Original Article

Clinicopathological profile of gastric cancer in a tertiary care hospital in Eastern India: A prospective 2 year study

Ayandip Nandi, Pranab Kumar Biswas, Manoranjan Kar[1], Swapan Kumar Sinha

Department of Pathology, Medical College, Kolkata, [1]Department of Surgery, Malda Medical College, Malda, West Bengal, India

ABSTRACT

Context/Background: Gastric malignancy is a major cause of morbidity and mortality throughout the world. Majority of gastric cancers present in late stages, so early detection is of paramount importance. **Aim/Objective:** To assess clinicopathological parameters of gastric carcinoma and to study expression of mucin by simple histochemical methods. **Materials and Methods:** Present prospective study were carried out over 2 years on surgically resected or endoscopically confirmed 116 cases of gastric carcinoma (>5 and <90-year-old) and their clinical profile, relevant investigation, and gross and microscopic features were studied. Periodic acid Schiff (PAS) and alcian blue (AB) staining were done along with hematoxylin and eosin (H and E) to study nature of mucin. **Results:** Mean age of study population were 53.02 years with overall male predominance (male:female (M:F) =2.41:1). Majority presented with vague dyspepsia, blood group A was most prevalent. Endoscopy revealed fungating growth in 41.37%, rapid urease test (RUT) was negative in most of patients. Majority of masses were located in antrum, mean diameter of masses being 3.56 cm. Poorly differentiated carcinoma were most prevalent histological type closely followed by equal percentage of diffuse and intestinal adenocarcinomas. Most carcinomas belonged to stage II or higher in TNM staging. Mucin stain reveals weak or absent PAS stain in diffuse and AB stain in most intestinal adenocarcinoms. **Conclusion:** Gastric carcinoma mainly affects elderly males. Poorly differentiated cases are on the rise. Simple mucin stains like PAS and AB can prove valuable adjunct to routine histological diagnosis, especially in cases with suspicious margin involvement, lymph node metastasis, and true depth of invasion assessment.

Key words: Clinicopathological study, gastric cancer, mucin

INTRODUCTION

Gastric malignancies are a major cause of morbidity and mortality in the world. Globally, it is the second commonest site of cancer second only to lung in male accounting for 7.36 million deaths worldwide.[1] China leads with age adjusted incidence rate of 145.4 followed by USA with 43.4 in population based cancer registry worldwide. Contrary to popular belief, third world countries have much less incidence when it comes to stomach malignancy. National Cancer Registry Program by Indian Council of Medical Research (ICMR) states that stomach cancer occupies the leading site (9.1%) in Chennai, fourth leading site (6.4%) in Bangalore, and fifth (5.4%) in Dibrugarh.[2] In Kolkata, it is the ninth leading cause of cancer (3.88% of all site).[3] In fairly large number of cases, stomach cancer is asymptomatic. Most of the cases present to us in a stage when it is beyond any intervention. Henceforth, detection of malignancy is of utmost priority to facilitate early intervention in form of surgery and/or chemotherapy. Clinical examination, endoscopy, and histopathological examination have been the cornerstone of investigation of gastric malignancy.

Stomach mucin glycoarray has been of much interest till 1970s. Normal gastric epithelium is mucin producing, the predominant mucin being of the neutral variety. In contrast, acid mucins (primarily sialomucins and sulphomucins), are produced only in small amounts in the foveola and neck cells of the fundus, foveola of the antrum, and cardiac glands of the stomach.[4] Several workers in the West have

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Address for correspondence: Dr. Ayandip Nandi, 48/7, Patuapara Lane, P.O. Serampore, Dt. Hooghly - 712 201, West Bengal, India.
E-mail: ayandipnandi@gmail.com

recorded an increased production of acidic mucin when malignancy supervenes.[5-9] Mucin histochemistry has been used to characterize these transformations of normal gastric epithelium leading to intestinal metaplasia and carcinoma. Although most major histopathology laboratories in the developed countries look towards immunohistochemistry as the main aid to histological diagnosis, time-proven histochemical techniques should not be underrated as valuable diagnostic adjuncts. It is well within the reach of the bulk of the patients of low socioeconomic status we serve at our hospital; it is faster, sensitive, and easy to perform when compared with immunohistochemistry.

