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Choriocarcinomatous Change With Immunocytochemically HCG-Positive Cells in the Gastric Carcinoma of the Males

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Summary. Gastric choriocarcinoma is a rare tumor and attracts interest because of its controversial pathogenesis. The present study reports a choriocarcinomatous change with immunocytochemically hCG-positive cells in the gastric carcinoma. The patients were males, one was 41 years old and the other 42 years old. The tumor of both cases consists of adenocarcinoma and choriocarcinoma. A sequential process of morphological transition of the adenocarcinoma to the choriocarcinoma can be traced. Indirect immunoperoxidase stain (PAP method) for human chorionic gonadotropin (hCG) demonstrates the localization of hCG in the syncytiotrophoblasts. Small number of cytotrophoblasts are weakly positive. None of the components of adenocarcinoma of both cases is positive for hCG. Human placental lactogen is not demonstrated in both cases. Stain for pregnancy specific β-1 glycoprotein is weakly positive in the adenocarcinoma of one case but not in the choriocarcinoma. In one case, the concentration of hCG was 19.9 mIU/ml in the preoperative serum and decreased to 1.2 mIU/ml after gastrectomy. HCG production by gastric carcinoma was discussed with regard to possible pathogenesis of gastric choriocarcinoma.

Key words: Choriocarcinoma – Gastric neoplasm – Human chorionic gonadotropin (hCG) – Pregnancy specific β-1 glycoprotein (SP-1) – Immunocytochemistry – Immunoperoxidase stain

Choriocarcinoma occurs commonly in the placenta as a highly malignant trophoblastic tumor, and less frequently in the ovaries and the testes of germ cell origin. It may arise, though rare, also in the extragenital sites along the midline of the body, e.g., in the pineal region, the mediastinum and the retroperitoneum as a tumor of teratoma group. However, "choriocarcinoma of the

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stomach" is very rare. Since Davidsohn (1905) reported the first case, only 42 cases have appeared in the literature (see Discussion). We report herein two cases of gastric carcinoma with a histology of choriocarcinoma in a part of the tumor tissue. A component of the choriocarcinoma was revealed to be positive for human chorionic gonadotropin (hCG) by immunocytochemistry, although clinical manifestations of the choriocarcinoma were absent.

Case Reports

Case No. 1

The patient was a 42-year-old Japanese male. At about 8 months and 4 months ago, he had an uncomfortable sense of upper abdomen after a meal but had not been medicated. Because of an upper abdominal distension after a meal and a continuous dull epigastralgia, he consulted a physician one month before admission to the Ehime University Hospital. A tender mass was palpable in the epigastrium. An upper gastrointestinal series revealed a filling defect of the fundus. Biopsy specimen showed a poorly differentiated adenocarcinoma. Neither gynecomastia nor testicular abnormality was clinically noted. Laboratory data were not contributory.

Case No. 2

The patient was a 41-year-old Japanese male. He had an operation of phymosis at the age of 27. He had suffered from duodenal ulcer and had been medicated by a physician for about 6 months, 3 years before admission to the Ehime University Hospital. Because of epigastralgia and a sense of distension of upper abdomen, he consulted the physician 3 weeks before admission. An upper gastrointestinal series revealed a large filling defect in the gastric antrum. He had lost 8 kg in his body weight within the last 1 year. On admission, gynecomastia was not noted. Both testes appeared to be clinically normal. Endoscopy of the stomach disclosed a gastric cancer of Borrmann type III, occupying the entire circumference of the antrum. Simultaneous biopsy revealed a moderately differentiated adenocarcinoma. Liver scintigram showed no space-occupying lesion.

