

ORIGINAL ARTICLE

Factors Predicting Gangrenous Changes in Acute Calculus Cholecystitis

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ABSTRACT

Background: The present study was conducted in the department of Surgical gastroenterology, Yashoda super speciality Hospital, Somajiguda, Hyderabad, Telangana over a period of one year with the objective of assessing the factors predicting gangrenous changes in acute calculus cholecystitis and other clinical measures as predictive factors for gangrene in acute cholecystitis and to know the statistical significance of the predictive factors and comparing with non-gangrenous cholecystitis.

Methodology: This is a Prospective analytical study. A total of 96 Patients diagnosed as acute calculus cholecystitis, the participants will be divided into two groups, gangrenous and non-gangrenous group.

In the present study age, gender, comorbidities like CKD and CVA, asthma, thyroid disease, hemolytic anemia, alcohol consumption, lab levels like serum procalcitonin level, LFT, serum lipase has no significant association between two groups. There is statistically significant association found between two groups in relation to comorbidities like diabetes and hypertension, ischemic heart disease, smoking, lab levels like TLC and CRP level, serum amylase levels. On ANOVA testing TLC, CRP levels, GB wall thickness, serum amylase, and age show significant differences, indicating their potential impact. Whereas on Linear regression analysis reveals that TLC, serum amylase, serum lipase, and age significantly influence the dependent variable. BMI, total bilirubin, SGOT, SGPT, GGT, ALP, serum albumin, CRP levels, and GB wall thickness show no significant effect.

Conclusion: Diabetes mellitus, hypertension, ischemic heart disease, smoking, leukocytosis CRP level, serum amylase level, gallbladder wall thickness and age were found to be factors predisposing to gangrene in acute calculous cholecystitis that represented a statistically significant difference. By implementing these risk factors urgency for surgery can be decided.

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KEYWORDS

- Gangrenous Cholecystitis • Cholecystectomy • Acute Calculus Cholecystitis
- Gallbladder Wall Thickness • Ultrasonography

INTRODUCTION

Gallbladder is a thin walled, pear-shaped pouch located in the visceral surface of the liver. It stores and concentrates bile secreted from the liver. The bile helps to digest and absorb fats in the small intestine. Gallbladder pathology varies from acute or chronic cholecystitis, cholelithiasis, cholesterosis and gallbladder cancer. Acute cholecystitis is commonly due to cystic duct obstruction by stones and less commonly secondary to tumours, infections or being acalculous.¹

Gangrenous cholecystitis (GC) has a complication rate of 16–25%. Obstruction of the cystic duct increases the pressure inside the gallbladder leading to its dilation, biliary stasis and proliferation of microorganisms, congestion of capillaries and lymphatics in the wall with subsequent subserosal edema. If this not detected and treated at this stage, areas of hemorrhage and necrosis begin to appear in the gallbladder wall due to vascular thrombosis. If this not treated in this situation the gall bladder wall becomes inflamed with neutrophil infiltration and areas of suppuration involving the entire thickness of gallbladder wall with peri cholecystic abscess formation.²

The patients of gangrenous cholecystitis have similar clinical presentations with acute cholecystitis. Therefore, it is difficult to discriminate between acute and gangrenous cholecystitis. Moreover, gangrenous cholecystitis has been associated with higher morbidity and mortality rate (15–50%) as compared to acute cholecystitis, mainly in elderly, diabetic and immunocompromised patients.³

To minimise such risks, it would be highly advantageous to predict the severity pre operatively. Hence the present study aimed to identify the factors that predict gangrenous cholecystitis according to preoperative patient dependent and clinical risk factors.

AIMS AND OBJECTIVES

1. To assess the factors predicting gangrenous changes in acute calculus cholecystitis.

2. To know the statistical significance of the predictive factors and comparing with non-gangrenous cholecystitis.

MATERIALS AND METHODS

Study population:

Patients presenting with abdominal pain of acute onset to outpatient department or to emergency department, diagnosed as acute calculus cholecystitis and admitted in the department of Surgical gastroenterology, Yashoda Hospital, Somajiguda, Hyderabad, Telangana. This study will be conducted over a period of one year after obtaining approval from the ethical clearance committee. After fulfilling the inclusion and exclusion criteria study participants will be divided into two groups, gangrenous and non-gangrenous based on the operative and histopathology findings.

