CARCINOMA OF THE STOMACH IN IDENTICAL TWINS

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Malignant tumors occurring in identical twins are sufficiently rare to warrant reporting another instance. In 1932, McFarland and Meade (8) collected from the literature a series of 40 tumors occurring simultaneously and symmetrically in twenty pairs of monozygotic twins. The tumors were divided equally between benign and malignant growths. McFarland and Meade argued that the similar, simultaneous, and symmetrical occurrence of abnormalities and tumors in both of homologous twins tends to prove the genetic origin of such abnormalities and tumors. Bearing in mind that homologous, identical, or uniovular twins arise from the division of a single ovum, the resulting two blastomeres each receiving an equal share of the genetic influences, materials, and defects, the above theory seems plausible.

The reported cases of malignant tumors occurring in homologous twins are summarized in Table I. Cases of chronic lymphatic leukemia and Hodgkin's disease simultaneously affecting identical twins are included in this group, since these two diseases of unknown cause and

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**Table I: Summary of Reported Cases of Malignant Tumors Occurring in Homologous Twins**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Location of Lesion</th>
<th>Type of Tumor</th>
<th>Age When Symptoms Appeared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silcock (12)</td>
<td>1892</td>
<td>Eye</td>
<td>Melanoma-sarcoma</td>
<td>—</td>
</tr>
<tr>
<td>Croom (3)</td>
<td>1912</td>
<td>Uterus</td>
<td>Adenocarcinoma</td>
<td>50 yrs.</td>
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<tr>
<td>Weitz (14)</td>
<td>1924</td>
<td>Uterus</td>
<td>Carcinoma</td>
<td>40 yrs.</td>
</tr>
<tr>
<td>Wells (15)</td>
<td>1927</td>
<td>Testicle</td>
<td>Sarcoma</td>
<td>—</td>
</tr>
<tr>
<td>Joughlin (5)</td>
<td>1928</td>
<td>Cerebrum</td>
<td>Glioma</td>
<td>32 yrs.</td>
</tr>
<tr>
<td>Leavitt (7)</td>
<td>1928</td>
<td>Cerebellum</td>
<td>Medulloblastoma</td>
<td>6 yrs.</td>
</tr>
<tr>
<td>Kimbrough (6)</td>
<td>1928</td>
<td>Ovary</td>
<td>Carcinoma</td>
<td>—</td>
</tr>
<tr>
<td>Benedict (1)</td>
<td>1929</td>
<td>Eye</td>
<td>Retinoblastoma</td>
<td>—</td>
</tr>
<tr>
<td>Champlin (2)</td>
<td>1930</td>
<td>Testicle</td>
<td>Sarcoma</td>
<td>24 yrs.</td>
</tr>
<tr>
<td>Dameshek, Savitz, &amp; Arbor (4)</td>
<td>1929</td>
<td>—</td>
<td>Chronic lymphatic leukemia</td>
<td>56 yrs.</td>
</tr>
<tr>
<td>Peacock (10)</td>
<td>1904</td>
<td>—</td>
<td>Hodgkin's disease</td>
<td>3 yrs.</td>
</tr>
<tr>
<td>Williams (16)</td>
<td>1908</td>
<td>—</td>
<td>Hodgkin's disease</td>
<td>4 yrs.</td>
</tr>
</tbody>
</table>
nature are generally classified with malignant tumors. Siegel (11) reported chronic lymphatic leukemia in twins aged two years and a half, but these were of opposite sex and therefore not homologous.

Two of the reports in Table I require a word of explanation. Silkcock (12) observed a mother and daughter with melanosarcoma of the eye. Twin sisters of the mother had lost one eye each and one of them died with multiple tumors. His inference that all these tumors were melanosarcomata lacks proof.

One of the twins reported by Weitz (14) died at forty years of age with cancer of the uterus. Three years later the second twin had a supravaginal hysterectomy for myomata of the uterus and removal of an ovarian cystoma. Grossly there was no sign of malignant degeneration of the uterine myomata, but no microscopic examination was done. Death occurred four years later from cancer of the liver, thought to be secondary to a primary hidden focus in the uterus.