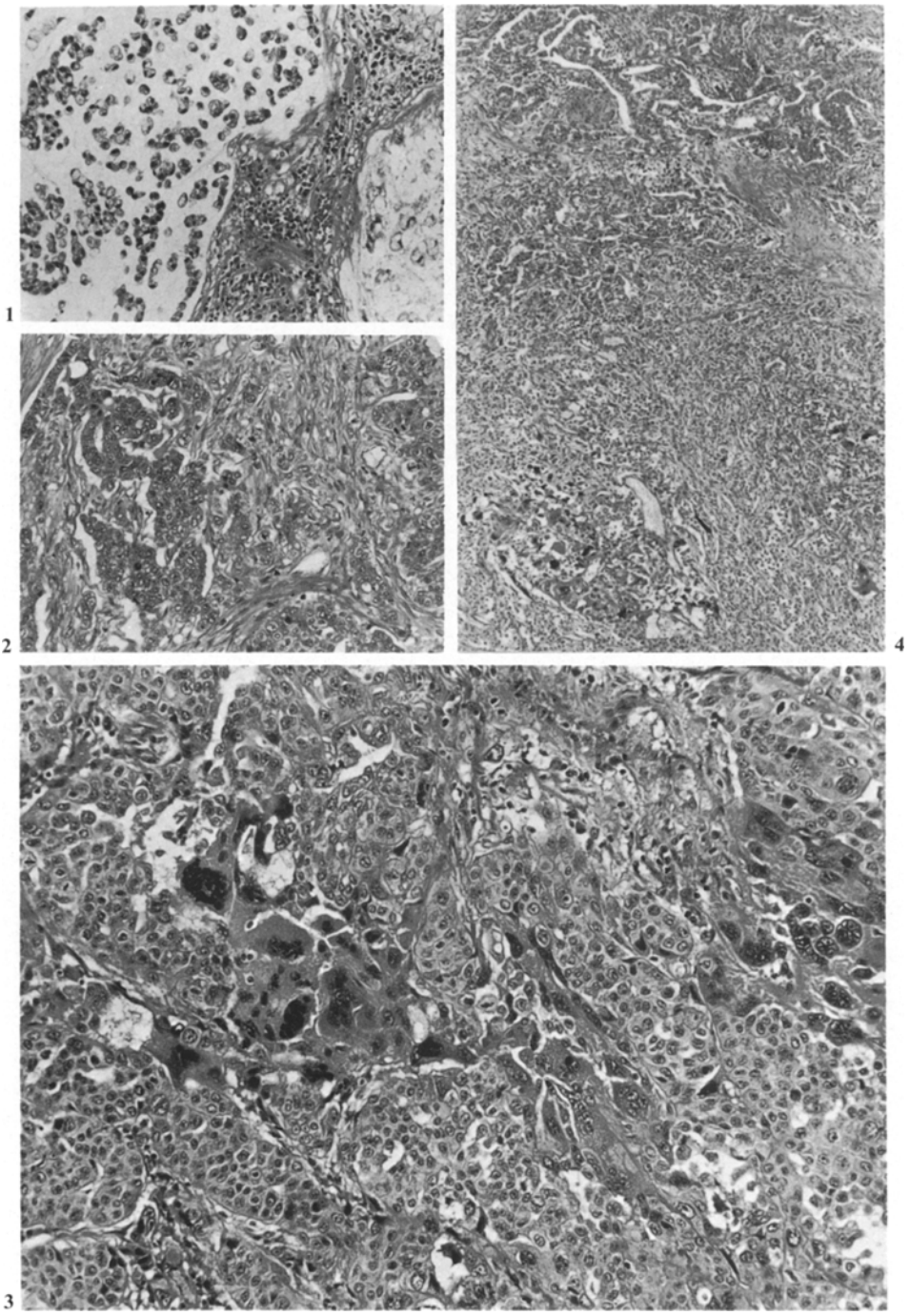
Materials and Methods

Resected stomachs were routinely fixed with formalin and processed to stain with H.E., P.A.S. and alcian blue. For immunocytochemistry additional several tissue blocks which were stocked in formalin for 18 months or 10 months were embedded in paraffine at below 60° C. Indirect immunoperoxidase stain (PAP method) for hCG, human placental lactogen (hPL) and pregnancy specific β-1 glycoprotein (SP-1) was applied to sections from these tissue blocks and also to conventionally processed sections using a K508 PAP kit (DAKO Corp., Santa Barbara, CA, USA). The kit consists of rabbit anti-hCG, anti-hPL or anti-SP-1 serum as first antibody, swine anti-rabbit IgG as second antibody and peroxidase/rabbit anti-peroxidase complex. The specificity of the immunoreaction was evaluated by (a) using a section of chorioadenoma destruens as a positive control, (b) using a non-cancerous stomach of other patient as a negative control and (c) using normal rabbit IgG instead of first antibody.

Results

Macroscopy and Histology

Case No. 1. Partial gastrectomy was performed on April 9, 1979 (specimen No. H0558-79). An ill-defined tumor measuring 5×5 cm with an ulcer of 3×1.5 cm was located on the posterior wall of the fundus near the greater



