Original Article

Natural History of Diverticular Diseases in Chiang Mai, Thailand

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ABSTRACT

Background & Aims: There was limited epidemiological information that described the current characteristic and outcomes associated to colonic diverticular disease in Thailand. This study aimed to investigate patient characteristic and identify factors related to poor outcome for patients which admitted with diverticular diseases (DD).

Methods: Retrospective cohort study, data from 2000 to 2010 were obtained from the electronic database (Digicard) of Maharaj Nakorn Chiang Mai Hospital. The predictors of mortality were identified by using multiple logistic regression analysis and Cox regression analysis.

Results: The 195 patients with a primary diagnosis of DD were recruited. The mean age was 62.3 ± 16.2. The 30-day mortality rate occurred in 3.6%, 1-year mortality in 9.2% and cumulative mortality in 21.5%. Extended LOS was identified as an independent predictor of 1-year all-caused mortality and cumulative mortality (OR 25.25, $p < 0.0001$ and OR 3.624, $p = 0.007$ respectively). Charlson index more than 4 and SIRS were also to be the independent predictive of cumulative mortality. Subgroup of diverticular bleeding, extended LOS was identified as an independent predictor of 1-year mortality (OR 12.16, $p = 0.007$ = 0.046-year mortality (OR 6.84s higher in patients with more Charlson index score (P=). Subgroup of diverticulits, AKI and hypoalbuminemia were identified as an independent predictor of 1-year mortality (OR 6.84, $p = 0.044$ and OR 10.35, $p = 0.046$). The independent predictor of cumulative mortality is hypoalbuminemia (OR 11.47, $p = 0.001$). The independent predictors for diverticular-related mortality were extended LOS (OR 11.00, $p = 0.034$) and operation (OR 10.51, $p = 0.037$).

Conclusion: Number of admission for diverticular disease increased in Thailand. Right-sided diverticular disease in Thailand found less than other studies from Asian countries. The extended LOS, SIRS, hypoalbuminemia and increased comorbidity are predictors for poor outcome.

Key words : Diverticular disease, epidemiology, Thailand.

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Introduction

Colonic diverticular disease is a common condition and the cause of significant morbidity and mortality in the Western world[1]. The prevalence reported to be rare prior to the age of 40, but increasing with age to up to 65% of patients aged over 80 years[2]. Diverticulosis is common in the USA and Western Europe with prevalence rates of 12-22 and 8-12 per million population, respectively[3]. In Africa and Asia, where the daily intake of dietary fiber is significantly higher[4,5], the prevalence of diverticular disease is between 0.1 and 0.5 per million population[3].

Colonic diverticular disease preferentially affected the sigmoid and the left colon in Western patients. In contrast, when colonic diverticular disease occurred in oriental populations, right-sided disease predominates[6,7]. In Whites in the West, diverticular disease had an overall barium enema frequency of 15%-35%, affected only the left colon in 90%-99% of cases, had no sex predilection, and increased in incidence with age[8-10]. In Southeast Asia, diverticular disease had a barium enema frequency of 8%-22%[11,12], affected the right side of the colon in 70%-98%of cases[7,11], had a slight female predilection, and peak incidence in patients age 50-60 years[7,13].

In Thailand, there was a data showed that colonic diverticular disease was not as common as in the Western countries and had many distinctive features. Solitary cecal diverticulum were at least five times more common than the Western countries, accounting for about one-fourth of all colonic diverticular disease, and showed definite male preponderance and occurred in younger patients. On the other hand, multiple colonic diverticulosis was essentially a disease of those above the age of 40 years and showed slight female preponderance[14].

There was limited epidemiological information that described the current characteristic and outcomes associated with admission of colonic diverticular disease in Thailand. The aim of this study was investigate patient characteristic and identify factors related to poor outcome for patients who admitted with diverticular diseases.