Sample size= 96

Inclusion criteria:

1. Age >12 years
2. Patients presenting with abdominal pain of sudden onset with diagnosis of acute calculus cholecystitis by radiological imaging
3. Patients admitted and operated within 4 days of onset of symptoms

Exclusion criteria:

1. Pregnant women
2. Patients unwilling to give voluntary consent to participate in the study

Research methodology:

Detailed history will be taken followed by clinical examination. Demographic data like age, sex; clinical data like presence of abdominal pain, severity and radiation of abdominal pain, fever, vomiting, vital parameters, tenderness in right upper abdomen, guarding, positive Murphy's sign, lump in right hypochondrium, other comorbid disease (ischemic heart disease, chronic renal

failure, diabetes, hypertension, chronic liver disease, diabetes, bronchial asthma, chronic obstructive pulmonary disease, upper abdominal surgeries, hypothyroidism, other medical illness) will be recorded.

Laboratory data like white blood cell count, neutrophil count, lymphocyte count, platelet count, erythrocyte sedimentation rate (ESR), blood sugar, blood urea, blood urea nitrogen (BUN), serum creatinine, serum amylase, serum lipase, Liver function tests, prothrombin time, international normalized ratio (INR), serum C-reactive protein (CRP), serum procalcitonin will be recorded. Time from onset of symptoms to surgery, the hospital length of stay including the intensive care length of stay will be noted.

All Imaging findings, intraoperative findings, postoperative outcomes will be recorded.

Acute cholecystitis is defined by a histological finding of an acute inflammatory infiltrate on examination of gallbladder wall. Gangrenous

cholecystitis is defined as cases involving transmural necrosis of gallbladder wall. The condition will be defined as focal if one portion of the gallbladder wall is involved and as diffuse if more than one portion is involved. Length of stay was defined as hospital stay from the time of surgery to discharge.

Outcome parameters:

Correlating clinical and biochemical parameters with development of gangrenous changes in acute calculus cholecystitis, duration of hospital stay and post operative events. All the parameters will be recorded as per the proforma and statistically analysed.

RESULTS AND ANALYSIS

In the present study 96 patients were studied. After fulfilling the inclusion and exclusion criteria study participants will be divided into two groups, gangrenous group (group I) and non-gangrenous group (group II) based on the operative and histopathology findings.

Table 1: Age distribution of the study groups

		Age group							Total
		12-20	21-30	31-40	41-50	51-60	61-70	>70	
Group I	Number	0	3	1	6	9	11	3	33
	Percentage	0%	9.09%	3.03%	18.19%	27.27%	33.33%	9.09%	100%
Group II	Number	2	14	10	11	13	8	5	63
	Percentage	3.18%	22.22%	15.87%	17.46%	20.63%	12.70%	7.94%	100%

There is no statistically significant association found between two groups in relation to age. $P = 0.07$

Table 2: Comparison of Comorbid Conditions between two groups

Comorbid conditions		DM		HTN	
		Yes	No	Yes	No
Group I	Number of cases	22	11	17	16
	Percentage	66.7%	33.3%	51.5%	48.5%
Group II	Number of cases	26	37	17	46
	Percentage	41.3%	58.7%	27%	73%
P value		0.018		0.016	

There is statistically significant association found between two groups in relation to diabetes (p value 0.018) and hypertension (p value 0.016).

Table 3: Comparison of Comorbid Conditions between two groups

Comorbid conditions		CKD		CVA		IHD	
		Yes	No	Yes	No	Yes	No
Group I	Number of cases	2	31	1	32	8	25
	Percentage	6.1%	93.9%	3%	97%	24.2%	75.8%
Group II	Number of cases	3	60	4	59	4	59
	Percentage	4.8%	95.2%	6.3%	93.7%	6.3%	93.7%
P value		0.78		0.48		0.01	

There is no statistically significant association found between two groups in relation to comorbidities like CKD (p value 0.78) and CVA (p value 0.48). There is statistically significant association found between two groups in relation to ischemic heart disease (IHD) (p value 0.01).

