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CA125 is a potential biomarker to predict surgically incurable gastric and cardia cancer

A retrospective study

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Abstract

Preoperative evaluation of the curability of gastric and cardia cancer is important to avoid risks of unnecessary surgery. Our previous study has reported several clinical parameters associated with incurable gastric surgery. In this study, we aimed to evaluate the correlation between CA125 and the curability of gastric and cardia cancer.

A total of 297 cases of gastric and cardia cancer were analyzed retrospectively, including 153 cases with radical surgery and 144 with surgery for incurable gastric or cardia cancer. χ^2 test was performed to analyze the associations between curability or incurable factors and clinicopathological data, including CA125 value. ROC curves were generated, and cutoff points for curability, T status, N status, peritoneal metastasis, and distant metastasis were found, respectively. Binary logistic regression was performed to verify the associations between dependent variables (curability, T status, N status, peritoneal metastasis, and distant metastasis) and covariates (related clinicopathological data from step 1 and cutoff points from step 2).

Esophageal involvement, T grade, and CA125 were risk factors of curability. T grade and Borrmann type were risk factors of T status. T grade and CA125 were risk factors of N status. Age, esophageal involvement, T grade, and CA125 were risk factors of peritoneal metastasis. CA125 was risk factor of distant metastasis.

CA125 is a potential biological marker for curability prediction of gastric and cardia cancer.

Abbreviations: AJCC = American Joint Committee on Cancer, CA125 = Cancer antigen 125, ROC = Receiver operating characteristic.

Keywords: CA125, cardia cancer, curability, gastric cancer, surgery

1. Introduction

Gastric and cardia cancer are one of the most commonly diagnosed malignancies in the world. Gastric cancer is the fifth most common cancer,[1] and the third leading cause of cancer death.[2] The number of gastric cancer patients in China is the largest worldwide, which accounts for >40% of new gastric cancer cases and deaths worldwide in 2012.[2] Most of gastric cancer cases are found in developing countries, and East Asia is with a high fatality rate as well.

In China, the 5-year survival of gastric cancer has improved from 15.3% for patients diagnosed during 1995–1999 to 29.0% during 2000–2004 and 31.3% during 2005–2009.[3] The improvement of prognosis is the consequence of advanced surgical techniques and adjuvant treatments. Radical surgery with adequate surgical resection and lymphadenectomy is regarded as the only curative way either for early gastric cancer or nonmetastatic advanced gastric cancer.[4] However, owing to its nonspecific symptoms and highly invasive characteristics, most cases are diagnosed at the advanced stage of disease.[5] It is reported that only 20% to 50% of patients who underwent surgical exploration can be operated with curative intent surgery.[6,7] Taken the risk of operation into consideration, it is not suggested for patients with incurable disease. Therefore, it will be of importance to confirm whether one patient is appropriate to receive operation preoperatively.

In our previous study,[8] we reported the association between clinical parameters and the curability of gastric cancer, in which the curability was defined as the possibility to undergo radical surgery, instead of palliative resection, exploratory surgery, and bypass surgery. Some commonly used serum tumor markers were not studied, however. Serum tumor markers, such as Cancer antigen 125 (CA125), play important roles in the diagnosis, management, and evaluation of prognosis, recurrence, and metastasis.

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CA125 is a widely used tumor marker, which is a glycoprotein expressed in epithelium lining body cavities, and regarded as the most reliable serum marker for ovarian carcinoma.[9] It has been found to show high sensitivity and specificity in the diagnosis of several digestive tract cancers.[10] Nevertheless, the correlation between CA125 and the curability of gastric or cardia cancer has not been reported before. On the basis of our previous results, we will study the association of CA125 and the curability of gastric and cardia cancer, and try to provide some evidence for clinical management of gastric and cardia cancer patients.

2. Method

2.1. Patients

We collected cases of primary gastric and cardia cancer surgically treated in Zhejiang Cancer Hospital (Hangzhou, China) from January 2007 to January 2011 retrospectively. Patients of T3/T4 gastric or cardia cancer with the data of preoperative CA125 were included. Those who did not receive operation, had other cancers simultaneously, or received preoperative chemotherapy or radiotherapy were excluded. This research was approved by Medical Ethics Committee, Zhejiang Medical College. Written informed consent was obtained from each patient before study enrolment.