Materials and Methods

Data collection

Data from 2000 to 2010 were obtained by the electronic database (Digicard) of Maharaj Nakorn Chiang Mai Hospital. The dataset included age, gender, main diagnosis, location of diverticuli, blood pressure, admission hemoglobin level, lowest hemoglobin level during hospital stay, admission albumin level, presenting with SIRS and/or AKI during admission, surgical operation, length of hospital stay and mode of discharge.

A diagnosis was coded by International Statistical Classification of Diseases and Related Health Problems 10th revision (ICD-10). Record for all patients with Diverticular Disease (DD) as a primary cause for admission or comorbidity (ICD-10 code: K57.2-DD of large intestine with perforation and abscess, K57.3-DD of large intestine without perforation or abscess, K57.4-DD of both small and large intestine with perforation and abscess, K57.5-DD of both small and large intestine without perforation or abscess, K57.8-DD of intestine part unspecified with perforation and abscess and K57.9-DD of intestine part unspecified without perforation or abscess) were retrieved. The Charlson index was used to categorize comorbidities derived from secondary diagnosis codes[1]. This is a score which predict 1-year mortality for a patient who may have a range of comorbidities. Each condition is assigned with a score of 1 or above depending on the risk of dying associated with it and an amalgamation of these individual scores gives a total score which predicts mortality.

The primary outcomes were 30-day, 1-year mortality and cumulative mortality. Death occurring out of hospital was derived by linking Department of Provincial Administration Death Certificate data.

Statistical analysis

Data was analyzed using the statistical software SPSS version 20. The categorical parameters were compared using the Chi-square or Fisher's exact test when appropriate, and continuous variable were compared with Student's t test. If the variable was not normal distribution, nonparametric test was performed. The Kaplan-Meier method was used to determine the cumulative mortality, the log-rank test was performed to compare the cumulative mortality between the two groups. Multiple logistic regression analysis and Cox regression analysis were performed to identify the independent predictors of these primary outcomes. Results were expressed as odds ratios and $p < 0.05$ was taken to be significant.

RESULTS

Admission demographic

During the study period, there were 195 patients with a primary diagnosis of DD were recruited. The mean age was 62.3 ± 16.2. The number of patients who admitted with DD was increased with age. Twenty patients (10.3%) were for patients aged less than 50 years, 28 (14.4%) were for patients aged 50-59, 30 (15.4%) were for patients aged 60-69, 39 (29%) were for patients aged 70-79 and 78 (40%) were foe patients aged greater than 80 years.

The 99 patients (50.8%) were male. The diverticular bleeding was presented in male higher than in female (61.5% and 38.5% respectively) (Table 1.)

A comorbidity was categorized by Charlson index and 85 patients (43.6%) who had a index score 0, 41 patients (21%) score 1, 27 patients (13.8%) score 2, 17 patients (8.7%) score 3, 13 patients (6.7%) score 4, 7 patients (3.6%) score 5 and 5 patients (2.6%) score 6 or more than 6.

Admission that included operative intervention occurred in 49 cases (25.1%). These interventions were undertaken on an emergency basis in 39 cases (79.6%) and on an elective basis in 10 cases (20.4%). Sigmoidectomy with Hartmann's procedure was performed in 12 case (24.5%), 11 cases (22.5%) underwent right hemicolectomy, 6 (12.2%) for subtotal colectomy and appendectomy, 4 (8.2%) for left hemicolectomy and total colectomy and 6 (12.2%) other gastrointestinal surgery. Recurrent in diverticular bleeding was found in 20 cases (22%) (Table 1).