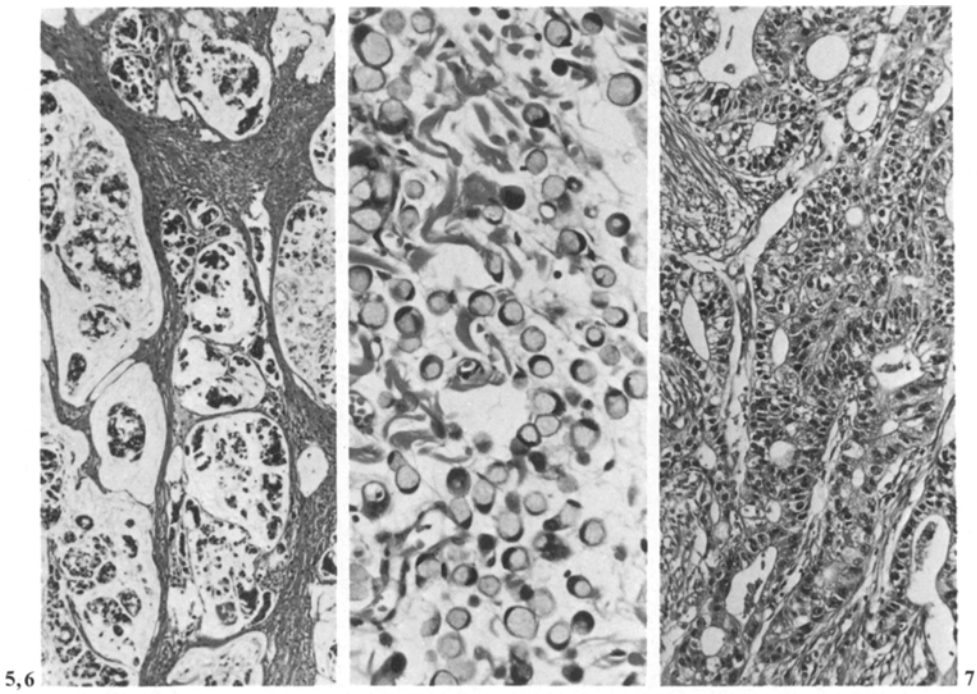
Figs. 1–4 are Case No. 1

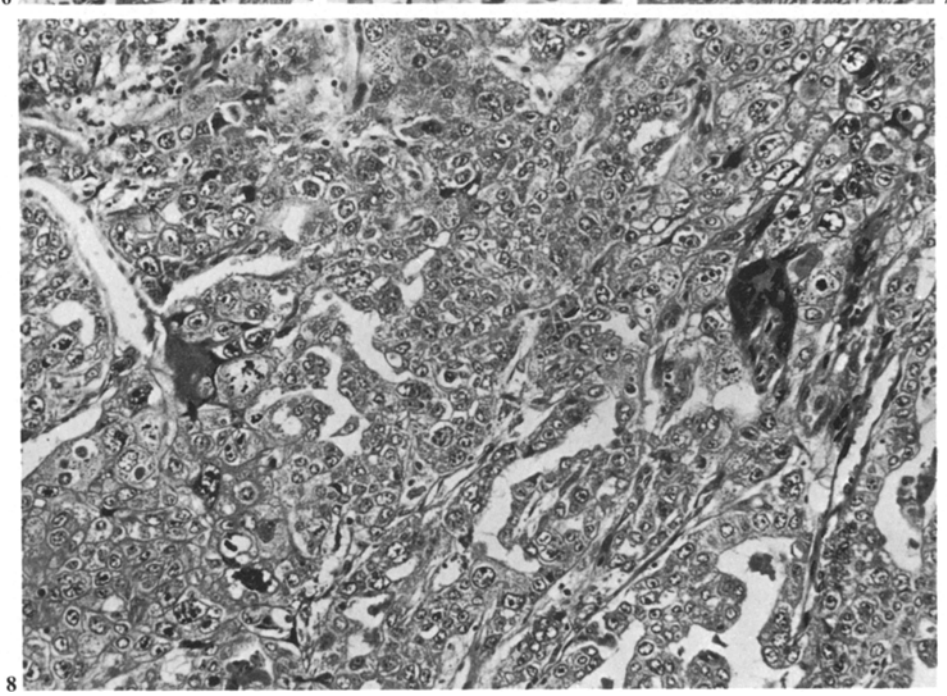
Fig. 1. Micinous adenocarcinoma is predominant in amount, invading the submucosa and the muscularis propria. ×100

Fig. 2. In the subserosa, 2 additional structures are seen. One is poorly differentiated adenocarcinoma. ×100

Fig. 3. Another is choriocarcinoma consisting of multinucleated syncytiotrophoblasts and mononuclear cytotrophoblasts. ×145

Fig. 4. Transition of adenocarcinoma (*upper half*) to choriocarcinoma (*lower half*) can be traced. ×45





Figs. 5–10 are Case No. 2

Figs. 5 and 6. Respectively mucinous adenocarcinoma and signet ring cell carcinoma. These two structures are predominant and extend to the subserosa. ×45, ×220, respectively

Fig. 7. Tubular adenocarcinoma with pale cytoplasm is seen in the entire width of the gastric wall. ×110

Fig. 8. Choriocarcinoma is seen at and around the basis of an ulcer. Syncytiotrophoblasts with dense cytoplasm are fairy few in number. ×145

