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Safe and feasible outcomes of cholecystectomy in extremely elderly patients (octogenarians vs. nonagenarians)

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Purpose: Cholecystectomy is the gold standard treatment for gallbladder disease. As life expectancy increases, awareness of cholecystitis treatment in the elderly changes. The safety and feasibility of cholecystectomy in octogenarians have been proven in many studies. Surgical treatment for cholecystitis should be considered in octogenarians and even nonagenarians. In this study, we aimed to assess the outcomes of cholecystectomy in octogenarians and nonagenarians with acute cholecystitis.

Methods: A total of 393 patients aged 80 to 89 years (352 octogenarians) and 90 to 99 years (41 nonagenarians) diagnosed with acute cholecystitis underwent cholecystectomy between March 2012 and June 2020. All patients were classified according to the Tokyo guidelines. The evaluated parameters included demographic data, surgical outcomes, American Society of Anesthesiologists physical status classification, and Tokyo guidelines.

Results: All 393 patients were analyzed and divided into two groups according to age; octogenarians (83.57 ± 2.64 years) and nonagenarians (92.98 ± 3.15 years). The survival rate was 97.7% for octogenarians and 97.6% for nonagenarians. Laparoscopic surgery was performed more in both groups (96.8% in octogenarians and 92.7% in nonagenarians) than open surgery (3.2% in octogenarians and 7.3% in nonagenarians). The operation time of the nonagenarian group (74.63 ± 30.83 minutes) was shorter than the octogenarian group (75.85 ± 34.63 minutes). The incidences of postoperative complications in the octogenarian and nonagenarian groups were as follows: pneumonia, 5.7% and 7.3%; bleeding, 1.7% and 2.4%; gastrointestinal symptoms, 6.0% and 2.4%; and bile leakage, 0.6% and 2.4%, respectively.

Conclusion: Cholecystectomy is a safe and efficient procedure for the treatment of acute cholecystitis in both octogenarians and nonagenarians.

Keywords: Cholecystitis, Aged, Laparoscopic cholecystectomy, Mortality

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INTRODUCTION

The increase in the number of elderly patients due to the rise in the average life expectancy is a global trend. According to the 2015 Statistics Office in Korea, 4.51% and 0.3% of the population aged 80 to 89 years and 90 to 99 years, respectively. Elderly individuals are the fastest-growing segment of the world population. The population of Korean senior citizens is expected to be number one worldwide by 2050 [1]. As life expectancy increases in the industrialized world, illnesses requiring appropriate treatment have become more common in elderly patients. Considering the future increase in the average life expectancy, evaluation and treatment of elderly patients become important.

Gallstone disease is one of the most common and costly of all digestive diseases. Gallstones frequently affect the elderly, and their prevalence increases with age. About 15% of males and 25%

of females aged over 70 years are likely to develop gallstones [2]. The incidence of gallstones increases with age because of an increase in gallbladder dysfunction. Complications secondary to gallstones, such as cholecystitis, cholangitis, and pancreatitis, also increase with age. Acute cholecystitis is the most common and life-threatening condition, particularly in elderly patients. Because of bile lithogenicity and gallbladder dysmotility, cystic duct obstruction by gallstones and bacterial infection result in acute cholecystitis, which can progress to sepsis and multiple organ failure [3].

Antimicrobial therapy is an important treatment approach, but surgical intervention is the best method. Laparoscopic surgery is considered to be the gold standard in gallbladder surgery. To take advantage of its benefits, the number of laparoscopic procedures carried out on elderly patients is increasing daily. However, surgeons are reluctant to perform this procedure on these patients. Because of the characteristics of cholecystitis, the incidence of this disease and occurrence of postoperative complications are more common and higher, respectively, in the elderly group than in the younger group. For this reason, conservative and antimicrobial therapies are chosen for acute cholecystitis treatment. However, elderly patients who did not undergo cholecystectomy after their initial presentation with symptomatic gallstones are at risk of presenting again in an emergent setting with gallstone complications [3]. Currently, preoperative, postoperative, and intensive care have improved, which leads to safer outcomes for elderly patients. Accordingly, more complex and aggressive surgical treatment becomes a more important option [4].