One hundred forty-four cases of incurable gastric and cardia cancer were selected, 36 of them underwent palliative resection, and the other 108 underwent exploratory surgery or bypass surgery. Meanwhile, 153 cases of gastric and cardia cancer who underwent radical surgery were collected as control group.

2.2. Data collection

The clinicopathological data including sex, age, surgery properties, tumor region, esophageal involvement, Borrmann type, pathologic type, grading of cancer, T grade, incurable factors, and CA125 value were collected. As some surgeons did not describe the gross specimen in the record, and the grading information was not included in some pathological reports, the Borrmann-type data were complete in 216 cases, and the grading data were complete in 234 cases.

The tumor staging, TNM stage system, and T grade were determined according to the guideline of 2002 American Joint Committee on Cancer (AJCC). Pathological T was used in cases with postoperative histopathologic examination. Surgical staging was used for those cases impossible to acquire pathological T (undergone exploratory or bypass surgery). T status (tumor was unresectable because of its direct infiltration), N status (tumor was unresectable because there were unresectable lymph nodes), peritoneal metastasis (the tumor was unresectable because peritoneal metastasis was found during operation), and distant metastasis (the tumor was unresectable because distant metastasis was found during operation) were categorized as incurable factors.

2.3. CA125 measurement

The procedures basically followed our previous study.[11]

Blood samples were collected with venipuncture before surgery. Serum was separated by centrifuge and then stored at −20°C until detection. Serum concentration of CA125 was measured by i4000 light-emitting apparatus (Abbott Laboratories Ltd.) with chemiluminescence. Reagent was provided by above company. According to the manufacturer's instructions, the cut-off concentration of CA125 was 35 U/mL.

2.4. Statistical analysis

Statistical analyses were performed using SPSS 19.0 (SPSS Inc, Chicago, IL). The analytical procedures basically followed our previous study:[8]

2.4.1. Step 1. χ^2 test was used to analyze the associations between clinicopathological data and curability, T status, N status, peritoneal metastasis, or distant metastasis.

2.4.2. Step 2. Analyze the relation of CA125 value and curability, T status, N status, peritoneal metastasis, and distant metastasis. Generate receiver-operating characteristic (ROC) curve, calculate the Youden index, and found cutoff points for curability (cut-off [C]), T status (cut-off [T]), N status (cut-off [N]), peritoneal metastasis (cut-off [P]), and distant metastasis (cut-off [D]), respectively.

2.4.3. Step 3. Binary logistic regression with backward: conditional method was performed. Dependent variables were curability, T status, N status, peritoneal metastasis, and distant metastasis. Covariates were the related clinicopathological data from step 1 and the CA125 cut-off points from step 2. Borrmann type and grading were exceptional because some cases had no available Borrmann type or grading data.

2.4.3.1. Step 4. If Borrmann type or grading factor was one of the related factors, binary logistic regression was then performed again using curability, T status, N status, peritoneal metastasis, or distant metastasis from step 2 as dependent variables and the related clinicopathological data from step 1 and the CA125

Table 1

Associations between curability and clinicopathological data.

	Curability		
	Yes	No	*P*
Sex			
Male	110	101	0.739
Female	43	43	
Age, y			
<60	75	87	0.049
≥60	78	57	
Gastric body			
Not involved	40	56	0.019
Involved	113	88	
Gastric antrum			
Not involved	76	54	0.035
Involved	77	90	
Esophagus			
Not involved	102	140	0.000
Involved	51	4	
Signet ring cell carcinoma			
No	116	99	0.275
Partly	24	25	
Mainly	13	20	
T grade			
3	138	46	0.000
4	15	98	
Grading (n = 301)			
Well and moderately differentiated	22	6	0.000
Poorly differentiated	110	96	
Borrmann type (n = 297)			
I + II	53	28	0.739
III	72	13	
IV	28	22	

Table 2

Associations between the T status or N status and clinicopathological data.