As far as can be determined, carcinoma of the stomach occurring simultaneously in uniovular twins has never been reported. Pack (9) recently reported carcinoma of the stomach occurring at the same time in brothers aged fifty-two and fifty-four years and pointed out the rarity of such an occurrence and its importance from the point of view of heredity or the conception of prolonged chronic irritation as the causative factor.

**Report of Cases**

Case I (J. S. D., P. H. 7633): A seventy-year-old carpenter was admitted to the hospital March 27, 1934, complaining of difficulty in swallowing. His general health had been good. In 1911 bilateral herniorrhaphy had been done for inguinal herniae. In 1928 operation was done for recurrence of the herniae. There was no family history of cancer, but the patient stated that his identical twin brother was also under treatment with symptoms similar to his own.

The present illness began in October 1933 with a sensation of fullness at the lower end of the sternum on eating. Food would seem to lodge there before passing down. This sense of obstruction progressed so that by January 1934 the patient was able to take very little solid food. A month later difficulty in swallowing soft solids and liquids had developed. There was occasional regurgitation of food after eating, but no hematemesis. The appetite remained good, but because of the mechanical difficulties in eating, there was a loss of 30 pounds in weight in five months. There was increasing constipation but no tarry stools. On Feb. 16, 1934, the patient was admitted to another hospital, where on x-ray examination a diagnosis of carcinoma of the fundus of the stomach with involvement of the lower end of the esophagus was made. He was referred to Pond-ville for palliative therapy.

Physical examination revealed a well developed, elderly male with evidence of considerable weight loss. There was an old fracture of the nose with deviation of the normal nasal contour and septum to the left. The heart and lungs were essentially normal. On deep palpation in the epigastrium there was slight tenderness, but no definite mass could be felt.

The laboratory findings were as follows: urine negative; white blood cells 7,550; red blood cells 3,310,000; hemoglobin 68 per cent; smear normal; non-protein nitrogen 35.9 mg. per 100 c.c.; blood sugar 82 mg. per 100 c.c.; blood Wassermann and Hinton reactions negative.

X-ray examination of the upper gastro-intestinal tract revealed slight dilatation of the esophagus and a little delay in the passage of a thin barium mixture from the
esophagus to the stomach. There was an extensive filling defect involving the fundus of the stomach and the lower end of the esophagus.

Because of increasing dysphagia, gastrostomy was done on March 31, 1934, under local anesthesia. Exploration revealed an infiltrating growth encircling the esophagus at the cardia and extending down along the anterior wall and lesser curvature of the stomach half way to the pylorus. Convalescence was satisfactory. After an initial loss of about 15 pounds, the weight was maintained at about 117 pounds. The patient gradually became weaker, began vomiting, and died June 17, 1934.

At autopsy, one and one-half hours later, the following significant observations were made. The body was that of a well developed, moderately well nourished, elderly, white male. There was a draining fistula in the middle of a left upper rectus incision. The omentum was adherent to the anterior abdominal wall around the gastrostomy opening. The duodenum and upper three feet of the jejunum were greatly dilated, the distal end of this portion being adherent to the anterior stomach wall at the site of gastrostomy. The remainder of the intestines was relatively collapsed. Heart, lungs, and spleen were essentially negative. The esophagus was slightly dilated.

A tumor was found involving the stomach from the cardiac orifice to within 5 cm. of the pylorus. The walls of the stomach were greatly thickened by tumor and varied from 1 to 3 cm. in thickness. At the cardiac orifice the lumen of the esophagus was almost completely obstructed by encroachment of the tumor. Posteriorly the tumor had become adherent to the pancreas and at this point there was a necrotic, sloughing ulcer measuring 5 × 4 cm. and 4 cm. deep.

The liver weighed 1,550 grams and was studded with firm, white nodules up to 0.2 cm. in diameter. In the substance of the right kidney were several hard, whitish nodules, the largest of which measured 0.4 cm. in diameter. The lymph nodes along the lesser curvature of the stomach were all enlarged and firm, and appeared to be grossly infiltrated by direct extension of tumor. The aorta showed decreased elasticity with numerous atheromatous plaques, ulceration, and calcification.