Considering the incidence of gallstone disease and the rapid aging rate of the global population, the overall prevalence of gallstone disease is increasing, and a larger demand for gallbladder surgery is expected in the near future [5]. While often underappreciated, the gallbladder may be affected by various pathological processes that have specific clinical correlates. Reactive changes within cholecystitis may mimic dysplasia [6].

Whether surgical or nonsurgical treatment should be recommended to the expected increasing number of elderly patients with cholecystitis presents a dilemma in clinical practice. Nowadays, the safety and feasibility of cholecystectomy in octogenarians have been proven in many studies [3,4,7]. According to the increase in the average life expectancy, cholecystectomy in nonagenarians also should be considered. But there are fewer studies and evidences about cholecystectomy in nonagenarians. This study compares outcomes of octogenarians with outcomes of nonagenarians and shows safety and feasibility of cholecystectomy in nonagenarians.

MATERIALS AND METHODS

We surveyed 393 patients aged 80 to 99 years who were diagnosed with cholecystitis and underwent surgical treatment between March 2012 and June 2020. The octogenarians (aged 80–89 years) and the nonagenarians (aged 90–99 years) comprised 352 and 41 of the patients, respectively. Diagnosis of cholecystitis was performed using abdominal computed tomography, blood test, abdominal ultrasound, and physical examination.

Prior to surgery, third-generation cephalosporin antibiotics were administered for all patients. Blood culture was performed, and bile culture was also carried out when percutaneous gallbladder drainage was performed. If patients were critically ill, antibiotics were changed to carbapenem or piperacillin-tazobactam.

Percutaneous transhepatic gallbladder drainage (PTGBD) was performed when the gallbladder was very large, the patient's right upper quadrant pain was severe, the liver function test was severely elevated, or a risk of rupture exists. When cholecystitis was accompanied by cholangitis, endoscopic retrograde cholangiopancreatography was performed while maintaining an endoscopic nasobiliary drainage tube. After the surgery, the presence or absence of common bile duct stones was assessed through a tubogram, and the stones were removed.

The severity of cholecystitis was classified according to the Tokyo guidelines. The American Society of Anesthesiologists (ASA) physical status (PS) classification, prothrombin time (PT), and medication history, as well as the levels of aspartate transferase, alanine transaminase, alkaline phosphatase, blood urea nitrogen, total bilirubin, and gamma-glutamyl transpeptidase were determined. Surgical outcomes were evaluated with survival rate, mean operation time, type of operation (laparoscopic or open), and postoperative complications.

Statistical analysis of data was performed using IBM SPSS version 1.0.0.1406 (IBM Corp., Armonk, NY, USA). Quantitative variables are expressed as medians and standard deviations, and qualitative variables as frequencies and percentages. The chi-square test was used to evaluate any potential association between the two groups. One-way analysis of variance was performed to assess differences in continuous variables between the two groups of patients. Statistical significance was considered for p values of less than 0.05.

RESULTS

The demographic characteristics of the 393 patients are shown in Table 1. Among these patients, 352 were octogenarians and 41 were nonagenarians. The common underlying diseases in the two groups were diabetes mellitus, hypertension, cerebrovascular attack history, and pulmonary disease. The patient's PS is more important than the underlying disease. Hypertension was the most common underlying disease in the octogenarians and nonagenarians (60.2% and 61.0%, respectively), followed by diabetes