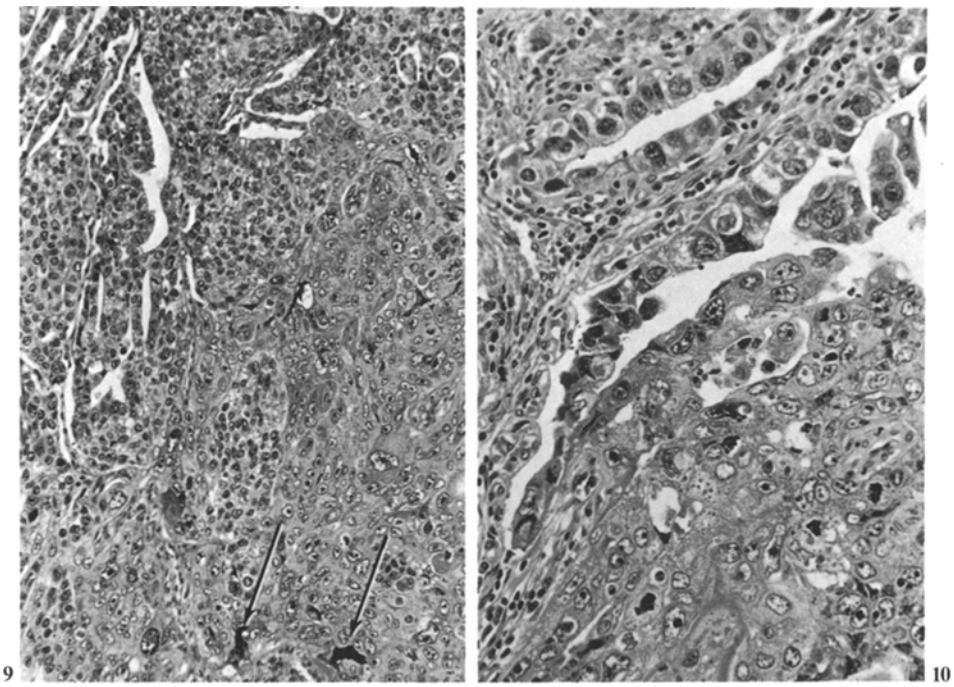


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Fig. 9. Morphological transition or close contact of adenocarcinoma (*upper half*) to choriocarcinoma (*lower half*) is shown. *Arrows* indicate syncytiotrophoblasts. ×110

Fig. 10. Higher magnification of transitional zone. *Upper half*; adenocarcinoma, *lower half*; choriocarcinoma. ×220

curvature. On the serosal aspect, two nodules of walnut-size and child's fist-size were formed. The tumor invaded the greater omentum, mesocolon and the pancreas. The liver showed no metastatic nodule, but there were peritoneal disseminations. Several lymphnodes were enlarged but were not excised because of non-curative operation.

Although there is a variety of histology, mucinous adenocarcinoma is predominant in amount, particularly in the submucosa and the muscularis propria (Fig. 1). In the subserosa at the basis of the tumor, two additional histological structures are present. One is poorly differentiated adenocarcinoma composed of trabeculae and small islands separated by fairly plenty stromal connective tissue (Fig. 2). The other is choriocarcinoma consisting of syncytiotrophoblasts and cytotrophoblasts but lacking in chorionic villous structures (Fig. 3). Syncytiotrophoblasts with many hyperchromatic nuclei and dense cytoplasm tend to be located in groups in the center of the nodules of choriocarcinoma. Morphological transition of the poorly differentiated adenocarcinoma cells to the cytotrophoblasts is found (Fig. 4).

Case No. 2. Subtotal gastrectomy was performed on December 4, 1980 (specimen No. H2374-80). An ill-defined tumor measuring 8×4 cm with two ulcers of

2.5 × 2 cm and 3 × 2 cm in diameter was present in the antrum. A cut section disclosed several mucinous nodules extending to the subserosa. There was no focus of definite necrosis and hemorrhage.

There is a marked variety of histology. Mucinous adenocarcinoma and signet ring cell carcinoma are predominant in amount and invade the subserosa (Figs. 5 and 6). Another type of adenocarcinoma with pale cytoplasm occurs in the mucosa, submucosa and muscularis propria, showing papillary, tubular and medullary arrangement (Fig. 7). Choriocarcinoma is seen in the submucosa and muscularis propria at and around the basis of one ulcer. Syncytiotrophoblasts are small in number. The nucleus of the cytotrophoblasts is various in size and has a coarse chromatin (Fig. 8). Small blood-filled cystic spaces or clefts are formed in several nests of choriocarcinoma. Close contact, otherwise transition of the adenocarcinoma to the choriocarcinoma is found not infrequently (Figs. 9 and 10) so that a sequential process of adenocarcinoma to choriocarcinoma can be traced. Lymphnode metastases show various structures with a predominance of tubular adenocarcinoma but are lacking of the choriocarcinoma.

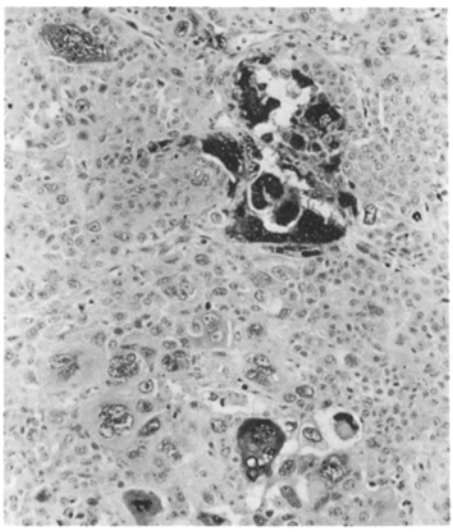
Immunocytochemistry

Dense brown deposits of immunoperoxidase stain for hCG are observed in a reticular or granular pattern in hCG-positive cells. In both cases the reaction products are identified in the cytoplasm of syncytiotrophoblasts, though not all, and small number of cytotrophoblasts are weakly positive (Figs. 11 and 13). None of the components of adenocarcinoma of both cases is positive for hCG. Immunoperoxidase stain for hPL is negative in both cases. Immunoperoxidase stain for SP-1 is weakly positive in the cytoplasm of poorly differentiated adenocarcinoma cells of Case No. 1 in a finely granular pattern (Fig. 12), but negative in Case No. 2.

