

# KIT-negative Gastrointestinal Stromal Tumor in a Child: A Case Report<sup>1</sup>

Se Woong Lim, M.D., Young Hwan Lee, M.D., Sang Hyeon Park, M.D.,  
Du-young Choi, M.D.<sup>2</sup>, Geum Ha Choi, M.D.<sup>3</sup>

We report here on the imaging findings of the case of KIT-negative gastrointestinal stromal tumor (GIST) in the stomach of a 12-year-old girl. Radiologic studies revealed the presence of a huge exophytic growing mass that originated from the gastric wall and this mass consisted of solid and cystic components on USG, CT and MR. The cystic regions were mainly located at the periphery of the mass and they were revealed to be myxoid degeneration and hemorrhage on histopathologic examination. The tumor consisted of epithelioid and typical spindle cells and they showed negative immunoreactivity for KIT. Although KIT-negative GISTs are rare, they can be considered in the differential diagnosis when a large heterogeneous extraluminal mass that contains solid portions and various degrees of peripheral cystic regions is observed.

**Index words :** Gastrointestinal Stromal Tumor  
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Gastrointestinal stromal tumors (GISTs) are the most common mesenchymal tumor among the gastrointestinal tumor in adults, yet these are uncommon tumors in pediatric patients. The clinical and histopathological features of GISTs in children differ from those in adults (1, 2). GISTs are well known for their immunoreactivity for KIT (CD 117, a stem-cell factor receptor), but a few GISTs show a weak or negative KIT expression (3-5). Although the KIT-negative GISTs usually show the typical clinicopathologic features of the conventional KIT-

positive GISTs, they have some unique features in some aspects. We report here on the imaging findings of a KIT-negative gastric GIST in a 12-year-old girl.

## Case Report

A 12-year-old girl who presented with a palpable abdominal mass was referred to our institution. She had experienced abdominal pain for the previous few days and the physical examination revealed a huge mass in the epigastric area. All laboratory findings were within the normal limits (hemoglobin: 12.6 g/dL, hematocrit: 35.8%, RBC count:  $4.20 \times 10^3/\mu\text{l}$ , WBC count:  $5.40 \times 10^3/\mu\text{l}$ , platelet count:  $221 \times 10^3/\mu\text{l}$ ). Abdominal ultrasonography (USG) revealed the presence of a huge mass that measured  $14 \times 11$  cm, it was abutting the gastric wall and it showed mixed echogenicity in the cystic and solid regions (Fig. 1A). Computed tomography (CT) and magnetic resonance imaging (MRI) were performed to accurately determine the location of the mass and to

<sup>1</sup>Department of Radiology, Wonkwang University School of Medicine and Hospital

<sup>2</sup>Department of Pediatrics, Wonkwang University School of Medicine and Hospital

<sup>3</sup>Department of Pathology, Wonkwang University School of Medicine and Hospital

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Address reprint requests to : Young Hwan Lee, M.D., Department of Radiology, Wonkwang University Hospital, 344-2 Shinyong-dong, Iksan, Jeonbuk 570-711, Korea.

Tel. 82-63-859-1927 Fax. 82-63-851-4749

E-mail: yjyh@wonkwang.ac.kr

characterize it. CT indicated that the mass was abutted to the wall of the lower gastric body and it had grown exophytically into the abdominal cavity. The mass consisted of cystic and solid regions, as observed on USG, and it showed heterogenous contrast enhancement (Figs. 1B–D). MRI also suggested that the mass surfaced from the gastric wall and it contained peripheral cystic regions that showed homogenous low signal intensity on the T1-weighted image and homogeneous high signal intensity on the T2-weighted image. The solid regions revealed intermediate signal intensity on both the T1- and T2-weighted images and slight contrast enhancement on the contrast-enhanced T1-weighted MR image

(Figs. 1E–G). The findings also indicated that the mass had not infiltrated the surrounding structures or metastasized to the liver or lymph nodes. The radiologic diagnosis was a GIST arising from the gastric wall, although GISTs have been rarely reported in children. The mass was removed by gastric wedge resection. Examination of the gross specimen showed that the mass originated from the gastric submucosa, and myxoid degeneration with cystic changes and hemorrhage was noted (Fig. 1H). These findings correlated with the findings of USG, CT and MRI.