Table 4: Comparison of addictions between two groups

Addictions		Alcoholism		Smoking	
		Yes	No	Yes	No
Group I	Number of cases	11	22	11	22
	Percentage	33.3%	66.7%	33.3%	66.7%
Group II	Number of cases	13	50	8	55
	Percentage	20.6%	79.4%	12.7%	87.3%
P value		1.72		0.015	

There is no statistically significant association between two groups in relation to alcohol consumption (p value 1.72). There is statistically significant association between two groups in relation to smoking (p value 0.015).

Table 5: Comparison of tlc, crp, procalcitonin levels between two groups

Parameter	Group I (n=33)		Group II (n=63)		P value
	Mean	SD	Mean	SD	
TLC	14831.21	5244.93	11282.38	5049.38	0.0017
CRP level	29.9	41.06	14.84	26.47	0.03
Procalcitonin level	0.78	0.81	1.95	12.56	0.59

There is statistically significant association found between two groups in relation to TLC level (p value 0.0017) and CRP level (p value 0.03). There is no statistically significant association between two groups in relation to serum procalcitonin level (p value 0.59).

Table 6: Comparison of Lft between two groups

Blood parameter	Group I (n=33)		Group II (n=63)		P value
	Mean	SD	Mean	SD	
Total bilirubin	1.7	1.06	1.42	1.13	0.24
SGOT	87.33	89.22	73.12	66.91	0.38
SGPT	110.24	105.98	83.2	77.52	0.15
GGT	92.39	90.75	107.15	124.72	0.54
ALP	75.4	45.39	105.5	92.59	0.08
Serum albumin	3.72	0.46	3.76	0.47	0.69

There is no statistically significant association of liver function tests among two groups (p value < 0.05)

Table 7: Comparison of serum amylase and lipase levels between two groups

	Group I (n=33)		Group II (n=63)		P value
	Mean	SD	Mean	SD	
Serum amylase	138.72	116.40	83.61	62.53	0.003
Serum lipase	108.6	71.9	112.28	252.97	0.93

There is statistically significant relation of serum amylase among two groups (p value 0.003). There is no statistically significant relation of serum lipase between two groups (p value 0.93).

Table 8: Comparison of gb wall thickness between two groups

GB wall thickness		<5 mm	5.1-6 mm	>6 mm	Total
Group I	Number of cases	2	7	24	33
	Percentage	6.1%	21.2%	72.7%	100%
Group II	Number of cases	11	27	25	63
	Percentage	17.5%	42.8%	39.7%	100%

There is statistically significant relation gall bladder wall thickness between two groups (p value 0.008)

Table 9: Comparison of time from onset of symptoms to surgery and time from surgery to discharge between two groups

	Group I (n=33)		Group II (n=63)		P value
	Mean	SD	Mean	SD	
Time from onset of symptoms to surgery	2.51	1.52	2.17	1.19	0.23
Time from surgery to discharge	3.15	1.03	3.06	1.20	0.71

There is no statistically significant association found between two groups in relation to Time from onset of symptoms to surgery (p value 0.23). There is no statistically significant association found between two groups in relation to time from surgery to discharge (p value 0.71).

Table 10: comparison of need for pre-operative ERCP between two groups

		Need for pre-operative ERCP		Total
		Yes	No	
Group I	Number of cases	2	31	33
	Percentage	6.06%	93.94%	100%
Group II	Number of cases	1	62	63
	Percentage	1.6%	98.4%	100%

There is no statistically significant association found between two groups in relation to need for preoperative ERCP (p value 0.23).