Table 1. Demographical data of octogenarians and nonagenarians

Variable	Octogenarian	Nonagenarian	*p* value
No. of patients	352	41	
Age (yr)	83.57 ± 2.64	92.98 ± 3.15	0.946
Male sex	158 (44.9)	13 (31.7)	0.954
Admission route			0.272
Outpatient clinic	100 (28.4)	7 (17.1)	
Emergency room	252 (71.6)	34 (82.9)	
ASA PS classification			0.006
I	119 (33.8)	14 (34.1)	
II	126 (35.8)	14 (34.1)	
III	94 (26.7)	11 (26.8)	
VI	13 (3.7)	2 (4.9)	
Tokyo guidelines			0.165
I	220 (62.5)	29 (70.7)	
II	86 (24.4)	7 (17.1)	
III	46 (13.1)	5 (12.2)	
Hypertension	212 (60.2)	25 (61.0)	0.079
Diabetes mellitus	87 (24.7)	5 (12.2)	0.932
Lung disease	27 (7.7)	5 (12.2)	0.742
Cardiac disease	54 (15.3)	3 (9.4)	0.211
Liver disease	4 (1.1)	0 (0)	0.758
Kidney disease	11 (3.1)	0 (0)	0.607
PTGBD	160 (45.5)	24 (58.5)	0.412

Values are presented as number only, mean ± standard deviation, or number (%).
ASA, American Society of Anesthesiologists; PS, physical status; PTGBD, percutaneous transhepatic gallbladder drainage.

mellitus (24.7% and 12.2%, respectively). However, no statistically significant differences were found in hypertension, diabetes mellitus, lung disease, cardiac disease, liver disease, and kidney disease.

The mean age was 83.57 ± 2.64 years in octogenarians and 92.98 ± 3.15 years in nonagenarians. The sex ratio was similar in both groups, and no statistically significant difference was noted between the two groups ($p = 0.946$). Both patient groups were admitted more through the emergency department than the outpatient clinic, but the difference was not statistically significant. ASA PS classification was compared using the chi-square test, and significant differences were found between the two groups ($p = 0.006$). ASA PS classifications of I, II, and III were not significantly different between the groups, but the ASA PS classification of IV was significantly different. PTGBD was performed in the two groups and more frequently performed in the nonagenarian group (58.5%). The severity of cholecystitis was classified according to the Tokyo guidelines. The patient ratios were similar in the groups. No statistically significant difference was found in the Tokyo guideline classification (Table 1).

In preoperative laboratory finding, aspartate transferase, alanine transaminase, and alkaline phosphatase levels were higher in the nonagenarian group, and significant differences were noted in the three categories ($p = 0.017$, $p = 0.044$, and $p < 0.001$). PT and levels of total bilirubin, albumin, gamma-glutamyl transpeptidase, cholesterol, blood urea nitrogen, and creatinine were higher in octogenarians, but no statistically significant differences were found in PT and levels of total bilirubin, cholesterol, blood urea nitrogen, and creatinine ($p = 0.946$, $p = 0.281$, $p = 0.503$, $p = 0.262$, and $p = 0.257$, respectively). The gamma-glutamyl transpeptidase and albumin levels were significantly different ($p = 0.025$ and $p = 0.007$, respectively) (Table 2).

The survival rate was high in both the octogenarian and nonagenarian groups (97.7% and 97.6%, respectively). The laparoscopic procedure was more frequently performed in both groups than the open procedure. The operation time was higher in the octogenarian group (75.85 ± 34.63 minutes and 74.63 ± 30.83 minutes, respectively), but no statistically significant difference was observed ($p = 0.06$). Causes of death were multiple organ failure due to septic shock and pneumonia.

We analyzed postoperative complications using Clavien-Dindo classification. The proportion of the patients with Clavien-Dindo grade I or higher was significantly higher in the nonagenarian group (14.7% vs. 22.0%) with a p value of <0.001. Postoperative complications were classified as bleeding, pneumonia, bile leakage, common bile duct injury, gastrointestinal symptoms (nausea, vomiting, and diarrhea), and cardiac problems (myocardial infarction and angina). Gastrointestinal symptoms were frequent in both groups. Hospital days were longer in the nonagenarian group (14 ± 5.86 days) than the octogenarian group (13 ± 7.22 days) with statistical significance ($p < 0.001$) (Table 3).