Postoperative Course

Case No. 1. The patient was dead 3 months after the operation, showing clinically metastases to the lymphnodes, the bone marrow and the liver with jaundice. Autopsy was not performed.

Case No. 2. After the histological examination revealed a presence of the choriocarcinoma in the tumor, concentrations of hCG in the preoperative serum were measured by radioimmunoassay and were found to be 19.9 mIU/ml (hCG-α:0.06 ng/ml, hCG-β:0.17 ng/ml). The levels of serum hCG decreased to 1.2 mIU/ml 3 months after gastrectomy but has increased to 318 mIU/ml (hCG-α:0.41 ng/ml, hCG-β:1.58 ng/ml) 9 months after the operation. Although serum level of carcinoembryonic antigen (CEA) remains in normal range (< 5 ng/ml), that of α-fetoprotein (AFP) has increased to 188 ng/ml (normal value: < 20 ng/ml) 11 months after gastrectomy. These data suggest metastatic tumor growth, particularly the liver metastasis.



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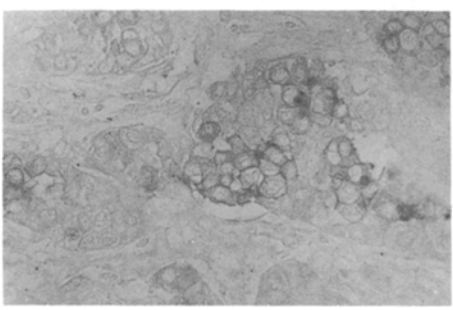

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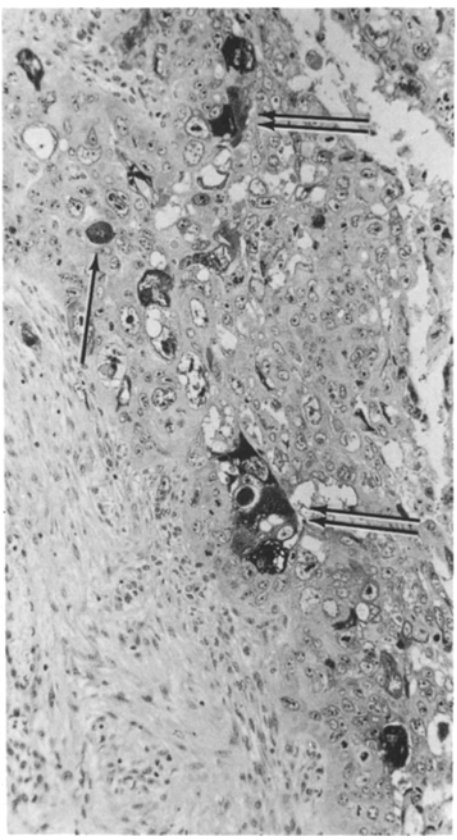

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Fig. 11. Syncytiotrophoblasts of Case No. 1 are positive for hCG, though not all, by indirect immunoperoxidase stain. Counterstained with hematoxylin, ×110

Fig. 12. Immunoperoxidase stain for SP-1 is weakly positive in the poorly differentiated adenocarcinoma of Case No. 1. ×200

Fig. 13. Syncytiotrophoblasts (*double arrows*) and small number of cytotrophoblasts (*single arrow*) of Case No. 2 are positive for hCG. Counterstained with hematoxylin, ×110

Discussion

Since Davidsohn (1905) reported the first case, the gastric choriocarcinoma has been scattered in the literature. Including a case of their own, Jindrak et al. (1976) reviewed 27 reported cases. Since then 15 additional cases have been reported (Tanaka et al. 1972; Sakauchi et al. 1972; Sugiyama et al. 1977; Smith et al. 1980; Haruma et al. 1980; Saigo et al. 1981; Hayashi et al. 1981). To the best of our knowledge, 44 cases of the gastric choriocarcinoma have been reported in the world literature including the present cases. Pertinent findings of the cases after the review of Jindrak et al. are summarized in Table 1.

Of 44 cases, the males totaled 31 and the females 13. The average age of the patients was 55 and 58 years old for males and females, respectively. The

Table 1. Findings of previously reported gastric choriocarcinomas after collection by Jindrak et al.

No.	Authors and year reported	Sex, age	Autopsy	Primary gastric tumor		Location and histology of metastases[a]	Gynecomastia	Condition of genitalia	Hormonal test
				Macroscopy	Histology[a]				
1	Tanaka et al. (1972)	M, 45	–	Fundus, lesser curvature, Borrmann II, 4 × 3 cm	por + chorio, isolated	Lymphnodes: adeno + chorio	Not recorded	Clinically normal testes	Not performed
2	Tanaka et al. (1972)	M, 46	–	Pylorus, Borrmann I, 17 × 10 cm	tub + chorio, transitional	Lymphnodes: tub + chorio	Not recorded	Clinically normal testes	Not performed
3	Tanaka et al. (1972)	M, 61	–	Pylorus, Borrmann III, 3.5 × 3 cm	adeno + chorio, transitional	Lymphnodes: adeno + chorio	Not recorded	Clinically normal testes	Friedman (−) Gonavis (−)
4	Sakauchi et al. (1972)	M, 45	–	Antrum, greater curvature, Borrmann II	chorio + undif	Liver, omentum, pelvic cavity	+	Clinically normal testes	Friedman (+) urinary hCG: 128,000 IU/l, urinary pregnanediol: 5.9 mg/24 h
5	Nakamura et al. (1974) (cited by Hayashi)	M, 73	–	Fundus, lesser curvature, tumor of 2,500 g on serosa	mucosa: adeno serosa: chorio, isolated	Lymphnodes	Not recorded	Clinically normal testes	Friedman (+) urinary hCG: 200,000 IU/l
6	Iizuka et al. (1976) (cited by Hayashi)	M, 73	–	Lesser curvature	chorio	Not recorded	Not recorded	Clinically normal testes	Not performed
7	Saito et al. (1977) (cited by Hayashi)	M, 66	–	Fundus, greater curvature, anterior wall, ulcerated tumor	chorio	No metastasis	Not recorded	Not recorded	Urinary hCG: 44.21 IU/l (postoperatively)