Objective

In this study, we will focus on the clinicopathological profile of gastric malignancy in this demographic, study the macroscopic and microscopic features and also expression of mucin by histochemical methods.

MATERIALS AND METHODS

Present institution-based, prospective, observational study were conducted over a period of 2 years (January 2011-January 2013) on 116 patients who have undergone endoscopic biopsy or surgical resection based on clinical/radiological suspicion. The study began after obtaining ethical clearance from institutional ethical committee and informed consent from patients, in collaboration with department of surgery and gastroenterology. Patients <5 year and >90-year-old, critically ill, or patients who have received prior chemo-irradiation were excluded from the study.

Clinical parameters like age, sex, family history, drug history, symptoms at presentation, blood group, endoscopic finding, and rapid urease test (RUT) results (if any) were noted. Endocopic biopsies were submitted as whole and gastrectomy specimens were grossed and representative sections including margins, lymph nodes, and omental deposits were submitted. Macroscopic features like size of the tumor, serosal involvement, number of lymph nodes, and texture of mucosa were noted. Step-cut sections of 3-5 μm thickness were cut, processed by routine histological techniques, and stained routinely with hematoxylin and eosin (H and E), periodic acid Schiff (PAS), and alcian blue (AB) at both pH 3.5 and 1 to study neutral (PAS+), sialo (AB+ at pH 3.5), and sulfomucin (AB+ at pH 1).[9]

RESULTS

Mean age of study population was 53.02 years and standard deviation (SD) was ± 12.79. Largest cluster of cases were in 60-69-year-old males (10.4%). Male:Female (M:F) ratio was 2.41:1. Carcinoma incidence steadily increased from earlier age, peaked from 5th to 6th decade [Table 1].

Vague dyspepsia was predominant presenting symptom followed by cancer cachexia, most prevalent blood group was Group A (16.8%). Only 1 case with diffuse gastric carcinoma showed a positive family history (0.8%). No relevant drug or occupational history could be found. 68.8% patients belonged to low socioeconomic group (Kuppuswamy scale) [Table 2].

Majority of patients had undergone total gastrectomy. Endoscopy detected mass in majority, whereas 15.51% [Figure 3a] presented as ulcer fungating mass were most common type (41.37%) RUT was available in 28 cases, only two being positive, one intestinal adenocarcinoma, and the other mucosa-associated lymphoid tissue lymphoma (MALToma) [Table 3].

Table 1: Distribution of cases according to age and sex (*n*=116)

Age in years	Male (%)	Female (%)
20-29	0	4 (1.6)
30-39	8 (3.2)	8 (3.2)
40-49	14 (5.6)	10 (4)
50-59	24 (9.6)	4 (1.6)
60-69	26 (10.4)	6 (2.4)
70 or above	10 (4)	2 (0.8)
Total	82 (32)	34 (13.6)

Table 2: Clinical profile of gastric carcinoma cases (*n*=116)

	Male	Female	Total	Percentage
Presenting symptom				
Vague dyspepsia (endoscopic detection)	34	18	52	44.8
Lump	6	14	20	17.2
Gastric outlet obstruction	10	2	12	10.3
Cachexia	24	8	32	27.58
Blood group				
A+	12	16	28	14 (11.2)
A−	8	6	14	7 (5.6)
B+	8	2	20	10 (8)
B−	3	5	8	4 (3.2)
AB+	12	8	20	10 (8)
AB−	2	4	6	3 (2.4)
O+	11	9	20	10 (8)
O−	0	0	0	0

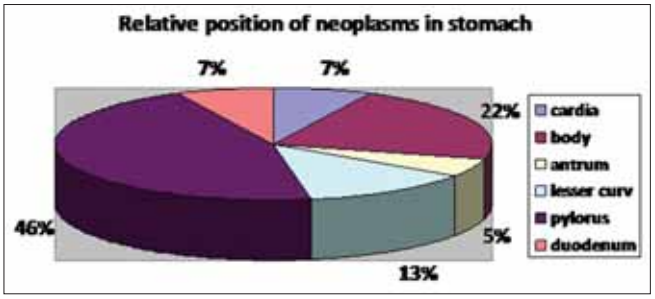

Figure 1: Relative position of masses in stomach

Figure 1 shows relative location of masses in stomach. Majority were located in antrum followed by body of stomach. Greatest mean dimension of lesions were 3.56 cm, SD 1.13 cm.