DISCUSSION

Cholecystectomy has rapidly become the gold standard in the treatment of gallstone disease since the late 1980s [8]. Cholecystectomy is the most common general surgery procedure performed in elderly patients because the incidence of gallstones and gallstone complications increases with age. However, elderly patients with gallstone complications are less likely to undergo cholecystectomy than younger patients. The sequelae of acute cholecystitis include cholangitis, septic shock, and even death. For these reasons, the current management of acute cholecystitis is primarily intravenous antibiotics and PTGBD, followed by prompt cholecystectomy [9,10], which leads to satisfactory results in the treatment of acute cholecystitis.

Table 2. Preoperative laboratory findings of octogenarians and nonagenarians

Variable	Octogenarians (n = 352)	Nonagenarians (n = 41)	*p* value
AST (U/L)	114.00 ± 242.20	145.61 ± 310.4	0.017
ALT (U/L)	81.21 ± 136.52	95.29 ± 155.24	0.044
Total bilirubin (mg/dL)	1.65 ± 1.61	1.48 ± 1.38	0.281
PT (sec)	12.67 ± 3.77	12.32 ± 2.29	0.946
ALP (U/L)	109.37 ± 83.26	111.20 ± 91.81	<0.001
γ-GTP (U/L)	124.63 ± 171.27	120.61 ± 200.36	0.025
Albumin (g/dL)	3.70 ± 4.16	3.25 ± 0.43	0.007
Cholesterol (mg/dL)	139.23 ± 46.47	119.15 ± 36.36	0.503
BUN (mg/dL)	21.26 ± 50.09	19.73 ± 10.87	0.262
Creatinine (mg/dL)	1.06 ± 1.05	0.86 ± 0.43	0.257

Values are presented as mean ± standard deviation.
AST, aspartate transferase; ALT, alanine transaminase; PT, prothrombin time; ALP, alkaline phosphatase; γ-GTP, gamma-glutamyl transpeptidase; BUN, blood urea nitrogen.

Table 3. Comparison of surgical outcome between octogenarians and nonagenarians

Variable	Octogenarians (n = 352)	Nonagenarians (n = 41)	*p* value
Survival rate (%)	97.7	97.6	
Type of operation			0.216
Laparoscopic	341 (96.8)	38 (92.7)	
Open	11 (3.2)	3 (7.3)	
Operation time (min)	75.85 ± 34.63	74.63 ± 30.83	0.060
Clavien-Dindo grade			<0.001
I	301 (85.3)	32 (78.0)	
≥II	51 (14.7)	9 (22.0)	
Postoperative complication	42 (11.9)	4 (9.8)	<0.001
Bleeding	6 (1.7)	1 (2.4)	
Pneumonia	20 (5.7)	3 (7.3)	
Bile leakage	2 (0.6)	1 (2.4)	
CBD injury	1 (0.3)	0	
Gastrointestinal symptom	21 (6.0)	1 (2.4)	
Cardiac problem	4 (1.1)	0	
Hospital day	13 ± 7.22	14 ± 5.86	<0.001

Values are presented as percentage only, number (%), or mean ± standard deviation.
CBD, common bile duct.

Whether elderly patients have acute cholecystitis is difficult to determine because of their comorbidity and age, with a more severe spectrum of gallbladder pathology [11]. The observation that complications in the elderly population are difficult to predict has led to the recent use of the concept of frailty to identify patients at risk [12]. Thus, elderly people who easily get ill should be monitored carefully. Although cholecystectomy is a safe and necessary procedure for seniors, the complicated biliary disease is associated with increased postoperative morbidity, and patients need to receive intensive care. In addition, aggressive management, such as PTGBD and surgical treatment, should be performed before complications occur or before they reach

octogenarians and nonagenarians, particularly inpatients with underlying disease in an effort to improve surgical results [13].

Many of the complications found in several papers, such as pulmonary and cardiac complications as well as death, can be attributed to reduced physiological reserves and pre-existing comorbidities rather than to the surgical procedure itself [14]. Higher morbidity and mortality in octogenarians and nonagenarians are often the result of aggravated systemic inflammation response and deterioration of comorbidities with low physiological reserve [15,16].