A pattern of distribution of diverticuli throughout the colon was classified into left-sided diverticular disease (LSDD) 63 patients (32.3%), 58 (29.7%) had right-sided diverticular disease (RSDD), 52 (26.7%) had pan-diverticular disease (Pan-DD). There were 13 patients (6.7%) had isolated cecal diverticulum (Table 2). The most common presentation of LSDD was acute diverticulitis, 58.8% (complicated diverticulitis 42.9% and uncomplicated diverticulitis 15.9%), followed by diverticular bleeding was 31.7%. The patients with RSDD were presented with acute diverticulitis, 50% (complicated diverticulitis 17.2% and uncomplicated diverticulitis 32.8%), and diverticular bleeding was 41.4%. In isolated cecal diverticular disease, acute diverticulitis was the most common presentation that clinical presentation was mimic acute appendicitis (Table 2).

Overall outcomes of diverticular disease

The 30-day mortality rate occurred in 3.6%, 1-year mortality in 9.2% and cumulative mortality in 21.5% (Table 3). Median length of stay (LOS) was 6 days with the 75th percentile equating to 9 days, the extended LOS is LOS beyond the 75th percentile. For patients with extended LOS, the 30-day, 1-year and cumulative mortality was 12.5%, 27.1% and 37.5% respectively that more than in patients without extended LOS ($p < 0.0001$) (Table 3).

The mortality rate in patients with systemic inflammatory response syndrome (SIRS) or acute kidney injury (AKI) during admission or serum albumin level less than 3.5 g/dL were higher than patient without these parameters significantly (Table 3).

The independent predictors of mortality were analyzed in the logistic regression analysis and Cox regression analysis. No significant covariates predictor of 30-day mortality was found. Extended LOS was identified as an independent predictor of 1-year mortality and cumulative mortality (OR 25.25, $p < 0.0001$ and OR 3.624, $p = 0.007$ respectively). However, Charlson index more than 4 and SIRS were also to be the independent predictor of cumulative mortality (Figure 1-3).

In diverticular bleeding subgroup, a total of 91 patients [56 males (61.5%)] median age was 66 years. Spontaneous hemostasis was seen in 82 cases (90.1%) and overt rebleeding was seen in 20 cases (22%). The 30-day mortality rate occurred in 1.1%, 1-year mortality in 6.6% and cumulative mortality in 20.93.ity in 21ve mortality in 21.5han 4 and SIRS were also to be independent predictive of cumulative mortality. %. The 1-year mortality rate of patients with extended LOS was significant higher than without extended LOS ($p = 0.001$). The cumulative mortality rate was higher in patients with more Charlson index score ($p < 0.0001$). There was no significant predictor for colonic diverticular rebleeding. Extended LOS was identified as an independent predictor of 1-year mortality (OR 12.16, 95% CI 2-73.85; $p = 0.007 = 0.046$-year mortality (OR 6.84s higher in patients with more Charlson index score (P=). Charlson index more than 3 was independent predictor of cumulative mortality (OR 10.44, 95% CI 1.08-100.62; p=0.04).

In acute diverticulitis subgroup, a total of 89 patients [51 females (57%)] median age was 61 years.

Table 1. Demographic characteristic of in-patient diverticular disease admission from 2000 to 2010.

