Dukes's classification: a valid prognostic indicator for gastric cancer

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Abstract

Dukes's classification for colorectal cancer is simple, and correlates well with survival. This study assessed whether the principles of Dukes's classification applied to gastric cancer resulted in the separation of prognostically useful groups. The cumulative survival curves determined by Dukes's, Astler-Coller's (another classification for colorectal cancer), and the Japanese classification for gastric cancer were evaluated using 476 curatively treated patients with gastric cancer. Of the three staging systems, both Dukes's and the Japanese classifications showed a step-wise relationship between the stage of the tumour and the survival of patients. The prognostic value of Dukes's classification was reinforced when Dukes's C cases were subdivided according to the number of positive nodes (1–6 v ≥7) or the level of positive nodes (n1 v n2, n3) but not when the subdivision was made according to the depth of wall invasion. A modified Dukes's classification in which Dukes's cases are subdivided according to the number of metastatic nodes (Dukes's Ca=1–6 nodes, Dukes's Cb >6 nodes) could be both simply and accurately applied to gastric cancer.
*(Gut 1994; **35**: 1368–1371)*

Pathological staging of tumours is important and is widely used to determine optimal treatment, assess prognosis, and evaluate treatment results.[1] For gastric cancer in Japan, the Japanese staging system outlined by the Japanese Research Society for Gastric Cancer[2] is generally used[3] but this is not so well known in western countries.

Dukes's classification[4] for colorectal cancer is simple, easy to recall, and correlates well with survival, and most gastroenterologists all over the world use it as an important prognostic indicator.[5] Astler-Coller's classification[6] also gives useful prognostic information in colorectal cancer.

In order to clarify whether or not Dukes's and Astler-Coller's classifications are also useful in gastric cancer, we analysed 476 curatively treated patients with gastric cancer and tested the criteria of Dukes's, Astler-Collier's, and the Japanese classifications. In addition, we sought a better staging system by modifying Dukes's classification.

Patients and methods

A consecutive series of 476 cases of gastric cancer was studied. All patients were curatively treated by either partial or total gastrectomy with lymph node dissection, and all resected specimens were examined histologically (using haematoxylin and eosin stains) in the Second Department of Surgery, Kyushu University between January 1975 and February 1986. No patient had liver or lung metastasis, peritoneal dissemination, extended lymph node metastasis, or adjacent organ involvement. In this series, lung and liver metastases were excluded by chest x ray, ultrasonography, and computed tomography, and extended lymph node metastasis was defined as involvement of the lymph nodes along the superior mesenteric artery, middle colic artery and abdominal aorta, and Virchow's node. Any cancers of the remnant stomach or cancers other than adenocarcinoma were excluded.

The stage of the disease was determined by the histological findings using the criteria of Dukes's, Astler-Coller's, and the Japanese staging systems. In Dukes's classification,[4] 'A' included tumours limited to the mucosa, submucosa, or muscularis propria; 'B' included those extending into the subserosa or serosa; and 'C' included those with lymph node metastasis. In Astler-Coller's classification,[6] 'A' included tumours limited to the mucosa; 'B1' included those invading the submucosa or muscularis propria; 'B2' included those extending into the subserosa or serosa; 'C1' included those not invading beyond the muscularis propria with lymph node metastasis; and 'C2' included those extending beyond the muscularis propria with lymph node metastasis. In the Japanese classification,[2] 'I' included tumours not invading beyond the subserosa without lymph node metastasis; 'II' included those extending into the subserosa or with positive group 1 nodes (n1); 'III' included those affecting the serosa or with positive group 2 nodes (n2); and 'IV' included those with positive group 3 nodes (n3).

The clinicopathological findings, including the level of lymph node metastasis, were analysed according to the general rules for gastric cancer study in surgery and pathology outlined by the Japanese Research Society for Gastric Cancer.[2] Follow up continued until death, or for more than five years for surviving patients. Information was obtained from death certificates. When death from recurrent gastric cancer was specified, the patient was included as a tumour-related death. The cumulative survival rates were calculated using the Kaplan-Meier method, and survival curves were tested using the Mantel-Cox method.