Octogenarians and nonagenarians are associated with increased morbidity following cholecystectomy for acute cholecystitis as well as a greater risk of conversion from a laparoscopic to open procedure [17,18]. When urgent intervention is impossible and no contraindications exist, patients should be scheduled for elective cholecystectomy after discharge, admission, or conservative therapy [19,20]. PTGBD and antibiotic therapy should be performed first in patients with a high risk of cholecystitis and surgery, and they are expected to reduce postoperative complications and mortality. It is recognized as a method [4,21,22]. PTGBD is a minimally invasive procedure designed to decompress the acutely inflamed gallbladder in patients who are unresponsive to medical therapy or who are at high risk for cholecystectomy. PTGBD only, surgery following PTGBD, and surgery without PTGBD are management methods for patients with cholecystitis. For high-risk elderly patients, PTGBD and antibiotic therapy are good for treating cholecystitis [9,23,24].

Experienced surgeons are needed to treat elderly patients with acute cholecystitis. During the learning curve, a more experienced surgeon is important because lack of training is one of the key factors for conversion procedure. Inexperienced surgery skills can result in induced bleeding, iatrogenic injury of the bile duct, and liver injury. Elderly patients are often confronted with severe acute cholecystitis; thus, gallbladder resection following the anatomical structure is difficult. In this study, a skillful surgeon performed cholecystectomy, which contributed to the survival rate [10].

This study shows comparable outcomes after cholecystectomy in the nonagenarians group even in the octogenarian group. Comparing with other studies, this study will suggest the direction of the treatment of cholecystitis in nonagenarians.

However, this study has several limitations. First, retrospective analysis might have caused selection bias and systematic error. Second, this study did not analyze long-term outcomes of surgery. Finally, we did not consider pneumoperitoneum after laparoscopic surgery. Pneumoperitoneum can cause complications such as cardiac and pulmonary problems and pain.

In conclusion, postoperative outcomes after cholecystectomy in nonagenarians were comparable to those in octogenarians, and surgical treatment for acute cholecystitis in extremely elderly patients can be considered as a safe and feasible procedure.

NOTES

Ethical statements

This study was approved by the Institutional Review Board (IRB) of Chosun University Hospital (No. 2020-12-029-003). The requirement for acquisition of informed consent from patients was waived by the IRB.

Authors' contributions

Conceptualization, Investigation: NKC, MHS, SMK
Data curation, Formal analysis, Methodology: SMK
Funding acquisition: NKC
Project administration: NKC, MHS
Visualization: NKC, SMK
Writing–original draft: NKC, SMK
Writing–review & editing: NKC, SMK
All authors read and approved the final manuscript.

Conflict of interest

All authors have no conflicts of interest to declare.

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REFERENCES

1. Statistics Korea. Causes of death statistics [Internet]. Daejeon: Statistics Korea; c2020 [cited 2020 Dec 11]. Available from: https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1YL20631&vw_cd=MT_GTITLE01&list_id=101&seqNo=&lang_mode=ko&language=kor&obj_var_id=&itm_id=&conn_path=MT_GTITLE01.
2. Bong JH, Jang DK, Lee JK, et al. Clinical outcomes of hospital-acquired acute cholecystitis in the elderly. Korean J Pancreas Biliary Tract 2017;22:172-178.
3. Irojah B, Bell T, Grim R, Martin J, Ahuja V. Are they too old for surgery? Safety of cholecystectomy in superelderly patients (≥ age 90).