	T status			N status		
	No	Yse	*P*	No	Yes	*P*
Sex						
YMale	170	41	0.691	180	31	0.487
YFemale	71	15		76	10	
Age, y						
Y<60	131	31	0.892	139	23	0.830
Y≥60	110	25		117	18	
Gastric body						
YNot involved	75	21	0.358	78	18	0.088
YInvolved	166	35		178	23	
Gastric antrum						
YNot involved	113	17	0.025	116	14	0.181
YInvolved	128	39		140	27	
Esophagus						
YNot involved	187	55	0.000	202	40	0.004
YInvolved	54	1		54	1	
Signet ring cell carcinoma						
YNo	171	44	0.412	182	33	0.403
YPartly	43	6		45	4	
YMainly	27	6		29	4	
T grade						
Y3	181	3	0.000	176	8	0.000
Y4	60	53		80	33	
Grading (n=301)						
YWell and moderately differentiated	26	2	0.036	27	1	0.157
YPoorly differentiated	170	36		173	33	
Borrmann type (n=297)						
YI+II	75	6	0.000	75	6	0.000
YIII	78	7		83	2	
YIV	38	12		43	7	

cutoff points plus Borrmann type or grading as covariates in those cases with complete Borrmann type or grading factor.

Step 5

If Borrmann type or grading factor was not one of the related factors obtained through binary logistic regression from step 3, the results in step 2 were the final result. However, if Borrmann type or grading factor was the related factor, the results in step 3 were the final result.

3. Results

3.1. Patient characteristics

Of all the 297 cases, the mean age was 57.93 ± 9.83 years (range 25–81 years) in the radical surgery group and 55.95 ± 10.72 years (range 22–77 years) in the incurable surgery group ($P = 0.097$). The incurable factors, that is, T status, N status, peritoneal metastasis, and distant metastasis, were categorized in 56, 41, 94, and 11 cases, respectively.

3.2. Associations between clinicopathological factors and curability

Of all clinicopathological factors, age, gastric body, gastric antrum, esophageal involvement, T grade, and grading of cancer were associated with curability (Table 1).

3.3. Associations between clinicopathological factors and T status, N status, peritoneal metastasis, or distant metastasis

T status was associated with gastric antrum, esophageal involvement, T grade, Borrmann type, and grading of cancer. N status was associated with esophageal involvement, T grade, and grading of cancer (Table 2). Peritoneal metastasis was associated with esophageal involvement, T grade, Borrmann type, and grading of cancer. There were no clinicopathological parameters associated with distant metastasis (Table 3).

3.4. Associations between CA125 value and clinicopathological factors, curability, T status, N status, peritoneal metastasis, or distant metastasis

The CA125 value was significantly higher in incurable, male, T4, and Borrmann type IV gastric and cardia cancer patients (Table 4). CA125 was also statistically associated with N status, peritoneal metastasis, or distant metastasis (Table 5).

3.5. The ROC curve of CA125 and curability, T status, N status, peritoneal metastasis, distant metastasis

The ROC curves of CA125 and curability (Fig. 1), T status (Fig. 2), N status (Fig. 3), peritoneal metastasis (Fig. 4), and distant metastasis (Fig. 5) were shown in Figures; 13.95 U/mL, 12.95 U/mL, 15.75 U/mL, 18.35 U/mL, and 53.55 U/mL were set as cut-off (C), cut-off (T), cut-off (N), cut-off (P), and cut-off (D), respectively.

The cutoff points were then tested by χ^2 test (Table 6). All the results showed significant differences.

3.6. Multivariate analyses for curability, T status, N status, peritoneal metastasis, and distant metastasis

Multivariate analyses of multiple steps (step 4 and step 5 in "statistical analysis" part) were performed. Esophageal involve-

Table 3

Associations between peritoneal metastasis or distant metastasis and clinicopathological data.

	Peritoneal metastasis			Distant metastasis		
	No	Yes	*P*	No	Yes	*P*
Sex						
YMale	146	65	0.624	201	10	0.139
YFemale	57	29		85	1	
Age, y						
Y<60	103	59	0.053	153	9	0.064
Y≥60	100	35		133	2	
Gastric body						
YNot involved	65	31	0.869	90	6	0.108
YInvolved	138	63		196	5	
Gastric antrum						
YNot involved	88	42	0.830	127	3	0.261
YInvolved	115	52		159	8	
Esophagus						
YNot involved	152	90	0.000	231	11	0.107
YInvolved	51	4		55	0	
Signet ring cell carcinoma						
YNo	154	61	0.136	205	10	0.334
YPartly	30	19		48	1	
YMainly	19	14		33	0	
T grade						
Y3	146	38	0.000	180	4	0.075
Y4	57	56		106	7	
Grading (n=301)						
YWell and moderately differentiated	24	4	0.012	28	0	0.501
YPoorly differentiated	144	62		197	9	
Borrmann type (n=297)						
YI+II	60	21	0.000	77	4	0.252
YIII	79	6		83	2	
YIV	35	15		50	0	