Microscopically, the tumor was composed of 2 types of cells: the epithelioid cells were present in the myxoid

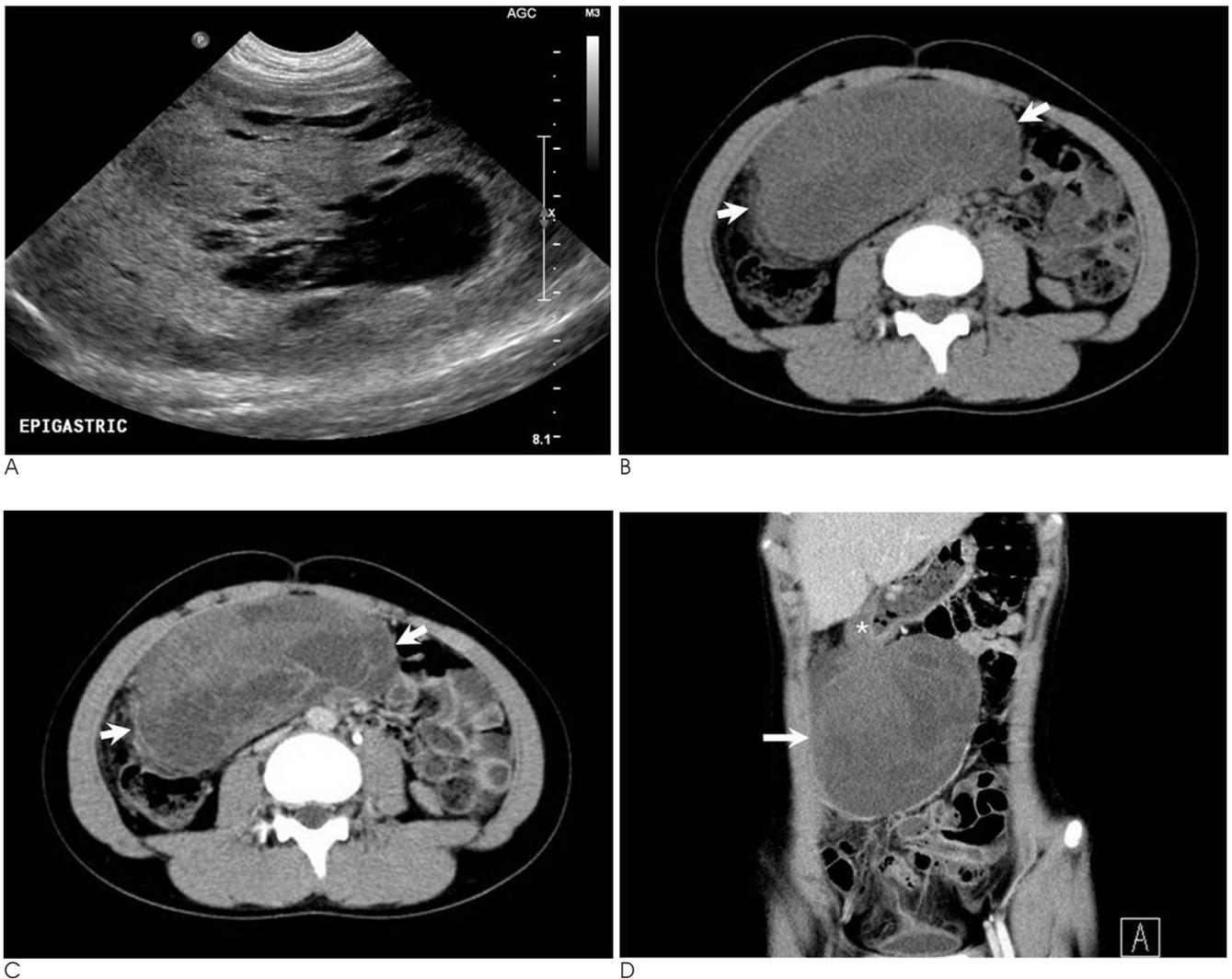


Fig. 1. A 12-year-old girl presented with a KIT-negative gastrointestinal stromal tumor of the stomach.  
 A. Abdominal ultrasonography shows a huge mass with heterogenous echogenicity and the mass is composed of cystic and solid regions.  
 B, C. Axial pre- and post- contrast CT images show a huge mass (arrows) occupying the abdominal cavity. The mass shows enhancing solid and non-enhancing cystic components.  
 D. Coronal contrast-enhanced CT image shows a heterogeneously enhanced exophytic mass (arrow) originating from the gastric wall of the lower body (asterisk).