Secondary deposit from periampullary adenocarcinoma and esophageal sqamous cell carcinoma were excluded from study. GIST = Gastrointestinal stromal tumor, MALToma = mucosa-associated lymphoid tissue lymphoma.

Table 3: Distribution of cases according to laboratory investigations and interventions undergone (*n*=116)

	Male	Female	Total	Percentage
Endoscopic finding (Borrmann)				
Polypoid	10	6	16	13.79
Fungating	28	20	48	41.37
Ulcerative	13	5	18	15.51
Infiltrating	23	11	34	29.31
RUT finding				
RUT+	2	0	2	1.72
RUT−	20	6	26	22.41
Type of surgery				
Endoscopic biopsy	18	6	24	20.68
Partial gastrectomy	24	14	38	32.75
Subtotal gastrectomy	2	4	6	5.1
Total gastrectomy	34	6	40	34.48
Others (perforation, stoma, whipples)	5	3	8	6.8

RUT: Rapid urease test

Table 4: Distribution of neoplastic cases according to sex (*n*=116)

Histological type	M	F	Total	Percentage
Diffuse	14	8	22	18.96
Intestinal	12	10	22	18.96
Papillary	6	5	11	9.48
Tubular	8	4	12	10.34
Mucinous	6	4	10	8.62
Signet ring	6	5	11	9.48
Poorly differentiated	12	12	24	20.68
GIST	0	2	2	1.72
MALToma	1	1	2	1.72

GIST: Gastrointestinal stromal tumor, MALToma: Mucosa-associated lymphoid tissue lymphoma, M: Male, F: Female

Greatest dimension, depth of involvement and lymph node involvement were studied in 90 cases (endoscopic biopsies and small biopsies were excluded).

Majority of lesions were in the range of 3-5 cm (45.45%) in case of intestinal adenocarcinoma where mostly >5 cm in case of diffuse adenocarcinoma (51%). This finding corroborates with the finding that diffuse adenocarcinoma progress further than intestinal before diagnosis. Eighty-five percent cases of diffuse carcinoma reached either subserosa or beyond serosa at time of diagnosis compared to only 54.54% cases of intestinal carcinoma [Figure 3b] extending up to subserosa. Tubular carcinoma [Figure 4a] did not extend beyond muscle layer. 77.78% of papillary [Figure 4b], 78.9% of poorly differentiated tumor [Figure 5a], 100% mucinous [Figure 3d], and 100% signet ring carcinoma [Figure 3c] extended up to subserosa or beyond visceral peritoneum. Diffuse adenocarcinoma showed metastasis in lymph nodes in mostly N2 (3-6) or N3a (7-15) category whereas intestinal type were mostly N0 or N1 category of TNM classification. None of the tubular carcinoma showed metastatic node and most poorly differentiated or signet ring showed metastasis in N2 category. 72.72% diffuse carcinomas belonged to stage III of World Health Organization (WHO)-TNM staging system, whereas 63.63% intestinal carcinomas belonged to stage II. Most poorly differentiated carcinoma belonged to stage III [Figure 5b], and tubular carcinomas belonged to stage II or stage I, papillary being predominantly stage II [Table 5].

Figure 2 shows pattern of mucin expression in major neoplasms. Majority of diffuse carcinoma showed either weak or absent PAS stain and negative AB stain (neutral mucin). Intestinal

Table 5: Gross and microscopical properties of different neoplasms (*n*=90)

	Diffuse	Intestinal	Mucinous	Signet ring	Poorly differentiated	Tubular	Papillary
Size (cm)							
1-3	3	6	1	2	3	6	6
3-5	7	10	3	3	7	3	3
>5	10	6	2	0	9	0	0
Level of infiltration							
Lamina propria	3	5	0	0	4	6	2
Muscularis propria	10	10	4	0	5	3	4
Serosa	7	7	2	5	10	0	3
Lymph nodal involvement							
Nil	1	10	0	1	3	6	2
1-2	4	6	4	0	5	3	0
3-6	8	6	2	4	6	0	5
7-15	7	0	0	0	5	0	2
TNM staging							
I	0	0	0	0	4	6	5
II	6	14	0	2	8	6	4
III	16	8	10	6	10	0	2
IV	0	0	0	3	2	0	0