Table 11: the parameters of significance after anova test

Parameter		Sum of Squares	df	Mean Square	F	Sig.
BMI	Between groups	.300	1	.300	.016	.900
	Within groups	1763.093	94	18.756		
	Total	1763.392	95			
Age in years	Between groups	2168.126	1	2168.126	9.403	.003
	Within groups	21673.833	94	230.573		
	Total	23841.958	95			
TLC	Between groups	272743201.461	1	272743201.461	10.417	.002
	Within groups	2461066094.372	94	26181554.195		
	Total	2733809295.833	95			
CRP levels	Between groups	4917.195	1	4917.195	4.749	.032
	Within groups	97326.738	94	1035.391		
	Total	102243.933	95			
Procalcitonin	Between groups	3.463	1	3.463	2.013	.159
	Within groups	159.962	93	1.720		
	Total	163.425	94			
Serum amylase	Between groups	65768.222	1	65768.222	9.145	.003
	Within groups	676049.403	94	7192.015		
	Total	741817.625	95			
Serum lipase	Between groups	293.222	1	293.222	.007	.935
	Within groups	4133734.736	94	43975.901		
	Total	4134027.958	95			

Table 12: The Parameters of Significance after Anova Test

Parameter		Sum of Squares	df	Mean Square	F	Sig.
Total bilirubin	Between groups	1.727	1	1.727	1.390	.241
	Within groups	116.813	94	1.243		
	Total	118.540	95			
SGOT	Between groups	4370.672	1	4370.672	.772	.382
	Within groups	532358.317	94	5663.386		
	Total	536728.990	95			
SGPT	Between groups	15829.622	1	15829.622	2.033	.157
	Within groups	732046.378	94	7787.727		
	Total	747876.000	95			
ALP	Between groups	19583.736	1	19583.736	3.081	.082
	Within groups	597499.622	94	6356.379		
	Total	617083.358	95			

table Cont....

Parameter		Sum of Squares	df	Mean Square	F	Sig.
GGT	Between groups	4721.042	1	4721.042	.361	.549
	Within groups	1228018.291	94	13064.024		
	Total	1232739.333	95			
Serum albumin	Between groups	.026	1	.026	.117	.733
	Within groups	20.854	94	.222		
	Total	20.880	95			
GB wall thickness	Between groups	3.879	1	3.879	5.132	0.026
	Within groups	71.051	94	.756		
	Total	74.930	95			

After ANOVA testing TLC, CRP levels, GB wall thickness, serum amylase, and age show significant differences ($p < .05$), indicating their potential impact. Other parameters exhibit no significant variation.

Table 13: Linear Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.218	.575		5.601	.000
Age in years	-.007	.003	-.240	-2.752	.007
BMI	.014	.010	.128	1.417	.160
TLC	-4.037E-005	.000	-.454	-3.691	.000
CRP	-.001	.001	-.046	-.458	.648
Procalcitonin	-.053	.037	-.146	-1.419	.159
Total bilirubin	-.041	.057	-.097	-.730	.467
SGOT	.000	.001	.023	.122	.903
SGPT	-.001	.001	-.134	-.758	.451
GGT	-4.983E-005	.001	-.012	-.079	.937
ALP	.001	.001	.170	1.195	.235
Serum albumin	-.129	.095	-.126	-1.353	.180
Serum amylase	-.002	.001	-.345	-3.214	.002
Serum lipase	.001	.000	.383	2.089	.040
GB wall thickness	-.079	.048	-.147	-1.664	.100

a. Dependent Variable: groups

Linear regression analysis reveals that TLC, serum amylase, serum lipase, and age significantly influence the dependent variable ($p < .05$). BMI, total bilirubin, SGOT, SGPT, GGT, ALP, serum albumin, CRP levels, and GB wall thickness show no significant effect.

DISCUSSION

Table 14: Comparison Between Present Study and Other Studies Regarding Predictive Factors to Gangrene Complicated Acute Calculous Cholecystitis

Factors	Present study	Bader Hamza Shirah et al ¹⁴	Hector Real Noval et al ⁵	Mehrdad Nikfarjam et al ⁶	Carlos Augusto Gomes et al ⁷	Server Sezgin Uludag et al ⁸	Yucel Yuzbasioglu et al ⁹
Age	+	+	-	+	*	-	*
Gender	-	+	-	+	*	+	*
Symptoms	-	+	-	+	*	*	*
Alcohol	-	*	*	*	-	*	*

table Cont....