ment, T grade, and CA125 (C) were found associated with curability (Table 7), T grade and Borrmann type were found associated with T status (Table 8), T grade and CA125 (N) were found associated with T status (Table 9), age, esophageal involvement, T grade, and CA125 (P) were found associated with T status (Table 10), and CA125 (D) was found associated with distant metastasis (Table 11).

4. Discussion

Complete surgical resection, with or without adjuvant chemotherapy or radiotherapy, is regarded as the only way to achieve curative treatment for gastric cancer.[12] Current strategies usually define stage 0 to III gastric cancer as curable, which is suitable for radical resection. For patients of stage IV, the curative opportunity may be limited, as it is reported that up to 50% of patients without metastatic disease who undergo "curative" surgical resection present with recurrent disease within 5 years.[13]

Surgery for incurable gastric and cardia cancer may also be of importance. Studies have suggested that approximately 20% of patients with stage IV gastric cancer who undergo palliative gastric resection could relieve tumor-related symptoms, avoid tumor-related complications, and improve quality-of-life.[14] Nonresectional procedures are common currently, as it is reported over half of patients with stage IV gastric cancer who receive surgical intervention underwent gastric bypass procedures, gastrostomy, and jejunostomy, etc.[14] However, the risk of surgery for incurable gastric and cardia cancer should not be ignored. A meta-analysis reveals an overall postoperative in-hospital mortality of 14% and morbidity of 27% in patients who undergo noncurative gastric surgery for stage IV gastric cancer.[15] So, the decision of surgery should be made cautiously for gastric and cardia cancer patient with unknown curability.

As all the imaging techniques have some limitations in preoperative evaluation of the curability of gastric cancer,[8] looking for some other indicators is necessary. Our previous study[8] reported some clinical parameters associated with the curability of gastric cancer, which, to our knowledge, was the first to evaluate the risk factors for surgery of incurable gastric cancer. Considering the role CA125 plays in the diagnosis, management, and prognosis evaluation of malignant diseases, it is necessary to study the importance of CA125 in the evaluation of curability of gastric and cardia cancer. Nevertheless, no related research about the correlation between CA125 and curability has been reported until now.

Our study found that CA125 was associated with curability and N status, peritoneal metastasis, and distant metastasis. In addition to this, esophageal involvement and T grade were associated with curability. T grade and Borrmann type were associated with T status. T grade was associated with N status. Age, esophageal involvement, T grade, and Borrmann type were associated with peritoneal metastasis.

T grade plays an important role in tumor evaluation. T4 gastric and cardia cancer has involved the serosal surface, even invaded adjacent tissues and organs. Although T4 gastric and cardia

Table 4

Associations between the value of CA125 and clinicopathological data.

	n	M (U/mL)	SD (U/mL)	*P*
Curability				
YNo	144	62.92	138.63	0.000
YYes	153	17.06	31.96	
Sex				
YMale	211	31.66	59.89	0.042
YFemale	86	58.04	163.18	
Age, y				
Y<60	162	47.91	131.72	0.110
Y≥60	135	28.96	42.27	
Gastric body				
YNot involved	96	43.65	145.34	0.611
YInvolved	201	37.22	72.45	
Gastric antrum				
YNot involved	130	38.65	75.23	0.923
YInvolved	167	39.80	118.46	
Esophagus				
YNot involved	242	41.60	105.36	0.413
YInvolved	55	29.16	83.56	
Signet ring cell carcinoma				
YNo	215	39.21	109.79	1.000
YPartly	49	39.59	77.84	
YMainly	33	39.46	76.84	
T grade				
Y3	184	28.14	59.08	0.016
Y4	113	57.46	145.17	
Grading (n=301)				
YWell and moderately differentiated	28	22.06	28.80	0.296
YPoorly differentiated	206	35.81	68.53	
Borrmann type (n=297)				
YI+II	81	32.76	74.46	0.031
YIII	85	15.02	11.33	
YIV	50	42.02	81.90	