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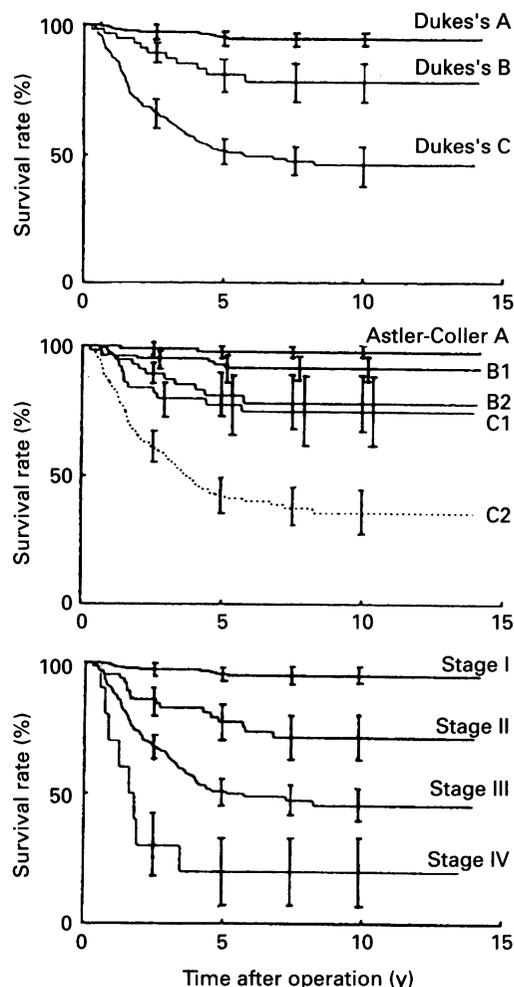
Figure 1: Cumulative survival curves for 476 patients with curatively treated gastric cancer according to the criteria of Dukes's (top), Astler-Coller's (middle), and Japanese (bottom) classifications. Vertical bars represent 95% confidence intervals.

TABLE I Five and 10 year survival rates in gastric cancer based on the Dukes's, Astler-Coller, and Japanese classifications

Staging system	No of patients	5 year survival rate (%)	10 year survival rate (%)
Dukes's:			
A	220	95	95
B	61	81	78
C	195	52	46
Astler-Coller's:			
A	112	98	98
B1	108	93	92
B2	61	81	78
C1	52	78	75
C2	143	42	36
Japanese stage:			
I	233	96	95
II	66	77	71
III	167	51	45
IV	10	20	20

Results

DUKES'S AND OTHER CLASSIFICATIONS

According to the criteria of Dukes's, Astler-Coller's, and the Japanese staging systems, cumulative survival curves and five and 10 year survival rates were calculated (Fig 1, Table I). Dukes's classification showed a clear correlation between tumour stage and survival. The five and 10 year survival rates were excellent in Dukes's A cases (95%, 95%), good in Dukes's B (81%, 78%), and fair in Dukes's C (52%, 46%). Astler-Coller's classification also showed a correlation between tumour stage and survival, but there was no step-wise relationship between stage and survival. The five and 10 year survival rates were similar in A cases (98%, 98%) and B1 cases (93%, 92%), and between B2 cases (81%, 78%) and C1 cases (78%, 75%). In the Japanese staging system, there was good correlation between tumour stage and survival. The five and 10 year survival rates were excellent in stage I cases (96%, 95%), good in stage II (77%, 71%), fair in stage III (51%, 45%), and bad in stage IV (20%, 20%), although the distribution of the number of patients in each stage was uneven (stage IV, for example, included only 2% of patients).

SUBDIVISION OF DUKES'S C CASES

Since Dukes's C cases consisted of many and various patients with node-positive gastric cancer, we tried to divide Dukes's C cases into two subgroups according to the depth of wall invasion, the number of positive nodes, and the level of positive nodes (Fig 2, Table II). Firstly, Dukes's C cases were subdivided according to the depth of wall invasion: Ca cases in which tumour invasion was not beyond the muscularis propria (52 cases); and Cb cases in which tumour invasion was beyond the muscularis propria (143 cases). The five and 10 year survival rates of Ca cases (78%, 75%) were obviously different from those of Cb cases (42%, 36%), but were almost the same as those of B cases (81%, 78%). Secondly, Dukes's C cases were subdivided according to the number of positive nodes: Ca cases had 1–6 positive nodes (134 cases) and Cb cases ≥7 positive nodes (61 cases). The five and 10 year survival rates of the former (64%, 59%) and the latter (25%, 18%) were clearly different from each other and from those of B cases (81%, 78%). Lastly, Dukes's C cases were subdivided according to the level of the positive nodes: Ca cases (n1) in which group 1 nodes were positive (116 cases); and Cb cases (n2, n3) in which group 2 or 3 nodes were positive (79 cases). The five and 10 year survival rates of the former (66%, 62%) and the latter (32%, 24%) were also different from each other and from those of B cases (81%, 78%). Thus the prognostic value of Dukes's classification was reinforced when Dukes's C cases were subdivided according to the number or level of positive nodes.