Factors	Present study	Bader Hamza Shirah et al ¹⁴	Hector Real Noval et al ⁵	Mehrdad Nikfarjam et al ⁶	Carlos Augusto Gomes et al ⁷	Server Sezgin Uludag et al ⁸	Yucel Yuzbasioglu et al ⁹
Smoking	+	*	*	-	-	*	*
DM	+	+	-	+	+	*	*
HTN	+	-	-	*	*	*	*
IHD	+	-	-	-	*	*	*
CKD	-	*	*	-	*	*	*
CVA	-	*	*	*	*	*	*
Asthma	-	-	*	*	*	*	*
Thyroid disease	-	-	*	*	*	*	*
TLC	+	+	-	+	+	+	+
CRP	+	*	+	+	*	+	+
Procalcitonin	-	*	*	*	*	*	-
Total bilirubin	-	-	*	+	*	*	*
SGOT	-	-	*	*	-	*	*
SGPT	-	-	*	+	-	*	*
ALP	-	-	*	-	*	*	*
GGT	-	-	*	+	+	*	*
Serum albumin	-	*	*	-	*	*	*
Serum amylase	+	-	*	-	*	*	*
Serum lipase	-	*	*	-	*	*	*
GB wall thickness	+	+	-	+	+	*	*

+ = Association present

- = No association

* = Not studied

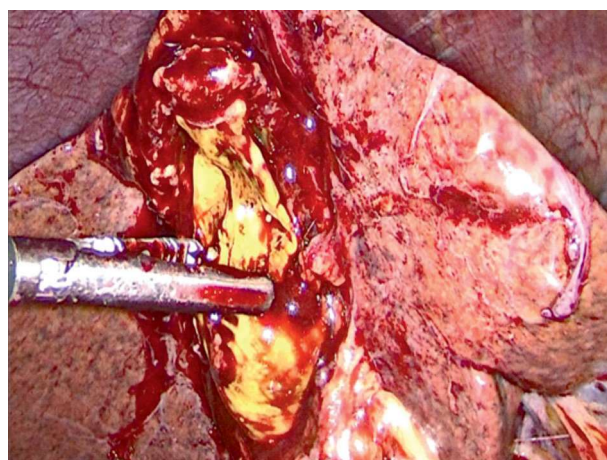


Figure 1: Gangrenous GB

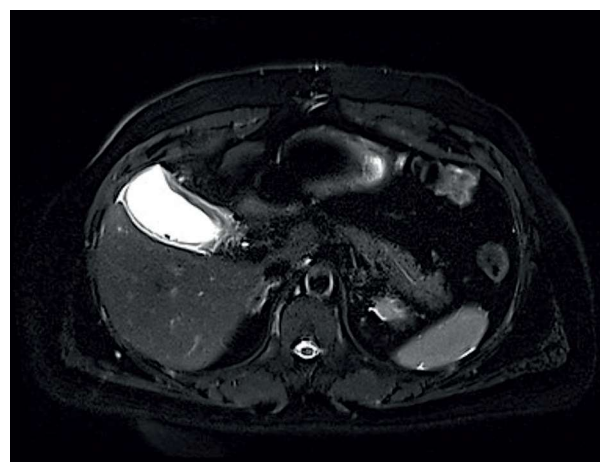


Figure 2: MRCP

CONCLUSION

1. Gangrenous cholecystitis is a disease state that necessitates emergency treatment
2. Diabetes mellitus, hypertension, ischemic heart disease, smoking, leukocytosis CRP level, serum amylase level, gallbladder wall thickness and age were found to

be factors predisposing to gangrene complicated acute calculous cholecystitis that represented a statistically significant difference.

3. By implementing these risk factors urgency for surgery can be decided.

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