		Overall Diverticular disease		Acute Diverticulitis		Diverticular Bleeding	
		N	%	N	%	N	%
Total		195	100	89	100	91	100
Age	<50	20	10.3	14	15.7	6	6.6
	50-59	28	14.4	16	18	10	11
	60-69	30	15.4	13	14.6	14	15.4
	70-79	39	20	13	14.6	24	26.4
	≥80	78	40	33	37.1	37	40.7
Gender	Male	99	50.8	38	42.7	56	61.5
	Female	96	49.2	51	57.3	35	38.5
Charlson index	0	85	43.6	42	47.2	56	61.5
	1	41	21	20	22.5	19	20.9
	2	27	13.8	11	12.4	15	16.5
	3	17	8.7	8	9	9	9.9
	4	13	6.7	4	4.5	9	9.9
	5	7	3.6	2	2.2	4	4.4
	6+	5	2.6	2	2.2	3	3.3
Disease	Uncomplicated Divertculitis	48	24.6	48	53.9	-	-
	Complicated Diverticulitis	41	21	41	46.1	-	-
	Diverticular Bleeding	91	46.7	-	-	91	100
	SUDD	13	6.7	-	-	-	-
	SCADD	2	1	-	-	-	-
Diagnosis	Colonoscopy	74	37.9	3	3.4	63	69.2
	CT scan	61	31.3	53	59.6	4	4.4
	Barium Enema	31	15.9	9	10.1	19	20.9
	Surgery	29	14.9	24	27	5	5.5
Indication	Pain	104	53.3	87	97.8	3	3.3
	Bleeding	86	44.1	1	1.1	85	93.4
	Bowel habit change	4	2.1	-	-	3	3.3
	Iron Def. anemia	1	0.5	1	1.1	-	-
Location	Left side	63	32.3	37	41.6	20	22
	Right side	58	29.7	29	32.6	24	26.4
	Left and right	9	4.6	3	3.4	6	6.6
	Entire colon	52	26.7	11	12.4	38	41.8
	Isolated cecum	13	6.7	9	10.1	3	3.3
LOS	Median(range)	6 (0-159)		7 (0-118)		5 (0-159)	
Treatment	Conservative	146	74.9	55	61.8	77	84.6
	Operative	49	25.1	34	38.2	14	15.4
Type of Operation	Total colectomy	4	2.1	1	1.1	3	3.3
	Subtotal colectomy	6	3.1	-	-	5	5.5
	Rt.hemicolectomy	11	5.6	6	6.7	5	5.5
	Lt.hemicolectomy	4	2.1	4	4.5	-	-
	Sigmoidec+Hartmann	12	6.2	12	13.5	-	-
	Appendectomy	6	3.1	6	6.7	-	-
	Others	6	6.1	5	5.6	1	1.1
Recurrent		28	14.4	6	6.7	20	22
Death	Within 30 days	7	3.6	6	6.7	1	1.1
	Within 1 year	18	9.2	11	12.4	6	6.6
	Cumulative mortality	42	21.5	21	23.6	19	20.9
	Diverticular related	8	4.1	7	7.9	1	1.1

Table 2. Diverticular disease and distribution of diverticuli.

		Location				
		Lt. side	Rt. side	Both Lt. and Rt. side	Pancolon	Isolated cecum
Uncomplicated diverticulitis	Count (N)	10	19	2	10	7
	% within disease	20.8	39.6	4.2	20.8	14.6
	% within location	15.9	32.8	22.2	19.2	53.8
Complicated diverticulitis	Count (N)	27	10	1	1	2
	% within disease	65.9	24.4	2.4	2.4	4.9
	% within location	42.9	17.2	11.1	1.9	15.4
Bleeding diverticular	Count (N)	20	24	6	38	3
	% within disease	22	26.4	6.6	41.8	3.3
	% within location	31.7	41.4	66.7	73.1	23.1
SUDD	Count (N)	4	5	0	3	1
	%within disease	30.8	38.5	0	23.1	7.7
	% within location	6.3	8.6	0	5.8	7.7
SCADD	Count (N)	2	0	0	0	0
	% within disease	100	0	0	0	0
	% within location	3.2	0	0	0	0

According to Modified Hinchey classification, uncomplicated diverticulitis was account for 53.9% and complicated diverticulitis was 46.1%. Operative intervention occurred in 34 cases (38.2%). These interventions were undertaken on an emergency basis in 29 cases (90.6%) and on an elective basis in 5 cases (9.4%). The 30-day mortality rate occurred in 6 cases (6.7%), all of 6 cases were female and left-sided complicated diverticulitis (4 cases for Hinchey class 4 and 2 cases for Hinchey class 2) and died after emergency surgery. The 1-year mortality was 12.4% and cumulative mortality was 23.63.ity in 21ve mortality in 21.5han 4 and SIRS were also to be independent predictive of cumulative mortality. %. The mortality rate in patients with complicated diverticulitis or extended LOS or AKI during admission or serum albumin < 3.5 g/dL were significantly higher than in patients without these parameters (OR 10.44, 95% CI 1.08-100.62; p= 0.04), (OR 6.84, 95% CI 1.05-44.53; p = 0.044), (OR 10.35, 95% CI 1.05-102.35; p = 0.046) and (OR 11.47, 95% CI 2.56-51.26; p = 0.001), respectively.