TNM: Tumor, Node, Metastasis

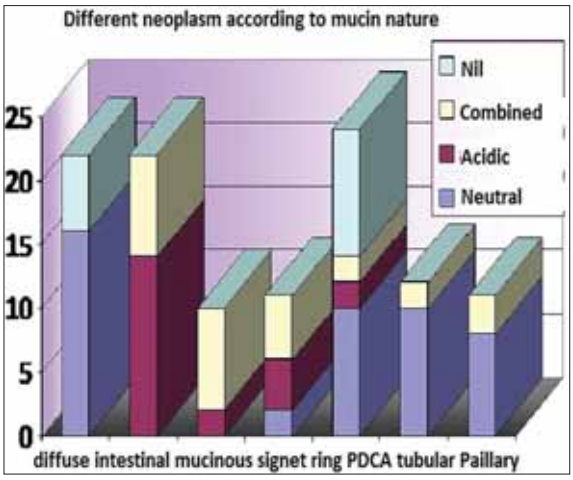

Figure 2: Different neoplasm according to mucin nature

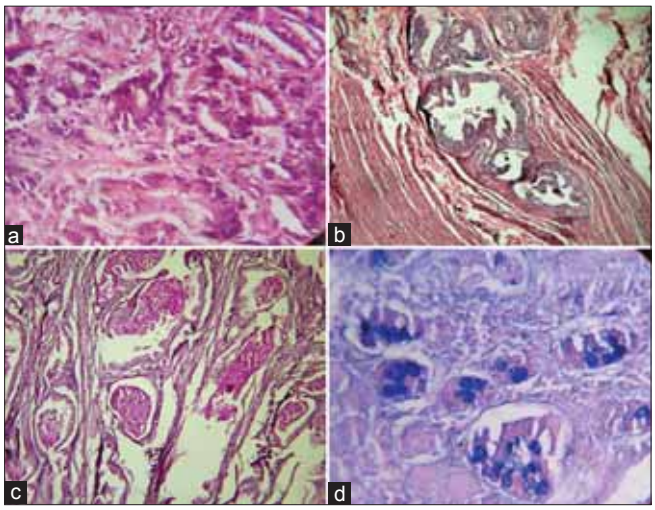

Figure 4: (a) Photomicrograph of tubular adenocarcinoma (H and E, ×400). (b) Photomicrograph of papillary adenocarcinoma (H and E, ×400). (c) Photomicrograph of intestinal adenocarcinoma showing periodic acid Schiff (PAS) + mucin in lumen and lining (PAS, ×400). (d) Photomicrograph of intestinal adenocarcinoma showing alcian blue (AB) positive in metaplastic goblet cells of lining mucosa (AB, ×400)

adenocarcinomas mostly showed acidic mucin (AB+ at both pH 3.5 and 1) and few showing combined PAS-AB positivity [Figure 5c and d] indicating combined nature of mucin. Tubular and papillary carcinoma predominantly neutral mucin, whereas poorly differentiated carcinomas showed no demonstrable mucin in most. Mucinous and signet ring carcinoma showed variable percentage of acid mucin. Gastrointestinal stromal tumor (GIST) [Figure 5c] and MALToma [Figure 5d] showed both PAS and AB negativity.

DISCUSSION

Gastric carcinoma is a frequent cause of morbidity and mortality throughout the world as well as in India. In present study, out of 116 cases, M: F ratio were 2.41:1 which is at par with Mohammadi *et al*.,[10] Ray *et al*.,[11] Zilberstein *et al*.,[12] and Nagini.[13] There is male preponderance of gastric carcinoma throughout the world.[14,15]