Discussion

In 1932, Dukes[4] proposed a staging system for rectal cancer based on the degree of tumour invasion and either the presence or absence of lymph node metastasis. In 1935, Gabriel, Dukes, and Bussey[7] subdivided C cases into C1 cases in which only regional lymph nodes contained metastases and C2 cases in which apical mesenteric nodes were affected. The classification was simple and accurate, and was soon applied to colonic cancer. In 1954, Astler and Coller[6] advocated another useful staging system for colorectal cancer. C cases, with
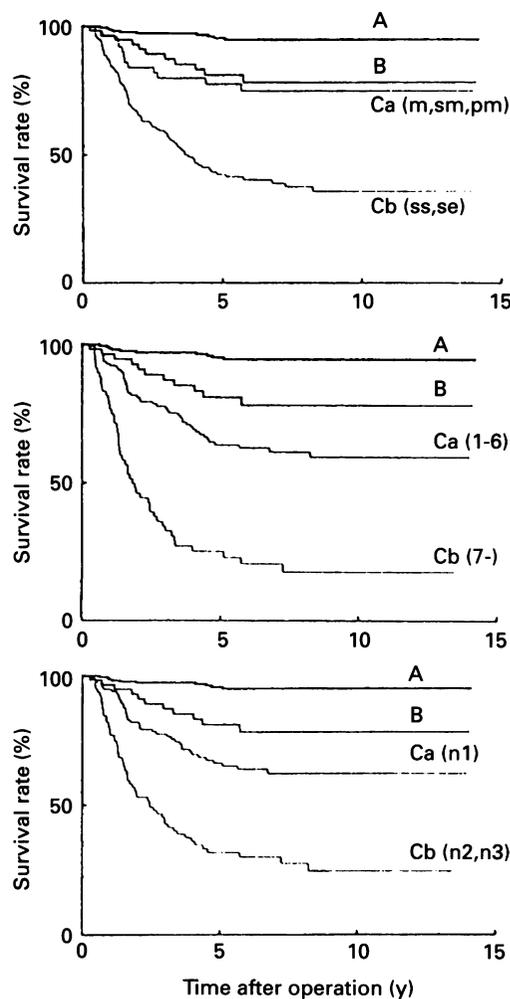
Figure 2: Cumulative survival curves for 476 patients with curatively treated gastric cancer according to the criteria of Dukes's classification with Dukes's C cases subdivided according to depth of wall invasion (top), number of positive nodes (middle), and level of positive nodes (bottom).

TABLE II *Five and 10 year survival rates in gastric cancer after modification of Dukes's C cases*

Staging system	No of patients	5 year survival rate (%)	10 year survival rate (%)
Dukes's depth of invasion			
A	220	95	95
B	61	81	78
Ca (m, sm, pm)	52	78	75
Cb (ss, se)	143	42	36
Dukes's number of nodes involved			
A	220	95	95
B	61	81	78
Ca (1–6)	134	64	59
Cb (7–)	61	25	18
Dukes's level of nodes involved			
A	220	95	95
B	61	81	78
Ca (n1)	116	66	62
Cb (n2, n3)	79	32	24

m=mucosa; sm=submucosa; pm=muscularis propria; ss=subserosa; se=serosa; n1=positive group 1 nodes; n2, n3=positive group 2, 3 nodes

lymph node metastasis, were subdivided into C1 cases in which the tumour was confined within the wall and C2 cases in which the tumour penetrated through the wall. Various other staging systems for colorectal cancer have been described by many authors, but the Dukes's and Astler-Coller's classifications have been the most widely used since they are simple, easy to remember, and accurate in estimating prognosis.[5]

With regard to the staging system for gastric cancer, a TNM classification by the American Joint Committee on Cancer[8] is popular in western countries, while a Japanese classification by the Japanese Research Society for Gastric Cancer[2] is preferred in Japan. Recently, it was suggested that the TNM classification reflected treatment results more accurately than the Japanese classification.[9] The TNM classification is difficult to memorise, however, since there are six stages consisting of 13 categories. The Japanese classification is also complex in numbering and grouping of lymph nodes. In order to evaluate the surgical results of gastric cancer in various countries and hospitals, a simple and easy staging system, such as Dukes's classification, is therefore needed.

Under these circumstances, we have tried to apply the Dukes's and Astler-Coller's classifications to gastric cancer, and tested whether or not these staging systems for colorectal cancer are valuable in gastric cancer. When prognostic value was compared in Dukes's, Astler-Coller's, and the Japanese staging systems, the Dukes's and the Japanese classifications clearly showed a close correlation between the stage of tumours and patient survival. Astler-Coller's classification was inferior to the others since separation between the stages was much less clear cut. Therefore, it was considered that Dukes's classification could also be successfully applied to gastric cancer as a simple and useful staging system.

In our study, the subdivision of Dukes's C cases was assessed in order to reinforce its prognostic importance. Subdivision according to the depth of wall invasion was inadequate, because the survival rate was similar for B cases (deeply invasive without nodal metastasis) and Ca cases (superficially invasive with nodal metastasis). On the contrary, subdivision according to the number and level of metastatic nodes was very significant. With regard to the number of positive nodes, its prognostic significance has been shown in cancers of the breast,[10] colorectum,[5] and stomach.[11–14] We recently clarified that survival of patients with node-positive gastric cancer was independently influenced by the number of positive nodes, survival rates markedly decreasing when the number of metastatic nodes exceeded six.[15] Therefore, it is suggested that a modified Dukes's classification according to the number of positive nodes would provide more essential information in patients with gastric cancer.

In conclusion, the results indicate that Dukes's classification can be well applied to gastric cancer as a simple and useful staging system, and a modified Dukes's classification according to the number or level of positive nodes provides further important prognostic information. Application of Dukes's classification will contribute to the further pathological assessment of gastric cancer.

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