There were 8 patients (4.1%) death from diverticular-related cause. All were female with LSDD, 7 patients were complicated diverticulitis and 1 patient for diverticular bleeding. All cases were admitted with LOS more than 9 days and 7/8 patients (87.5%) underwent emergency operation as shown in Table 4. The independent predictors for diverticular-related mortality were extended LOS (OR 11.00, p = 0.034) and operation (OR 10.51, p = 0.037).

DISCUSSION

In this study, we showed examined the number of hospital admission for diverticular disease (DD) in Chiang Mai, Thailand. The overall patterns were described for all DD admissions as categorized by ICD codes K57.2-57.9; however, the outcome analysis was only for inpatient admissions.

We showed that the number of patients who admitted with DD was increased over the course of the study and increased with age, the trend of admission was similar to the study from England[16,17]. A male preponderance of between 1.6:1 and 3:1 was reported in studies before 1930, but subsequent reports from the 1950 and 1960 have shown higher prevalence rates amongst females[2]. In the recent epidemiologic study from England, the male-to-female ratio was 1:1.6[18]. In our study there was not gender preponderance for all DD, the male-to-female ratio is 1:1 but in subgroup of acute diverticulitis found the ratio was 1:1.3 but in subgroup of diverticular bleeding the ratio was 1.6:1. The preponderance of male with diverticular bleeding in this study was in agreement with the study of In-

Table 3. 30-day, one-year and cumulative mortality of all diverticular diseases.