Anatomical Diagnoses: Carcinoma of the stomach with local extension to the pancreas and regional lymph nodes and metastases to the liver and right kidney. Incomplete intestinal obstruction. Gastric fistula.

Microscopically (Fig. 1) the tumor cells and their arrangement varied a great deal. In some sections the tumor occurred in long, irregular columns, at times forming pseudo-glands. In these areas the cells were either cylindrical or ovoid, with moderately abundant basophilic cytoplasm and spherical or ovoid nuclei with one or more moderately prominent nucleoli. In the deeper layers of the stomach the tumor was seen either in delicate strands or small clusters formed in association with a loose stroma and some chronic inflammatory changes. The cell forms were numerous, mostly spherical, with acidophilic cytoplasm containing large, pale, vesicular nuclei with nucleoli varying in size and prominence. Occasionally mitoses and multinucleated cells were seen. No evidence of secretory activity was found. There was considerable variation in the amount of stroma, particularly in the deeper layers. It was irregularly invaded by round cells and even polymorphonuclear leukocytes.

Microscopic Diagnosis: Adenocarcinoma.

Case II (G. D., P. H. 7750): A seventy-year-old carpenter was admitted to the hospital on April 21, 1934, complaining of inability to eat. He had usually been in excellent health. In December 1915, he had a fall and sustained a fracture of the lower end of the left femur. While he was convalescing from this injury a bilateral inguinal herniorrhaphy was done for a large inguinal hernia on the right side and a smaller one on the left. The herniae recurred and an umbilical hernia also developed. All of these were repaired on Oct. 28, 1920. In 1924 a second fall resulted in fracture of the nose and two ribs.

The present illness began in November 1933, with loss of appetite, about three weeks after the patient's identical twin brother first showed symptoms. The patient felt hungry much of the time, but could not eat. At times he had rather severe epigastric pain. There was increasing constipation, and the abdomen became progressively distended. Finally, on Feb. 21, 1934, he was admitted to another hospital with a diagnosis of carcinoma of the descending colon with obstruction. At exploratory laparotomy on the
FIG. 1. **Case I: Photomicrograph of Tumor Metastasis in a Lymph Node**, Showing the Invasive Character of the Tumor, Pseudoglands, and Occasional Mitoses. × 250

FIG. 2. **Case II: Photomicrograph of Tumor Metastases in a Lymph Node**, Showing Masses of Tumor Cells Containing a Few Acini. × 250
Following day, six quarts of turbid fluid were removed. There was a generalized carcinomatosis. No definite single mass could be palpated, but the primary growth was believed to be in the sigmoid. Since the intestines were not distended, neither colectomy nor colostomy was done. Biopsy specimens from the abdominal wall fat and peritoneum showed metastatic adenocarcinoma. The postoperative course was marked by a rapid loss of weight and strength, increasing difficulty in swallowing, and persistent constipation.

Physical examination at the time of admission to Pondville Hospital revealed an elderly, pale, emaciated, dehydrated male. The lips were somewhat cyanotic. The resemblance to the twin brother, who was a patient on the same ward, was striking. Except for the more pronounced weight loss and deviation of the nose to the right in the second case and to the left in the first case, the appearance of the two patients was the same. The abdomen was distended and resistant. Beneath a recent right rectus incision was a hard, slightly tender, nodular, adherent mass. There were bilateral inguinal operative scars with a recurrent right inguinal hernia.

Urine examination showed a slight trace of sugar and a few white blood cells. Blood studies showed: red cells 3,020,000; white cells 10,000; hemoglobin 65 per cent; non-protein nitrogen 64.5 mgm. per 100 c.c.; blood sugar 90.9 mgm. per 100 c.c. The Hinton test was negative.

X-ray examination of the gastro-intestinal tract with a barium meal revealed a very definite delay in the emptying of the esophagus but no defect in its outline. A small amount of barium finally entered the stomach and revealed a large defect in the cardia due to an annular carcinoma. The duodenum was much dilated and hypertrophied. The small intestine was filled with gas and showed hypertrophy interpreted as due to partial obstruction lower down in the intestine.