8	Sugiyama et al. (1977)	M, 45	–	Fundus~pylorus, Borrmann I, 7.2×7.5×4 cm	por+chorio, transitional	Liver:chorio	+	Histologically normal testes	Gonavis (+) urinary hCG: 2,000 IU/l (postoperatively)
9	Kodama et al. (1978) (cited by Hayashi)	M, 68	–	Fundus, lesser curvature	pap+chorio	Liver	Not recorded	Clinically normal testes	Not recorded
10	Smith et al. (1980)	F, 23	+	Antrum, lesser curvature, Borrmann II or III, 10.5×6×2 cm	tub+sig +chorio, transitional	Lymphnodes, lung:adeno, Liver:chorio	/	Many corpus luteum cysts in ovaries; thickened, hemorrhagic endometrium	Serum β-hCG: 155,000 mIU/ml, urinary hCG: 355,000 mIU/ml (Gravidex)
11	Haruma and Moriwaki (1980) (cited by Hayashi)	M, 63	+	Pylorus, Borrmann II	pap+chorio, transitional	Lymphnodes: adeno, Lungs, liver: chorio	+	Adenomatoid tumor of testicular capsule, histologically normal testicular parenchyme	Serum hCG: 1,600,000 IU/l
12	Haruma et al. (1980)	M, 75	+	Early cancer (2 years before) lesser curvature of residual stomach, Borrmann I, 4×2.5 cm	tub+chorio, transitional	Lymphnodes, lungs, liver: chorio	+	Histologically normal testis	Serum hCG: 140,000 IU/l
13	Saigo et al. (1981)	F, 56	+	Cardia, 2×3.5 cm flat lesion	adeno+undif +chorio, transitional	Lungs, liver: chorio	/	Ovary:atrophic, endometrium: edematous	Serum hCG: 67,500 ng/ml

Table 1 (continued)

No.	Authors and year reported	Sex, age	Autopsy	Primary gastric tumor		Location and histology of metastases[a]	Gynecomastia	Condition of genitalia	Hormonal test
				Macroscopy	Histology[a]				
14	Saigo et al. (1981)	F, 67	+	Antrum, 3.5 cm ulcerated tumor and 15 × 17 × 7.5 cm 'encapsulated' extragastric tumor	adeno + undif + chorio	Transvers colon, abdominal wall, liver, lungs, omentum, uterine serosa: chorio	/	Endometrium: marked decidual reaction	Urinary hCG: 200,000 IU/l
15	Hayashi et al. (1981)	M, 68	–	Antrum, posterior wall Borrmann II	chorio	Liver, lymphnode	–	Clinically normal testes	Serum hCG-β: 8,320 ng/ml, urinary hCG: 14,880 ng/ml
16	Present case (No. 1)	M, 42	–	Fundus, posterior wall, greater curvature, Borrmann III	muc + por + chorio, transitional	Omentum, mesocolon, pancreas: adeno, Lymphnodes: not identified histology	–	Clinically normal testes	Not performed
17	Present case (No. 2)	M, 41	–	Antrum, Borrmann III, 8 × 4 cm	muc + sig + tub + chorio, transitional	Lymphnodes: adeno	–	Clinically normal testes	Serum hCG: 19.9 mIU/ml

[a] Abbreviation of histological types: chorio; choriocarcinoma, adeno; adenocarcinoma, pap; papillary adenocarcinoma, tub; tubular adenocarcinoma, muc; mucinous adenocarcinoma, sig; signet-ring cell carcinoma, por; poorly differentiated adenocarcinoma, undif; undifferentiated carcinoma. "Isolated" and "transitional" mean that the choriocarcinoma is isolated from, and is transitional to other types of the gastric carcinoma, respectively

numerical preponderance and younger age of the males may simply reflect a hesitance of pathologists to accept a primary extragenital choriocarcinoma in the females, particularly in those of child-bearing age. Twelve of the 44 cases had only choriocarcinoma in the primary gastric tumor (males 10/31, females 2/13); 26 showed a histology consisting of choriocarcinoma and other structures, particularly the adenocarcinoma (males 18/31, females 8/13). In the 36 cases in which metastases were histologically clarified, 34 had the choriocarcinoma with or without other structures in the metastatic lesions; 20 had exclusively the choriocarcinoma in the metastases. Eight cases had the choriocarcinoma as the sole pattern in both the primary and the metastases (males 6, females 2).