		30-day mortality			One-year mortality			Cumulative mortality		
		Yes	No	*p*-value	Yes	No	*p*-value	Yes	No	*p*-value
Total (%)		7 (3.6)	188 (96.4)		18 (9.2)	177 (90.8)		42 (21.5)	153 (78.5)	
Age	<50	0	20 (100)	0.156	0	20 (100)	0.056	2 (20)	18 (90)	0.052
	50-59	0	28 (100)		1 (3.6)	27 (96.4)		3 (10.7)	25 (89.3)	
	60-69	1 (3.3)	29 (96.7)		3 (10)	27 (90)		4 (13.3)	26 (86.7)	
	70-79	2 (5.1)	37 (94.9)		4 (10.3)	35 (89.7)		8 (20.5)	31 (79.5)	
	≥80	4 (5.1)	74 (94.9)		10 (12.8)	68 (87.2)		25 (32.1)	53 (67.9)	
Gender	Male	0	99 (100)	0.006	4 (4)	95 (96)	0.011	18 (18.2)	81 (81.8)	0.274
	Female	7 (7.3)	89 (92.7)		14 (14.6)	82 (85.4)		24 (25)	53 (67.9)	
Charlson index	0	2 (2.4)	83 (97.6)	0.514	3 (3.5)	82 (96.5)	0.005	6 (7.1)	79 (92.9)	<0.0001
	1	2 (4.9)	39 (95.1)		4 (9.8)	37 (90.2)		6 (14.6)	35 (85.4)	
	2	1 (3.7)	26 (96.3)		3 (11.1)	24 (88.9)		9 (33.3)	18 (66.7)	
	3	1 (5.9)	16 (94.1)		3 (17.6)	14 (82.4)		7 (41.2)	10 (58.8)	
	4	1 (7.7)	12 (92.3)		3 (23.1)	10 (76.9)		8 (61.5)	5 (38.5)	
	5	0	7 (100)		1 (14.3)	6 (85.7)		3 (42.9)	4 (57.1)	
	6+	0	5 (100)		1 (20)	4 (80)		3 (60)	2 (40)	
Disease	Uncomplicated diverticulitis	0	48 (100)	0.318	0	48 (100)	0.97	5 (10.4)	43 (89.6)	0.016
	complicated diverticulitis	6 (14.6)	35 (85.4)		11 (26.8)	30 (73.2)		16 (39)	25 (61)	
	Bleeding	1 (1.1)	90 (98.9)		6 (6.6)	85 (93.4)		19 (20.9)	72 (79.1)	
	SUDD	0	13 (100)		1 (7.7)	12 (92.3)		2 (15.4)	11 (84.6)	
	SCADD	0	2 (100)		0	2 (100)		0	2 (100)	
Location	Lt.side	7 (11.1)	56 (88.9)	0.001	10 (15.9)	53 (84.1)	0.006	21 (33.3)	42 (67.7)	0.030
	Rt.side	0	58 (100)		6 (10.3)	52 (89.7)		10 (17.2)	48 (82.8)	
	Both Lt&Rt	0	9 (100)		1 (11.1)	8 (89.9)		3 (33.3)	6 (66.7)	
	Pancolon	0	52 (100)		1 (1.9)	51 (98.1)		6 (11.5)	46 (88.5)	
	Isolate cecum	0	13 (100)		0	13 (100)		2 (15.4)	11 (84.6)	
Extended LOS	Yes	6 (12.5)	42 (87.5)	<0.0001	13 (27.1)	35 (72.9)	<0.0001	18 (37.5)	30 (62.5)	0.001
	No	1 (0.7)	146 (99.3)		5 (3.4)	142 (96.6)		24 (16.3)	123 (83.7)	
BP	<90/60	1 (7.7)	12 (92.3)	0.412	3 (23.1)	10 (76.9)	0.075	4 (30.8)	9 (69.2)	0.335
	≥90/60	6 (3.3)	176 (96.7)		15 (8.2)	167 (91.8)		38 (20.9)	144 (79.1)	
AKI	Yes	6 (18.8)	26 (81.2)	<0.0001	10 (31.2)	22 (68.8)	<0.0001	15 (46.9)	17 (53.1)	<0.0001
	No	0	118 (100)		6 (5.1)	112 (94.9)		19 (16.1)	99 (83.9)	
Hypoalbuminemia	Yes	6 (10.2)	53 (89.8)	0.020	13 (22)	46 (78)	0.006	22 (37.3)	37 (62.7)	0.011
	No	0	51 (100)		2 (3.9)	49 (96.1)		6 (11.8)	45 (88.2)	
SIRS	Yes	6 (9.1)	60 (90.9)	0.005	13 (19.7)	53 (80.3)	0.002	22 (33.3)	44 (66.7)	0.001
	No	0	83 (100)		3 (3.6)	80 (96.4)		10 (12)	73 (88)	
treatment	Conservative	1 (0.7)	145 (99.3)	<0.0001	9 (6.2)	137 (93.8)	0.011	28 (19.2)	118 (80.8)	0.240
	Operation	6 (12.2)	43 (87.7)		9 (18.4)	40 (81.6)		14 (28.6)	35 (71.4)	
Recurrent	Yes	0	28 (100)	0.596	0	28 (100)	0.081	6 (21.4)	22 (78.6)	0.617
	No	7 (4.2)	160 (95.8)		18 (10.8)	149 (89.2)		36 (21.6)	131 (78.4)	

dian-subcontinent Asian patients[1].

36.4% of our patients with diverticulosis had it only on the right side of the colon (RSDD and isolated cecal diverticulosis), 32.3% exclusively in the left hemicolon and 31.3% bilaterally. Interestingly in most other studies from Asian population documented a preponderance of right-sided diverticular disease more than our study, diverticular disease among the Japanese was predominantly right-side about 70%[19], as it was in study from Malaysia where 80% had only on the right side of the colon[20]. Others published data from Singapore again documented a preponderance of right sided diverticular disease (70%)[6].