The patient's condition rapidly became worse. He developed a gradually increasing cyanosis of the fingers of the right hand which extended up the arm to the axilla and resulted in a gangrene of the hand. After being stuporous for two days, he died on April 29, 1934, eight days after admission.

Post-mortem examination was done eighteen hours after death. The body was well developed but emaciated. The fingers of the right hand were hard, dry, and black around the distal phalanges. The remainder of the hand was shrunken, dry, and dark blue in color. On the abdomen was a well healed, recent surgical incision just to the right of the umbilicus; there were healed incisions in both groins.

The peritoneal cavity contained one liter of clear, yellowish, semi-gelatinous fluid. The peritoneum was thickened throughout, and the loops of small intestine were matted together by dense adhesions.

The right pleural cavity contained 500 and the left 200 c.c. of clear, straw-colored fluid. Dense adhesions obliterated the greater portion of the left pleural cavity.

In each pulmonary artery were friable, reddish gray emboli measuring 1 to 1.5 cm. in length, that on the right side being slightly adherent to the intima of the vessel. The lung tissue was quite red and edematous.

The spleen was essentially negative except for dense adhesions to the stomach and transverse colon.

The stomach was the seat of a large tumor infiltrating the walls of that organ from the cardia to within 4 cm. of the pylorus, where it ended quite abruptly. On its mucosal aspect the main portion of the lesion was ulcerated, presenting a reddish yellow surface covered with malodorous, yellowish green, necrotic tissue. On section, the infiltration was found to extend through the entire thickness of the stomach wall. The transverse colon and mesocolon were involved by direct extension of tumor tissue from the stomach. Around the upper end of the root of the mesentery, numerous loops of small intestine were enmeshed in a mass of tumor extending to the anterior abdominal wall. The intestinal serosa was thickened and covered with gelatinous exudate. No definite points of obstruction could be found. The body and tail of the pancreas were partially invaded by extension of the tumor.

The para-aortic, iliac, mesenteric, and gastrohepatic lymph nodes were enlarged and the normal architecture was replaced by hard, yellowish white granular tissue. One lymph node in the right suprACLavicular region appeared to be invaded by tumor.
In the right subclavian artery, 4 cm. from its origin, was a densely adherent, reddish gray thrombus almost occluding the lumen of the vessel. A second thrombus was found 2 cm. distal to the first. The abdominal aorta contained many calcified and ulcerated atheromatous plaques.


**Microscopic examination** confirmed the gross impressions and in addition revealed bronchopneumonia. Sections of the stomach showed a remarkable increase in the thickness of its wall with surprising regularity of tumor tissue arrangement in the form of long, gland-like structures. The latter were close-set, appearing superficially much like an excessively thickened mucosa. More deeply, tumor cells invaded the submucous, muscular, and serosal layers, causing profound thickening of the latter. The tumor cells were of the tall, columnar type with fairly large nuclear structures with prominent nucleoli (Fig. 2). The gland elements contained little secretion. In the deeper layers the epithelium was of lower type with an increase in fibrous tissue elements and compression of the muscularis.

**Microscopic Diagnosis:** Adenocarcinoma.

**Discussion**

Several points in the cases here reported are particularly noteworthy, namely the marked resemblance of the brothers to each other, the almost simultaneous appearance of identical symptoms at seventy years of age, the rapid progression of the disease, the symmetrical location of the tumors in the stomach, and their similarity on pathological examination. Gastrostomy, which was done for the severe dysphagia in Case I, prolonged life for several weeks. Of incidental interest was the history of bilateral inguinal hernia in each, with recurrence in both after herniorrhaphy.

The age of these twins, seventy years, is considerably greater than the ages reported in similar cases where the age was stated. The tendency seems to be for such tumors to develop in childhood or early adult life.

**Summary**

Cases of carcinoma of the stomach occurring simultaneously and symmetrically in homologous twins are reported. The occurrence of similar, simultaneous, and symmetrical carcinomata in identical twins tends to give further confirmation to the theory of the genetic origin of these tumors.

**Bibliography**


15. Wells, H. G.: Personal communication to Twinem (13).