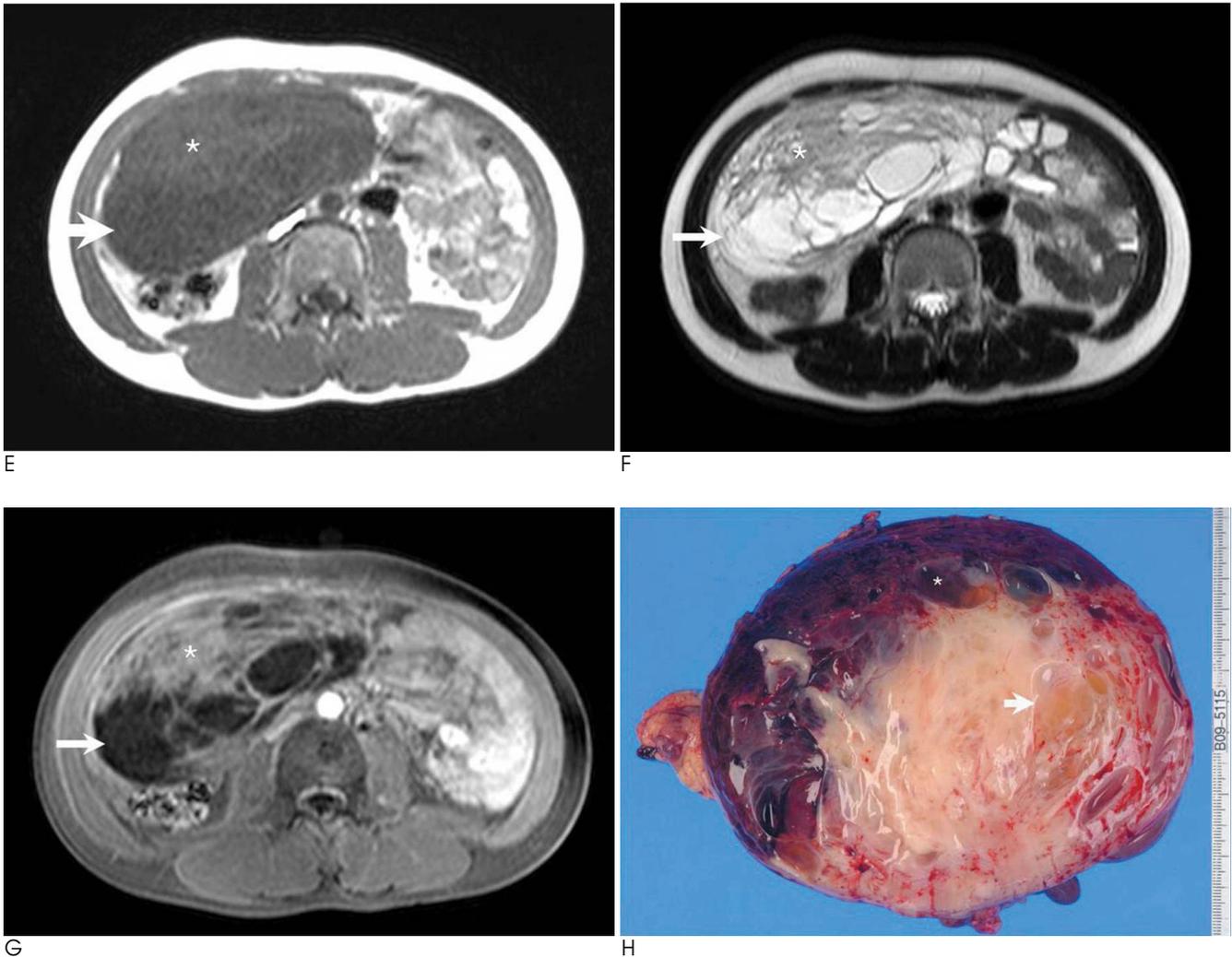


Fig. 1. E-G. Axial T1-weighted MR image (E), T2-weighted MR image (F) and contrast-enhanced T1-weighted MR image (G) show a complex mass with cystic and solid regions. The solid regions (asterisk) have intermediate signal intensity on both the T1- and T2-weighted images with slight contrast enhancement on the contrast-enhanced T1-weighted image. The cystic regions (arrow) show low signal intensity on the T1-weighted image and high signal intensity on the T2-weighted image without contrast enhancement on the contrast-enhanced T1-weighted image. H. Photograph of gross pathologic specimen revealed that the tumor had cystic regions that showed myxoid degeneration (arrow) and hemorrhage (asterisk).

region and there were also spindle cells. Although the tumor was negative for a KIT expression, the diagnosis of GIST was made on the basis of the fact that the tumor showed the typical clinicopathologic features of GISTs. On the immunohistochemical analysis, the tumor showed positive immunoreactivity for CD 34. Analyses for the expression of other cell markers such as desmin, neuron-specific enolase (NSE), S-100 protein and smooth muscle actin (SMA) were all negative.

### Discussion

GISTs rarely occur in children and the clinicopathologic features of GISTs in children differ from those in

adults (1, 2). A review of the articles on GISTs in children and young adults suggests that pediatric GISTs tend to frequently occur in girls and they predominately affect the stomach (1). In adults, there is no difference of the incidence of GISTs between men and women and the stomach is the most common site (6). The common clinical symptoms of pediatric GISTs are chronic anemia, a palpable mass and abdominal pain, which occur in 86.4%, 11.9% and 15.3% of the patients, respectively (2).