There was an overall 30-day mortality rate of 3.6% and 1-year all-cause mortality rate of 9.2% compared with study in England which 30-day and 1-year

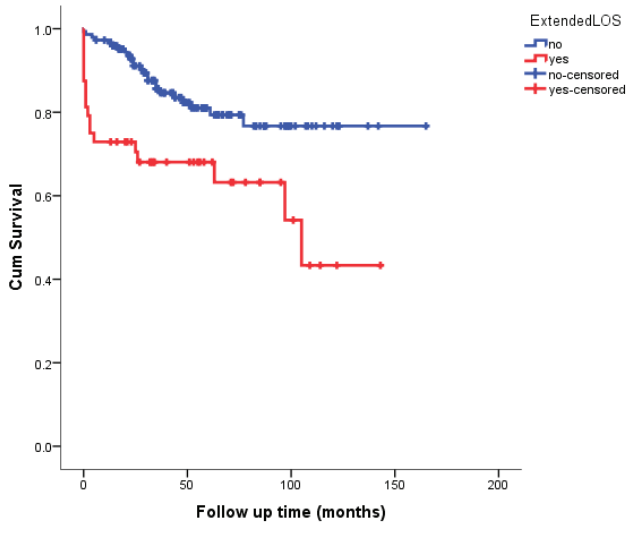

Figure 1. Extended LOS was identified as an independent predictor of 1-year mortality and cumulative mortality.

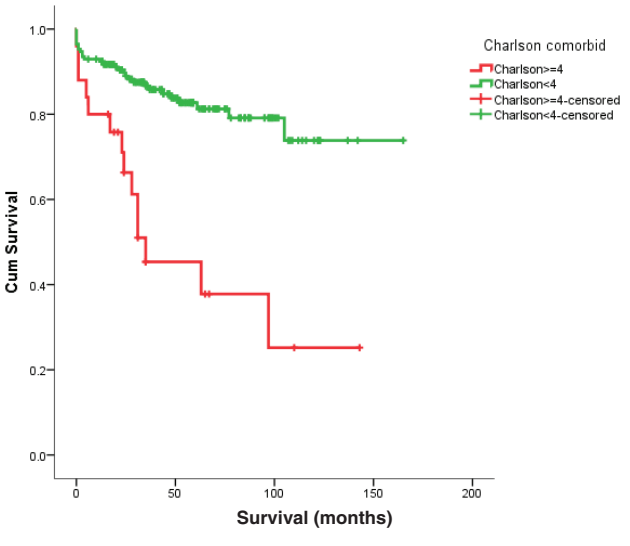

Figure 2. Charlson index more than 4 was identified as an independent predictor of 1-year mortality and cumulative mortality.

mortality were 5.1% and 14.5% respectively[17]. Our study had cumulative all-cause mortality of 21.5% with followed up for a median of 42 months.

For all diverticular disease, extended LOS was an important predictor for 1-year and cumulative all-cause mortality. SIRS and increasing comorbidity measured by Charlson index correlated well with increasing cumulative all-cause mortality. Study in English showed the increasing age and gender differences (male vs. female) were significant in the regression models investigating 30-day and 1-year mortality but these