cancer patients can benefit from aggressive en bloc surgical resection,[16] some T4 gastric cancer cases are regarded unfit for curative surgery. T4 cases sometimes show marked invasion to adjacent structures, which makes them surgically incurable.[17] Extended curative operation may lead to high incidence of postoperative morbidity and mortality.[16] Serosal surface involvement of T4 gastric cancer means risk for peritoneal dissemination,[18] and peritoneal recurrence is common among patients with T4 primaries who are regarded as curable and undergo resection.[19] T4 gastric cancer is also often combined with metastasis such as lymph node involvement and liver metastasis.[17] Our study revealed that T grade was correlated with, and also a risk factor of, curability, T status, N status, and peritoneal metastasis, which was consistent with previous reports.

The classification of gastric and cardia cancer according to Borrmann criteria is accepted worldwide. Gastric and cardia cancer of different Borrmann type shows different clinical

Table 5

Associations between the value of CA125 and T status, N status, peritoneal metastasis, or distant metastasis.

	n	M (U/mL)	SD (U/mL)	*P*
T status				
YNo	241	40.13	110.51	0.769
YYes	56	35.70	48.17	
N status				
YNo	256	32.02	65.69	0.002
YYes	41	84.71	215.68	
Peritoneal metastasis				
YNo	203	25.53	100.73	0.001
YYes	94	69.02	97.73	
Distant metastasis				
YNo	286	33.80	64.38	0.000
YYes	11	182.28	405.53	

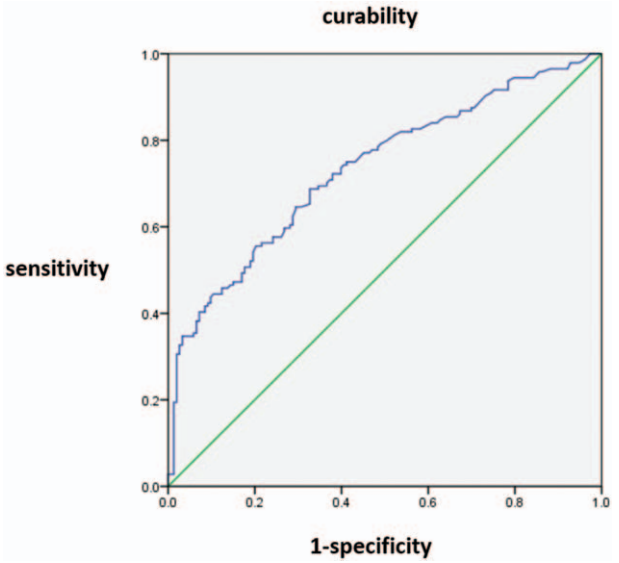

Figure 1. The receiver-operating characteristic curve of CA125 and curability. The area below the CA125-curability curve was 0.734 ($P=0.000$), the Youden index was maximum when the value was 13.95 U/mL (sensitivity 0.688, specificity 0.673).

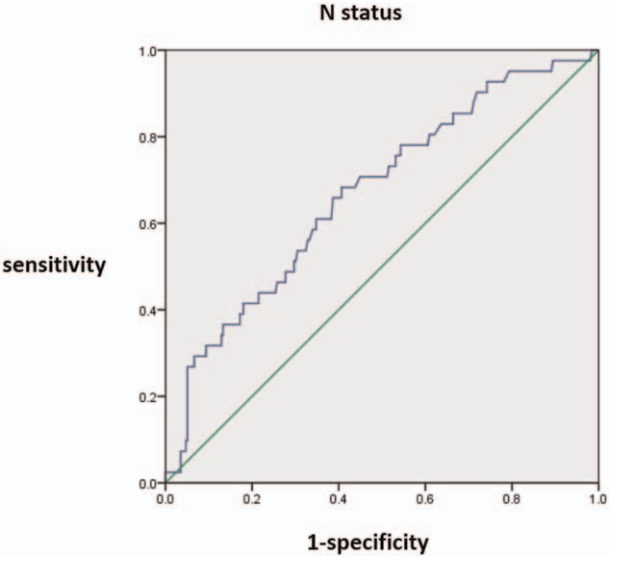

Figure 3. The receiver-operating characteristic curve of CA125 and N status. The area below the CA125-N status curve was 0.670 ($P=0.000$), the Youden index was maximum when the value was 15.75 U/mL (sensitivity 0.683, specificity 0.594).