Histopathologically, most GISTs that occur in adults typically consist of spindle cells (6); however, pediatric GISTs predominantly show an epithelioid morphology. The other characteristics of pediatric GISTs include the

frequent involvement of lymph nodes and the lack of a KIT expression or platelet-derived growth factor receptor (PDGFR) mutations (1). In this case, the tumor affected the stomach of a 12-year-old girl and the tumor had mixed cell types, including epithelioid cells and the typical spindle cells. However, no predominant cell type was observed and the lymph nodes were not involved.

Most GISTs express CD 117 (95%), CD 34 (70%) and heavy caldesmon (80%), whereas 25% are positive for a SMA expression and less than 5% are positive for a desmin expression, but a few tumors show a weak or negative KIT expression even though they show the typical clinicopathologic and cytogenetic features of GISTs (3–7). CD 34 antigen is not specific for GISTs, but it is commonly present in GISTs (6). KIT-negative GISTs predominantly occur in the stomach, omentum or mesentery and they usually show an epithelioid or mixed epithelioid-spindle cell morphology on histopathologic examination (3–5). The diagnosis of GIST was made in this case, although the tumor showed no immunoreactivity for KIT (CD117), because the tumor consisted of epithelioid cells and the typical spindle cells and the tumor was positive for a CD 34 expression, but it was negative for SMA and desmin expressions. Other markers or a cytogenetic analysis can be used for making the diagnosis of GIST in the absence of KIT immunoreactivity. Particularly, the presence of KIT/PDGFR mutation is almost pathognomonic for the diagnosis of GIST. However, regardless of KIT positivity, GISTs do not always contain the KIT/PDGFR mutation (3, 5, 7). Unfortunately, cytogenetic study was not performed in this case.