Perm J 2017;21:16-013.
4. Tugmen C, Sert I, Kebabci E, et al. Outcomes of laparoscopic cholecystectomy in patients 65 years and older. Br J Med Med Res 2016;13:1-8.
5. Novello M, Gori D, Di Saverio S, et al. How safe is performing cholecystectomy in the oldest old? A 15-year retrospective study from a single institution. World J Surg 2018;42:73-81.
6. Kumar H, Kini H, Tiwari A. Histological evaluation of 400 cholecystectomy specimens. J Pathol Nepal 2015;5:834-840.
7. Kim S, Choi N, Shin M, Jung D. Clinical safety of laparoscopic cholecystectomy in elderly patients: a comparison of clinical outcomes in patients aged 65 to 79 years and over 80 years. J Acute Care Surg 2020;10:1-4.
8. Peker Y, Ünalp HR, Durak E, et al. Laparoscopic cholecystectomy in patients aged 80 years and older: an analysis of 111 patients. Surg Laparosc Endosc Percutan Tech 2014;24:173-176.
9. Lee SI, Na BG, Yoo YS, Mun SP, Choi NK. Clinical outcome for laparoscopic cholecystectomy in extremely elderly patients. Ann Surg Treat Res 2015;88:145-151.
10. Bhandari TR, Shahi S, Bhandari R, Poudel R. Laparoscopic cholecystectomy in the elderly: an experience at a tertiary care hospital in western Nepal. Surg Res Pract 2017;2017:8204578.
11. Nikfarjam M, Yeo D, Perini M, et al. Outcomes of cholecystectomy for treatment of acute cholecystitis in octogenarians. ANZ J Surg 2014;84:943-948.
12. Wysocki AP, Allen J, Rey-Conde T, North JB. Mortality audit of octogenarians with acute cholecystitis. CRSLS 2014 Nov 16 [Epub]. DOI: 10.4293/CRSLS.2014.00098.
13. Lee W. Cholecystectomy in octogenarians: recent 5 years' experience. Korean J Hepatobiliary Pancreat Surg 2013;17:162-165.
14. Loozen CS, van Ramshorst B, van Santvoort HC, Boerma D. Early cholecystectomy for acute cholecystitis in the elderly population: a systematic review and meta-analysis. Dig Surg 2017;34:371-379.
15. Petric M, Badovinac D, Pintar T, Tomazic A. Acute calculous cholecystitis with complications in octogenarians: is laparoscopic cholecystectomy the method of choice? Surgery Surg ENDOS 2019;1:11-18.
16. Matsui Y, Hirooka S, Yamaki S, et al. Assessment of clinical outcome of cholecystectomy according to age in preparation for the "Silver Tsunami". Am J Surg 2019;218:567-570.
17. Wiggins T, Markar SR, Mackenzie H, et al. Evolution in the management of acute cholecystitis in the elderly: population-based cohort study. Surg Endosc 2018;32:4078-4086.
18. do Amaral PC, Azaro Filho Ede M, Galvão TD, et al. Laparoscopic cholecystectomy for acute cholecystitis in elderly patients. JSLS 2006;10:479-483.
19. Escartín A, González M, Cuello E, et al. Acute cholecystitis in very elderly patients: disease management, outcomes, and risk factors for complications. Surg Res Pract 2019;2019:9709242.
20. Nassar Y, Richter S. Management of complicated gallstones in the elderly: comparing surgical and non-surgical treatment options. Gastroenterol Rep (Oxf) 2019;7:205-211.
21. Cho JY ,Kim JY, Chang SK, Kim SG, Hwang YJ, Yun YK. Is laparoscopic cholecystectomy safe in octogenarians?. J Korean Surg Soc 2009;76:231-235.
22. Shin MS, Park SH. Clinical outcomes of laparoscopic cholecystectomy in elderly patients after preoperative assessment and optimization of comorbidities. Ann Hepatobiliary Pancreat Surg 2018;22:374-379.
23. Ziskind S, Netz U, Gibor U, Atias S, Lantsberg L, Perry ZH. Gallbladder disease in the aged patient- a comprehensive diagnosis and treatment approach. Adv Res Gastroenterol Hepatol 2017;8:555730.
24. Na BG, Yoo YS, Mun SP, Kim SH, Lee HY, Choi NK. The safety and efficacy of percutaneous transhepatic gallbladder drainage in elderly patients with acute cholecystitis before laparoscopic cholecystectomy. Ann Surg Treat Res 2015;89:68-73.