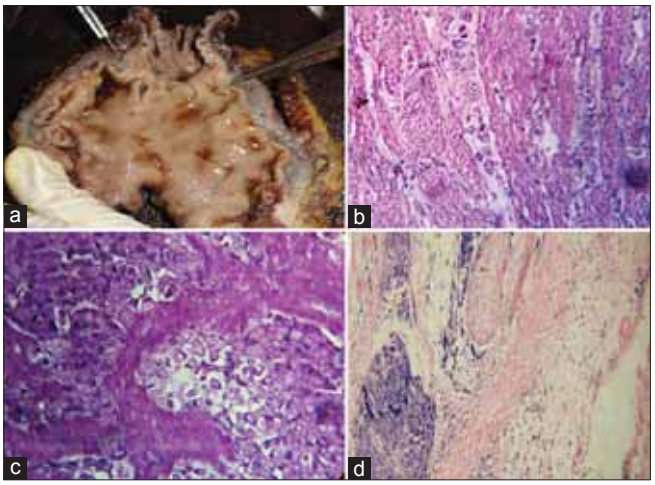

Figure 3: (a) Photomicrograph of a partial gastrectomy specimen showing diffuse flattening of mucosa and wall showing mucinous material. (b) Photomicrograph of diffuse carcinoma (H and E, ×400). (c) Photomicrograph of signet ring carcinoma (H and E, ×400). (d) Photomicrograph of mucinous carcinoma (H and E, ×400)

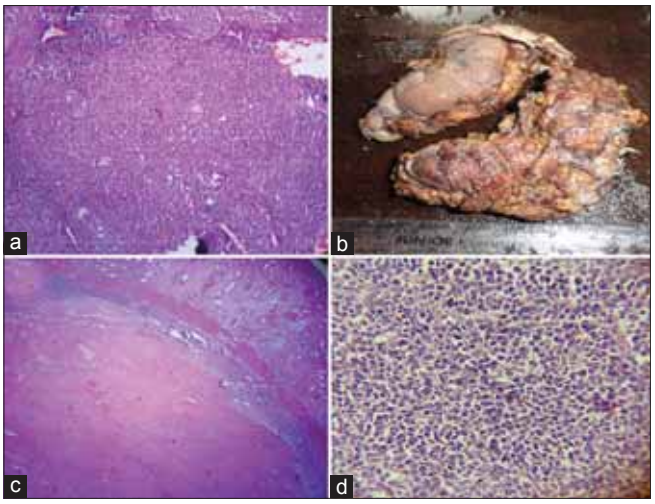

Figure 5: (a) Photomicrograph of poorly differentiated adenocarcinoma. (b) Photomicrograph of partial gastrectomy specimen showing extensive omental deposits. (c) Photomicrograph of gastrointestinal stromal tumor arising from submucosa (H and E, ×200). (d) Photomicrograph of mucosal-associated lymphoid tissue lymphoma (H and E, ×400)

In study of age cohort, majority of patient belonged to 60-69 year age group followed by 50-59 year (27.58 and 22.41%, respectively). In females, maximum number of cases (8.62%) occurred earlier in 40-49 year age group. Females also showed earlier age of onset. Six females and four males below 40 years of age were diagnosed with gastric carcinoma. Youngest patient to be diagnosed with stomach cancer was a 26-year-old female and a 34-year-old male; both of them suffered from diffuse adenocarcinomas. This finding corroborates with finding of Pavithran *et al*.,[15] who showed that gastric carcinoma affected females at an earlier age.

Carcinoma incidence steadily increased from earlier age, peaked from 5th to 6th decade, then again declined at extreme

old age. A study from Mumbai[16] and studies by Roder[17] also showed a steady decline of gastric cancer over the decades. Age cohort of present study also corroborated with Sambasivaiah *et al.*, in Andhra Pradesh, India.[18]

Clinical profile showed majority (44.8%) of patients presented with vague symptoms of dyspepsia, abdominal pain, and heartburn. This finding is supported by Koh and Wang,[19] Sigon *et al.*,[20] and Chattopadhyay *et al.*,[21] who found that pain abdomen was commonest symptom (84%) in gastric cancer patients rather than obvious mass.[22]

Present study showed positive family history in a single case of diffuse gastric carcinoma (0.8%). This is in accordance with authors like Yaghoobi *et al.*,[23] who found that a first degree relative of gastric cancer significantly raises the odds of having gastric cancer. Hereditary diffuse gastric carcinoma results from loss of E-cadherin gene and has about 75% penetrance rate among first degree relatives.[24] However, as we did not have a control population, a single case cannot be concluded as evidence.