patterns. Type IV gastric cancer is found in 9% of gastric cancer patients,[20] and is associated with advanced tumor progression. Type IV gastric cancer has a poor prognosis, and is even seen as surgically incurable because of the poor outcomes after surgery.[21] Type IV gastric cancer is reported to be correlated with poorly differentiated carcinoma, lymph node metastases, peritoneal metastases, serosal invasion, and lymphatic invasion by a meta-analysis including 15 studies.[22] All these clinical characteristics of type IV gastric and cardia cancer lead to a low curative resection. In our research, Borrmann type IV gastric and cardia cancer was associated with T status, N status, and peritoneal metastasis, which was similar to that observed in other studies. It was a risk factor of T status, too.

CA125 is a repeating peptide epitope of the mucin MUC16.[23] MUC16 can help in the formation of a disadhesive barrier,[24] and in regulating the mucosal defenses of the epithelial cell layer.[25] CA125 is identified as a 5797 -base pair cDNA isolated from the OVCAR-3 cDNA library.[26] It presents at human

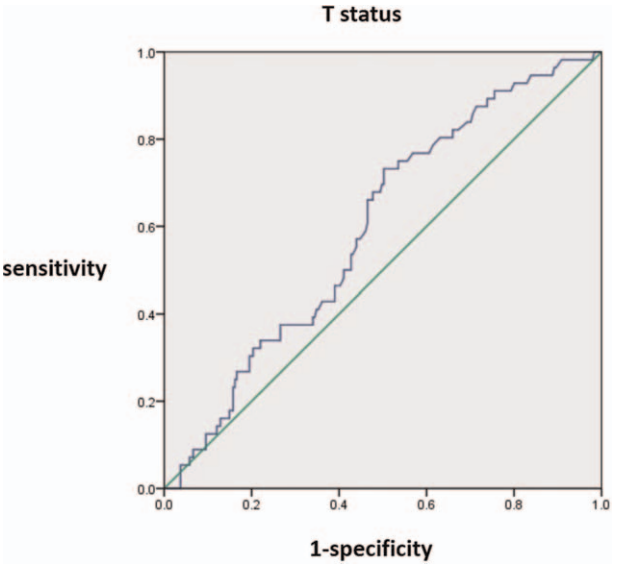

Figure 2. The receiver-operating characteristic curve of CA125 and T status. The area below the CA125-T status curve was 0.596 ($P=0.025$), the Youden index was maximum when the value was 12.95 U/mL (sensitivity 0.732, specificity 0.498).

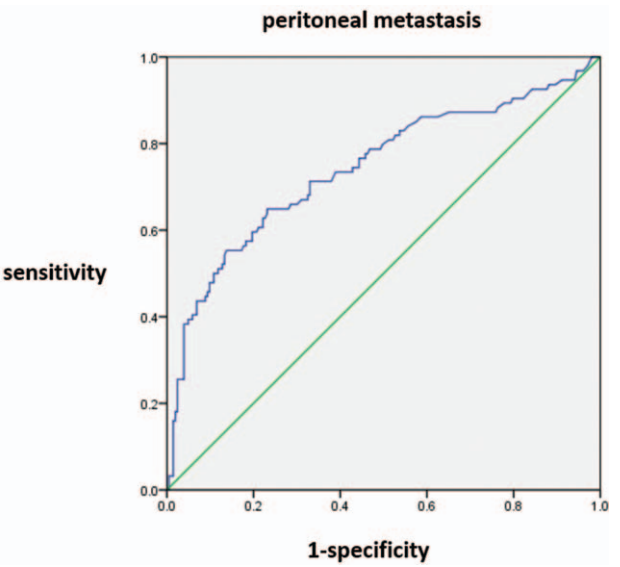

Figure 4. The receiver-operating characteristic curve of CA125 and peritoneal metastasis. The area below the CA125-peritoneal metastasis curve was 0.743 ($P=0.000$), the Youden index was maximum when the value was 18.35 U/mL (sensitivity 0.649, specificity 0.768).

