1257.19 ± 143.73	2443.93 ± 180.218	< 0.001
Mean cost of preoperative investigations	1330.94 ± 263.96	2998.39 ± 292.73	
Surgical material cost	3189.53 ± 254.47	4556.25 ± 239.94	
mean for anaesthesia medication cost	1343.28 ± 152.08	2779.82 ± 183.67	
postoperative medicine cost	1886.56 ± 469.13	4286.68 ± 415.47	
Mean total cost	9009.38 ± 747.87	17065.07 ± 744.93	

Graph 4: Comparison of means of total costs in two treatment groups among males and females.



When the effect of age was noted it was found that in treatment group A there were 17 patients in age group ≤ 50 years, Mean preoperative medicine cost was 1202.94 ± 167.39 , preoperative investigation cost was 1368.24 ± 321.54 , surgical material cost was 3164.12 ± 255.39 , anesthesia medicine cost was 1345.88 ± 150.32 and postoperative medication cost was 1874.12 ± 427.11 . Mean total cost for early laparoscopic cholecystectomy was found out to be 8955.29 ± 726.39 . In treatment group B there were 20 patients in age group ≤ 50 years, mean preoperative medicine cost was 2374.75 ± 205.50 , preoperative investigation cost was 3064 ± 296.96 , surgical material cost was 4581.50 ± 323.94 ,

anesthesia medicine cost was 2762.75 ± 181.46 and postoperative medication cost was 4406.50 ± 532.48 . Mean total cost for late laparoscopic cholecystectomy was found out to be 17189.50 ± 905.74 . When t-test was applied to compare the mean total cost in patients with age ≤ 50 years in treatment groups A and B the p-value was found out to be < 0.001 [Table 7, Graph 5]. In treatment group A there were 33 patients in age group > 50 years, mean preoperative medicine cost was 1269.39 ± 121.91 , preoperative investigation cost was 1358.79 ± 252.25 , surgical material cost was 3198.03 ± 243.89 , anesthesia medicine cost was 1344.09 ± 172.69 and postoperative medication cost was 1933.64 ± 509.28 .

Mean total cost for early laparoscopic cholecystectomy was found out to be 9105.76 ± 719.59 . In treatment group B, there were 30 patients in total, mean preoperative medicine cost was 2432.83 ± 159.19 , preoperative investigation cost was 3011.83 ± 272.26 , surgical material cost was 4511.33 ± 242.76 , anesthesia medicine cost was

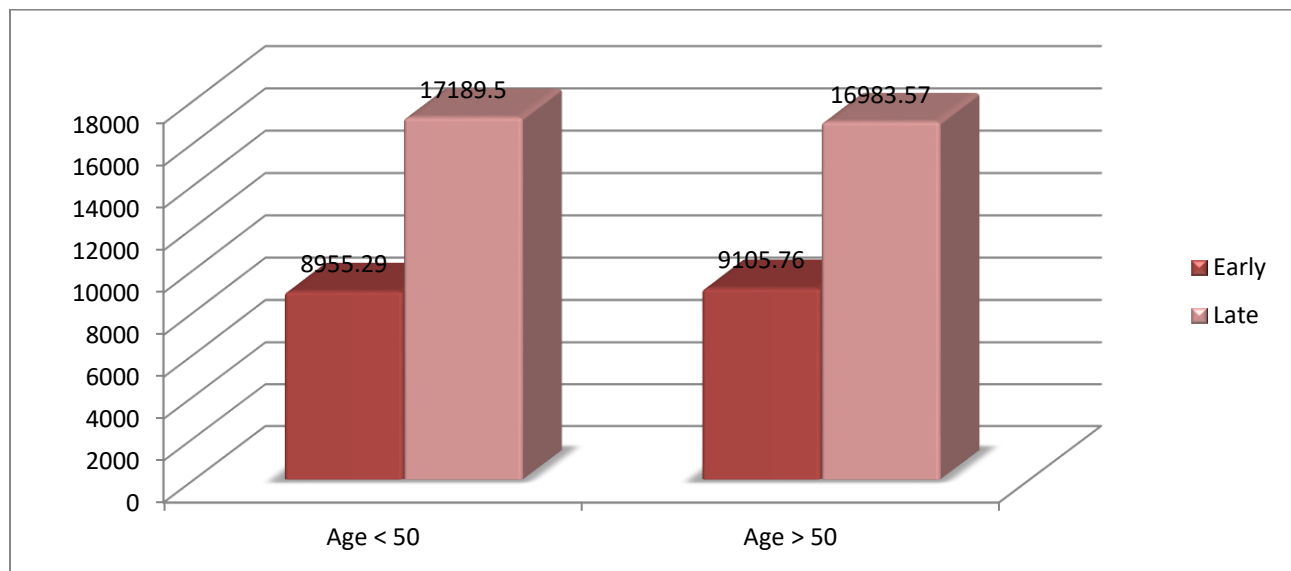
2739.33 ± 179.78 and postoperative medication cost was 4288.07 ± 447.50 . Mean total cost for late laparoscopic cholecystectomy was found out to be 16983.57 ± 793.69 . When t test was applied to compare patients with age group > 50 years in treatment groups A and B the p-value was found out to be < 0.001 [Table 8, Graph 5].

Table 7: Comparison of means of various costs in treatment groups A and B in those with age ≤ 50 years

	Age ≤ 50 years Group A [n=17]	Age ≤ 50 years Group B [n=20]	p-value
Mean cost of preoperative medication	1202.94 ± 167.39	2374.75 ± 205.50	< 0.001
Mean cost of preoperative investigations	1368.24 ± 321.54	3064 ± 296.96	
Surgical material cost	3164.12 ± 255.39	4581.50 ± 323.94	
mean for anesthesia medication cost	1345.88 ± 150.32	2762.75 ± 181.46	
postoperative medicine cost	1874.12 ± 427.11	4406.50 ± 532.48	
Mean total cost	8955.29 ± 726.39	17189.50 ± 905.74	

Table 8: Comparison of means of various costs in treatment groups A and B in those with age > 50 years.

	Age ≤ 50 years Group A [n=33]	Age ≤ 50 years Group B [n=30]	p-value
Mean cost of preoperative medication	1269.39 ± 121.91	2432.83 ± 159.19	< 0.001
Mean cost of preoperative investigations	1358.79 ± 252.25	3011.83 ± 272.26	
Surgical material cost	3198.03 ± 243.89	4511.33 ± 242.76	
mean for anaesthesia medication cost	1344.09 ± 172.69	2739.33 ± 179.78	
postoperative medicine cost	1933.64 ± 509.28	4288.07 ± 447.50	
Mean total cost	9105.76 ± 719.59	16983.57 ± 793.69	



Graph 5: Comparison of means of total costs in treatment groups A and B in patients with different age 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 [11]. 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 [12]. 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 [13].

The management of acute cholecystitis has evolved with the increase in laparoscopic experience [14]. 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 [15]. 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 [16]. 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 [17]. 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 [18].

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 [19].

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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