The gastric carcinoma, particularly the advanced cancer, often shows a variety of histology. Its histological type is usually classified by what structure predominates in amount within the tumor. Therefore, it may be questionable whether all of the cases reported previously could be classified as the choriocarcinoma. It seems appropriate that some cases are thought to be the usual type of the gastric carcinoma, a part of which undergoes choriocarcinomatous change. This view seems to be applicable also to our present cases. The morphological transition of the adenocarcinoma to the choriocarcinoma or the intermixture of both structures, documented in ten cases including the present cases, seems to support this view. However, it seems probable that pure gastric choriocarcinoma is present, as shown by the fact that the choriocarcinoma was found as the sole pattern in both the primary and the metastases in 8 cases.

In this context, the pathogenesis of the gastric choriocarcinoma is an interesting problem. Several theories have been proposed: Davidsohn (1905); origin in an abdominally displaced gonadal anlage, Koritschoner (1920); long delayed metastasis from a hypothetical intra-uterine choriocarcinoma, Hartz and Ramirez (1953); development from an underlying gastric teratoma, Voss (1954); origin in a totipotential cell of primary gonadal type occurring in a gastric polyp, Pick (1926); retrodifferentiation or opisthoplasia of the carcinoma to the level of embryonal ectoderm with the ability to form trophoblasts. Among these theories of pathogenesis, the retrodifferentiation of the cancer cells seems to be of great advantage. Regan and Cremin (1960) explained an occasional absence of non-choriocarcinomatous components by postulating complete replacement of the original adenocarcinoma by the more aggresive choriocarcinoma. Morphological retrodifferentiation would possibly be accompanied by functional retrodifferentiation, that is, the restoration of gene expression of hCG production which has been suppressed in the non-cancerous condition (Uriel 1976).

For the definite diagnosis of the choriocarcinoma, the direct demonstration of hCG production by tumor cells is required in addition to the histological observation of typical characteristics of two-cell pattern consisting of syncytiotrophoblasts and cytotrophoblasts. Recent progress in immunocytochemistry using fluorescein-labeled or peroxidase-labeled antibodies enables the demonstration of the localization of hCG in the trophoblasts (de Ikonikoff and Cedard 1973). Kameya et al. (1976) was the first to apply this staining method to the gastric choriocarcinoma, which was serially transplanted in the nude mice. They detected hCG in about 5% of the tumor cells, predominantly in the

syncytiotrophoblasts. However, there is a controversy concerning which type of trophoblasts produces hCG in the gastric choriocarcinoma. Smith et al. (1980) demonstrated the localization of hCG in the mononuclear tumor cells (possibly the cytotrophoblasts). On the other hand, Saigo et al. (1981) detected more intense reaction products for hCG in the syncytiotrophoblasts than in the cytotrophoblasts. Hayashi et al. (1981) detected hCG predominantly in the syncytiotrophoblasts but also in small number of cytotrophoblasts. The findings of latter two authors are consistent with our results.

Human chorionic ganadotropin has been known not only as one of the ectopic hormones produced by neoplasms of non-endocrine organs but also as one of the carcinoembryonic proteins such as AFP or CEA. Various tumors including lung, liver, breast, adrenal, kidney and prostate have been known to secrete hCG or its subunits (see Kodama et al. 1981). The gastric carcinoma is also one of those tumors. Vaitukaitis et al. (1976) detected hCG in serum in 22% (16/73) of the gastric carcinoma by radioimmunoassay. Kuwashima et al. (1976) examined the gastric carcinoma of male patients in whose urine hCG was detected by hemagglutinin test, and demonstrated the immunofluorescence for hCG in 6 of 8 gastric carcinomas which were histologically devoid of trophoblastic elements. Kodama et al. (1981) have analyzed the gastric carcinoma with serum AFP level higher than 20 ng/ml and have reported the positivity of hCG and AFP to be 26% (9/35) and 54% (19/35), respectively. A value of 26% (35/134) is obtained by us for the positivity of hCG in the advanced gastric carcinoma, regardless of the histological type (unpublished).

However, it seems unlikely that hCG thus detected immunologically in the gastric carcinoma has always a biological activity as the placental hCG. None of the gastric carcinomas without trophoblastic elements mentioned above has been shown to manifest clinical signs caused by hCG. Although there are several positive cases for biological test (Friedman's or other similar tests) in the gastric choriocarcinoma reported previously, many cases have not been documented to show biologically positive signs such as gynecomastia, Leydig cell hyperplasia or endometrial hyperplasia. Also our cases showed clinically neither gynecomastia nor testicular abnormality. There are several evidences indicating that hCG produced by non-placental malignant tumors is somewhat different from placental hCG. Yoshimoto et al. (1979) observed that hCG produced by non-placental carcinomas contained less carbohydrate than placental hCG and carbohydrate contents of hCG differed among various cancer tissues. It is shown that non-placental malignant tumors are accompanied by unbalanced secretion of hCG subunits (Hattori et al. 1980). Although the placenta has been reported to produce more hCG-α than hCG-β (Vaitukaitis 1974), serum levels of hCG-β are higher than those of hCG-α in Case No. 2 of the present study. The fact that the immunoperoxidase stain for hPL is negative in our both cases and that for SP-1 is only weakly positive in one case seems to suggest that the trophoblastic elements of the gastric choriocarcinoma has no biological functions as the placental trophoblasts.