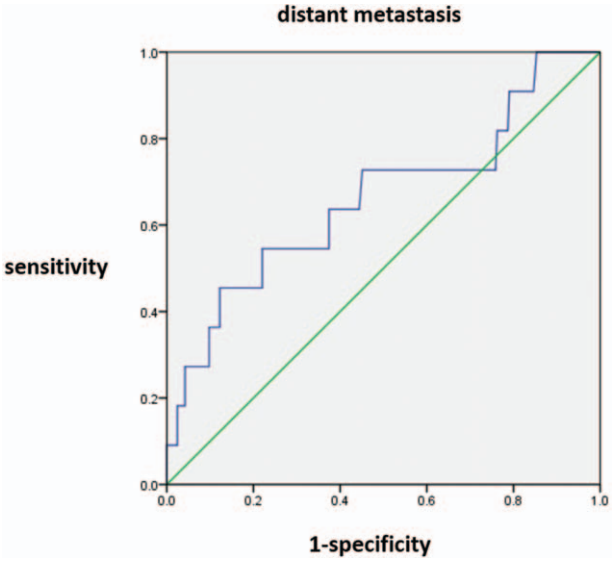

Figure 5. The receiver-operating characteristic curve of CA125 and distant metastasis. The area below the CA125-distant metastasis curve was 0.661 ($P = 0.070$), the Youden index was maximum when the value was 53.55 U/mL (sensitivity 0.455, specificity 0.878).

chromosome 19p13.2, and spans ~179 kb of genomic DNA encoding for a 22,152 aa protein, which has an approximate core protein size that varies from 2 to 5×10^6 Da.[27] Predicted glycosylated form of the protein is ~2×10^7 Da.[28] Its biological function includes promoting cancer cell proliferation and inhibiting anti-cancer immune responses.[29] CA125 is originally found as a specific biological marker for ovarian cancer, and is considered to be a method of diagnosing gastric cancer.[29] It is more frequently positive with peritoneal recurrence,[30] and the importance of CA125 in the evaluation of peritoneal metastasis is suggested.[31] According to Shigenobu et al,[32] Serum CA125 is a clinically useful marker in diagnosis, evaluating the efficacy of chemotherapy, and predicting the prognosis of patients with peritoneal dissemination. The expression of CA125 is found to be an independent predictor of poor outcome not only in gastric adenocarcinomas, but also pancreatic ductal adenocarcinomas and potentially in esophageal adenocarcinomas.[33] Bruce et al[34] find CA125 is predictive for the presence of extrauterine disease in patients with uterine cancer. Another literature reports that the level of CA125 appears to correlate with disease activity, disease-free and overall survival in patients of non-Hodgkin lymphoma.[35] In our study, CA125 was found to be associated with curability, N status, peritoneal metastasis, and distant metastasis of gastric and cardia cancer. Cutoff points were found, which means CA125 is a biological marker not only for the diagnosis and prognosis, but also potentially for estimating curability. In addition, CA125 was a risk factor of curability, N status, peritoneal metastasis, and distant metastasis. Our results may suggest that CA125 was correlated with tumor metastasis of gastric and cardia cancer.

However, there were still some limitations. As this was a retrospective study, the definition of Borrmann type and grading was not strictly unified, so there may be systematic bias. Besides, the information was incomplete in some patients, which affected the credibility of our study. The number of cases of distant metastasis was limited and relevant results need a larger number of cases to verify.

The result of this study was similar to our previous report.[8] Although both the studies were performed in the same center, the patients enrolled were different. So there were some differences that existed between the results of 2 studies. In short, we found CA125 was statistically associated with the curability and metastasis-related factors (N status, peritoneal metastasis, and

Table 6

The test of CA125 cutoff points.

	Curability		
	Yes	**No**	***P***
CA125 <13.95 U/mL	103	45	0.000
CA125 >13.95 U/mL	50	99	
	T status		
	Yes	**No**	***P***
CA125 <12.95 U/mL	15	120	0.001
CA125 >12.95 U/mL	41	121	
	N status		
	Yes	**No**	**p**
CA125 <15.75 U/mL	13	152	0.001
CA125 >15.75 U/mL	28	104	
	Peritoneal metastasis		
	Yes	**No**	**p**
CA125 <18.35 U/mL	33	156	0.000
CA125 >18.35 U/mL	61	47	
	Distant metastasis		
	Yes	**No**	**p**
CA125 <53.55 U/mL	6	251	0.009
CA125 >53.55 U/mL	5	35	

Table 7

Multivariate analyses for curability.