Sakurai *et al* analyzed 30 GISTs that were weakly positive or totally negative for KIT. They introduced the concept of "myxoid epithelioid GISTs", which contained myxoid stroma with less cohesive epithelioid cells (7). In our case, the tumor consisted of 2 types of cells: epithelioid cells in a myxoid background and spindle cells. Interestingly, these features are very similar to those of pediatric KIT-positive GISTs.

Tateishi *et al* reported on 10 GISTs that were weakly positive or totally negative for KIT. According to their study, CT and MR indicated the presence of a large heterogeneous mass that contained cystic regions and various degrees of soft-tissue elements. Pathologically, all the tumors were soft-tissue masses with cystic regions. Myxoid degeneration was frequently present in the cystic regions, and necrosis and hemorrhage were present in a few lesions (4). However the cystic regions of the

conventional KIT-positive GISTs were usually necrotic or apoptosis was present (8, 9). In our case, the tumor also contained many cystic regions with soft-tissue elements. On the histopathologic examination, myxoid degeneration and hemorrhage were noted in the cystic regions. Unlike the KIT-positive GISTs that have shown central necrosis (8), the cystic regions in this case were present on the periphery of the tumor. A previous article presented the imaging findings of 3 cases of KIT-negative GISTs, and in 2 of these cases, the cystic regions were present on the periphery of the tumor (4). Thus, the cystic changes caused by myxoid degeneration in KIT-negative GISTs seemed to be present more peripherally than those in the KIT-positive GISTs. However, we could not find any reference showing whether peripheral myxoid degeneration was commonly present in the KIT-negative GISTs or in other tumors, except for neurogenic tumors. Peripheral myxoid degeneration is typically present in some schwannomas (10).

The differential diagnosis of gastric GIST that occurs in childhood consists of lymphoma, neuroendocrine tumor, neurogenic tumor, etc. Lymphoma usually tend to be solid tumor without a cystic portion, but neurogenic tumors and neuroendocrine tumors can contain cystic portions, so making the radiologic differentiation of these tumors is difficult.

It is very interesting that our case showed the typical clinical, radiologic and pathologic characteristics of both pediatric and KIT-negative GISTs. To the best of our knowledge, this is the first case report of a pediatric KIT-negative GIST in the medical literature. Although the occurrence of pediatric GISTs or KIT-negative GISTs is rare, the thorough knowledge of the clinical, radiological and pathological features of pediatric and KIT-negative GISTs will be helpful for making the differential diagnosis. In conclusion, KIT-negative GISTs can be considered when a large heterogeneous extraluminal mass with peripheral cystic regions and various degrees of soft-tissue elements is observed.

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## 소아에서 발생한 KIT 음성 위장관간질종양: 증례 보고<sup>1</sup>

<sup>1</sup>원광대학교 의과대학 영상의학과

<sup>2</sup>원광대학교 의과대학 소아청소년과

<sup>3</sup>원광대학교 의과대학 병리과

임세웅 · 이영환 · 박상현 · 최두영<sup>2</sup> · 최금하<sup>3</sup>

저자들은 12세 여아의 위에서 발생한 KIT 음성 위장관간질종양(GIST)의 영상소견을 보고하고자 한다. 초음파, CT, MR 등 영상의학 검사에서 위벽에서 기원한 큰 외장형 종괴가 보였고 내부는 고형성 부위와 낭성 부위가 혼합되어 있었다. 낭성 부위는 주로 종양의 바깥쪽에 있었고 조직병리학적으로 점액성 변성 및 출혈로 확인되었다. 종양의 고형 부위는 상피양 세포 및 전형적인 방추형 세포로 구성되어 있었다. KIT 음성 위장관간질종양은 드물지만, 큰 외장형 종괴가 내부에 불균일한 고형성 부위와 다양한 정도의 낭성 부위를 포함하고 있고, 특히 낭성 부위가 종양의 변연부에 있을 때 KIT 음성 위장관간질종양을 고려해 볼 수 있다.