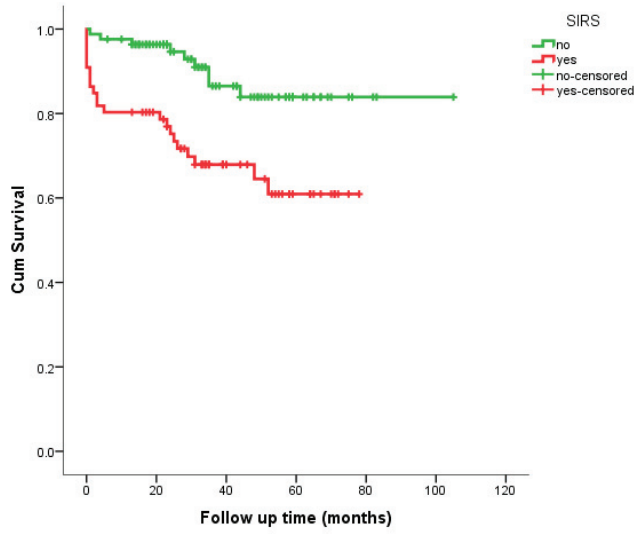

Figure 3. Systemic inflammatory response syndrome (SIRS) was identified as an independent predictor of 1-year mortality and cumulative mortality.

independent factors was not significant in our study. There was no independent predictor for 30-day mortality in this study.

Subgroup analysis for diverticular bleeding, extended LOS was identified as an independent predictor of 1-year mortality = 0.046-year mortality (OR 6.84s higher in patients with more Charlson index score (P=. Charlson index more than 3 was independent predictive of cumulative mortality, which was similar to the study of Lisa L. et al[21]. Overt rebleeding occurred in 20 patients (22%). Study from Japan showed the rebleeding was 27% and higher BMI and colonoscopic finding of actively bleeding or nonbleeding visible vessel could used as predictive factor for colonic diverticular rebleeding[22]. Our study there was neither data of BMI nor endoscopic finding, we analyzed other variables in the regression model but we could not identify independent factor for rebleeding.

Subgroup analysis for acute diverticulitis, uncomplicated diverticulitis was account for 53.9% and complicated diverticulitis was 46.1%. Operative intervention occurred in 34 cases (38.2%). These interventions were undertaken on an emergency basis in 29 cases (90.6%) and postoperative mortality rate was 6.7% comparable with study from Spain which postoperative mortality was 6.2%[23]. In this study, there was no independent predictor for postoperative mortality. Other published data documented an advanced age, high ASA classification, high Mannheim peritonitis

Table 4. Patients characteristic of diverticular-related death.

	Gender	Age	Charlson index	Disease	Location	Ext.LOS	AKI	SIRS	Hypoalbuminemia	Emergency operation
1	Female	79	2	Diverticular bleeding	LSDD	Yes	Yes	Yes	Yes	No
2	Female	54	3	Comlicated diverticulitis	LSDD	Yes	NA	NA	NA	Yes
3	Female	92	1	Comlicated diverticulitis	LSDD	Yes	Yes	Yes	Yes	Yes
4	Female	69	4	Comlicated diverticulitis	LSDD	Yes	Yes	Yes	Yes	Yes
5	Female	88	1	Comlicated diverticulitis	LSDD	Yes	Yes	Yes	Yes	Yes
6	Female	63	0	Comlicated diverticulitis	LSSD	Yes	Yes	Yes	Yes	Yes
7	Female	74	0	Comlicated diverticulitis	LSSD	Yes	Yes	Yes	Yes	Yes
8	Female	46	1	Comlicated diverticulitis	LSSD	Yes	Yes	Yes	Yes	Yes

index and hypoalbuminemia were the factors linked with a poor outcome[23-25]. For our study, AKI and hypoalbuminemia were identified as an independent predictor of 1-year mortality, hypoalbuminemia not only be a predictor of 1-year mortality but also be a predictor of cumulative mortality.

The limitation of this study, because of the retrospective design of the study some important clinical data were not recorded. There was selection bias due to the electronic database (Digicard) of Maharaj Nakorn Chiang Mai Hospital was introduced to use in 2007 thus data from patient who admitted before 2007 and had no follow up data were not included in this study.

In conclusion, the number of admission for diverticular disease was increasing in Thailand. Right-sided diverticular disease in Thailand was found less than other studies from Asian countries. The predictors of extended LOS, SIRS, hypoalbuminemia and comorbidity were associated with poor outcome.

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