	OR	*P*	aOR	*P*
Esophagus				
YNot involved	1		1	
YInvolved	0.057 (0.020–0.163)	0.000	0.080 (0.020–0.270)	0.000
T grade				
Y3	1		1	
Y4	19.600 (10.359–37.085)	0.000	16.037 (7.965–32.289)	0.000
CA125				
YLower than cut-off (C)	1		1	
YHigher than cut-off (C)	4.532 (2.782–7.384)	0.000	3.506 (1.879–6.541)	0.000

The optimum cut-off point for CA125 (cut-off [C]) was 13.950 U/mL with a sensitivity of 68.8% and a specificity of 67.3%. aOR = adjusted odds ratio.

Table 8

Multivariate analyses for the T status.

	OR	*P*	aOR	*P*
T grade				
Y3	1		1	
Y4	36.437 (10.288–129.054)	0.000	36.437 (10.288–129.054)	0.000
Borrmann type				
YI + II	1		1	
YIII	1.122 (0.360–3.492)	0.843	3.164 (0.793–12.635)	0.103
YIV	3.947 (1.375–11.335)	0.011	3.313 (1.042–10.537)	0.043

The optimum cut-off point for CA125 (cut-off [T]) was 12.950 U/mL with a sensitivity of 73.2% and a specificity of 49.8%. aOR = adjusted odds ratio.

Table 9

Multivariate analyses for the N status.

	OR	*P*	aOR	*P*
T grade				
Y3	1		1	
Y4	9.075 (4.012–20.530)	0.000	6.849 (2.977–15.756)	0.000
CA125				
YLower than cut-off (N)	1		1	
YHigher than cut-off (N)	3.148 (1.558–6.361)	0.001	2.265 (1.073–4.783)	0.032

The optimum cutoff point for CA125 (cut-off [N]) was 15.750 U/mL with a sensitivity of 68.3% and a specificity of 59.4%. aOR = adjusted odds ratio.

Table 10

Multivariate analyses for peritoneal metastasis.

	OR	*P*	aOR	*P*
Age, y				
Y<60	1		1	
Y≥60	0.611 (0.370–1.008)	0.054	0.545 (0.299–0.991)	0.047
Esophagus				
YNot involved	1		1	
YInvolved	0.132 (0.046–0.379)	0.000	0.236 (0.076–0.737)	0.013
T grade				
Y3	1		1	
Y4	3.775 (2.259–6.306)	0.000	2.931 (1.649–5.212)	0.000
CA125				
YLower than cut-off (P)	1		1	
YHigher than cut-off (P)	6.135 (3.595–10.471)	0.000	6.116 (3.414–10.956)	0.000

The optimum cut-off point for CA125 (cut-off (P)) was 18.350 U/mL with a sensitivity of 64.9% and a specificity of 76.8%. aOR = adjusted odds ratio.

Table 11

Multivariate analyses for distant metastasis.

		OR	P
CA125	Lower than cut-off (D)	1	
	Higher than cut-off (D)	5.976 (1.732–20.618)	0.005

The optimum cut-off point for CA125 (cut-off(D)) was 53.550 U/mL with a sensitivity of 45.5% and a specificity of 87.8%. OR = odds ratio.

distant metastasis) in primary gastric and cardia cancer. Combined with other clinicopathological parameters, such as Borrmann type, esophageal involvement, and T grade, CA125 is valuable in the preoperative curability evaluation. It is an important biomarker to predict surgical curability of gastric and cardia cancer.

5. Conclusion

Esophageal involvement, T grade, and CA125 were risk factors of curability. T grade and Borrmann type were risk factors of T status. T grade and CA125 were risk factors of N status. Age, esophageal involvement, T grade, and CA125 were risk factors of peritoneal metastasis. CA125 was risk factor of distant metastasis. CA125 was predictive for the evaluation of curability of gastric and cardia cancer.

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