It is an interesting problem to be clarified why non-gonadal choriocarcinoma occurs with preference in the stomach and how immunologically detected hCG in gastric choriocarcinoma is different from the placental hCG.

References

Davidsohn C (1905) Chorion-Epitheliom und Magenkrebs, eine seltene Verschmelzung zweier bösartiger Geschwulste. Charité Ann 29:426–437

de Ikonicoff LK, Cedard L (1973) Localization of human chorionic gonadotropic and somatomam-

motropic hormones by the peroxidase immunohistoenzymologic method in villi and amniotic epithelium of human placentas. Am J Obstet Gynecol 116:1124–1132
Hartz PH, Ramirez CA (1953) Coexistence of carcinoma and chorioepithelioma in the stomach of a young man. Cancer 6:319–326
Haruma K, Takashima S, Suenaga K, Ide H, Moriwaki S (1980) Adenocarcinoma with chorion-epitheliomatous change in the remnant stomach of a male adult, report of a case (in Japanese). Stomach Intestine 15:1235–1240
Hattori M, Yoshimoto Y, Matsukura S, Fujita T (1980) Qualitative and quantitative analyses of human chorionic gonadotropin and its subunits produced by malignant tumors. Cancer 46:355–361
Hayashi K, Motoi M, Tsutsumi A, Endo T (1981) Choriocarcinoma in the stomach of an adult male. Case report with a review of the literature on male subjects (in Japanese). Jpn J Cancer Clin 27:1654–1660
Jindrak K, Bochetto JF, Alpert LI (1976) Primary gastric choriocarcinoma: Case report with review of world literature. Hum Pathol 7:595–604
Kameya T, Shimosato Y, Tumuraya M, Ohsawa N, Nomura T (1976) Human gastric choriocarcinoma serially transplanted in nude mice. J Natl Cancer Inst 56:325–332
Kodama T, Kameya T, Hirota T, Shimosato Y, Ohkura H, Mukojima T, Kitaoka H (1981) Production of alpha-fetoprotein, normal serum proteins, and human chorionic gonadotropin in stomach cancer: Histologic and immunohistochemical analyses of 35 cases. Cancer 48:1647–1655
Koritschoner R (1920) Über ein Chorionepitheliom ohne Primärtumor mit abnorm langer Latenzzeit. Beitr Pathol Anat Allg Pathol 66:501–570
Kuwashima M, Nishimura M, Tsumura O, Sato H, Sekiguchi S, Iwata S, Kawaoi A, Kawano K, Tsuchiya T (1976) Ectopic gonadotropin production in gastric carcinoma. I. Urinary gonadotropin level and immunopathological findings (in Japanese). Jpn J Clin Pathol 24:737–741
Pick L (1926) Über die chorionepitheliomähnliche metastasierende Form des Magencarcinoms. Klin Wochenschr 5:1728–1729
Regan JF, Cremin JH (1960) Chorionepithelioma of the stomach. Am J Surg 100:224–232
Saigo PE, Brigati DJ, Sternberg SS, Rosen PP, Turnbull AD (1981) Primary gastric choriocarcinoma. An immunohistological study. Am J Surg Pathol 5:333–342
Sakauchi N, Chikada C, Nomura K, Mukojima T (1972) Choriocarcinoma probably of stomach origin and gastric carcinoma with immunological activity of hCG (in Japanese). Jpn J Cancer Clin 18:439–442
Smith FR, Barkin JS, Hensley G (1980) Choriocarcinoma of the stomach. Am J Gastroenterol 73:45–48
Sugiyama Y, Chiba M, Ino M, Kikuchi A, Yokouchi M (1977) Coexistence of chorionepithelioma and carcinoma in the stomach of a man. Case report and review of the literature in the male subject (in Japanese). Stomach Intestine 12:371–376
Tanaka S, Sakae K, Kato N (1972) Coexistence of chorionepithelioma and carcinoma in the stomach in the male adult: Report of four cases (in Japanese). Stomach Intestine 7:1369–1375
Uriel J (1976) Cancer, retrodifferentiation, and the myth of Faust. Cancer Res 36:4269–4275
Vaitukaitis JL (1974) Changing placental concentrations of human chorionic gonadotropin and its subunits during gestation. J Clin Endocrinol Metab 38:755–760
Vaitukaitis JL, Ross GT, Braunstein GD, Rayford PL (1976) Gonadotropins and their subunits: Basic and clinical studies. Recent Prog Horm Res 32:289–331
Voss C (1954) Primäres Chorionepitheliom des Magens. Virchows Arch [Pathol Anat] 325:455–464
Yoshimoto Y, Wolfsen AR, Odell WD (1979) Glycosylation: A variable in the production of hCG by cancers. Am J Med 67:414–420

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