Our study found blood group A was most prevalent among gastric carcinoma cases (16.8%). Authors like Arid *et al.*, and Beasley has discussed this in his study at Liverpool, England as early as 1955.[25,26] Wang *et al.*, found that an increased risk of gastric cancer in blood group A individuals, and people with blood type A are more prone to be infected by *Helicobacter pylori* than other ABO blood type individuals, whereas, a slightly decreased risk of gastric cancer was identified in blood type O individuals.[27]

Present study showed a high proportion of endoscopic biopsy cases over radical operations. At par with current trend, endoscopic biopsy showed high diagnostic yield in both preneoplastic and neoplastic cases. This is corroborated by findings of authors like Ford *et al.*,[28] and Kim and Ku.[29]

Mucosal biopsies were subjected to RUT for detection of *H. pylori*. In present study, 28 of 116 cases, RUT result was available (24.13%). Among them, two cases were positive (1.72%), malignancy being one intestinal adenocarcinoma and one MALToma. Wen-Hung Hsu *et al.*,[30] found RUT to be 80% sensitive and 96% specific. They considered RUT as the least expensive screening test and the diagnostic test of first choice.

Present study found that highest number of growth was on pylorus (46%) followed by body of stomach (21.81%). This is at par with the study in India by Suvarna and Sasidharan[31] who found incidence of 52.85% lesions in pylorus. Liu *et al.*,[32] found that carcinoma of lower one-third of stomach is decreasing over years in Japan.

Majority of poorly differentiated, diffuse, signet ring carcinomas acquired a large size before detection, already metastasized to lymph node and infiltrated through the muscular wall, whereas well differentiated intestinal, tubular, papillary varieties belonged to lower TNM stages. Findings clearly show well-differentiated tumors present at an earlier stage where less differentiated tumors present at a higher grade.[33,34]

Using Lauren's classification [Table 4], 11 each of diffuse and intestinal adenocarcinoma (18.96% of all neoplasm) were diagnosed. In the present study, ratio of diffuse and intestinal adenocarcinoma was 50:50. Several studies found wide variation in relative incidence of these two subtypes throughout the world. Where most authors like Mihailovic *et al.*,[35] and Biggar *et al.*,[36] found that diffuse variety occurred more frequently than intestinal type, (55 and 62%, respectively). Flucke *et al.*,[37] have found the reverse (diffuse 36%). We conclude that it is due to difference of risk factors like *H. pylori* prevalence. Due to endemicity of *H. pylori* in our country relative incidence of intestinal adenocarcinoma is higher in this part of country equating to diffuse variety. Sakitani *et al.*, showed this hypothesis that intestinal type is prevalent with people carrying high-risk factors like intestinal metaplasia and *H. pylori*.[38] González *et al.*,[39] showed intestinal metaplasia is one of the significant risk factor. Ye *et al.*, also identified several risk factors like cigarette smoking, alcohol, dietary habits, etc.[40]

Diffuse gastric carcinomas stained either weekly or strongly with PAS as they contained neutral mucin and intestinal metaplasia and intestinal adenocarcinoma cases stained with AB as they contained acidic mucin. In several cases, intestinal metaplasia were identified in mucosa closer to malignancy. In present study, 81.81% of diffuse carcinoma stained weekly with PAS and 18.18% showed no demonstrable mucin. Intestinal adenocarcinoma cases stained with AB (both at pH 3.5 and 1) and PAS both.[41] This finding is also corroborated by several authors like Babu *et al.*,[42] Pinto-de-Sousa *et al.*,[43] and Saito *et al.*,[44] showed altered mucin profile in preneoplastic and neoplastic gastric mucosa, which might reflect altered differentiation in multistep carcinogenesis.

CONCLUSION

Present study showed poorly differentiated carcinoma to be the most frequent malignancy closely followed by equal percentage of diffuse and intestinal carcinoma. Most patients belonged to 60-69 year age group and had a male predominance. Blood group A was most prevalent and predominant presenting symptom was vague dyspepsia. Majority showed a fungating growth in endoscopy, very few were RUT +ve. Majority of masses were of 3-5 cm range, most infiltrated into subserosa or beyond, majority belonged

to stage II or higher according to TNM classification. Mucin histochemistry showed diffuse carcinomas expressing, neutral or absent mucin; while intestinal carcinoma showed acidic mucin demonstrable by AB. Simple mucin histochemistry by PAS and AB proved faster, effective, cheap, and easier alternative to immunohistochemistry. Mucin histochemistry proved valuable in assessing true depth of invasion, ascertaining nature of metastatic deposit in lymph nodes, indicating margin involvement.

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