Evaluation of gastrointestinal stromal tumors by multislice computed tomography and magnetic resonance imaging

Avaliação de tumores estromais gastrointestinais por tomografia computadorizada multislice e ressonância magnética: relato de três casos

Fabiano Elias Porto[1], Ronaldo Hueb Baroni[2], Christina Helena de Toledo Pelizon[3], Antônio Luiz de Vasconcellos Macedo[4], Manoel de Souza Rocha[5], Marcelo Buarque de Gusmão Funari[6]

ABSTRACT

This article presents three cases of gastrointestinal stromal tumors with clinical manifestations and pathological features, along with differential diagnoses, with special emphasis on multislice computed tomography and magnetic resonance imaging findings.

Keywords: Gastrointestinal neoplasms/diagnosis; Mesenchymoma/diagnosis; Stromal cells/pathology; Tomography; x-ray computed; Magnetic resonance imaging

RESUMO

Neste trabalho apresentamos o relato de três casos de tumores estromais gastrointestinais, a descrição de suas principais características clínicas e anatomopatológicas e diagnósticos diferenciais, com destaque para os achados na tomografia multislice e ressonância magnética.

Descritores: Neoplasias gastrointestinais/diagnóstico; Mesenquimoma/diagnóstico; Células estromais/patologia; Tomografia computadorizada por raios X; Imagem por ressonância magnética

INTRODUCTION

The mesenchymal neoplasms of the gastrointestinal tract are divided into two large groups. The first group comprises tumors originating from specific cell lineages: smooth muscles (leiomyoma, leiomyoblastoma and leiomyosarcoma), nerve cells (schwannoma and neurofibroma), endothelial cells (hemangioma and lymphangioma) and many others. The second group is composed of gastrointestinal stromal tumors (GIST)[1].

The GIST correspond to a relatively new entity that comprises a group of mesenchymal neoplasms originating from a common precursor cell. Although rare, these tumors are the most commonly observed in the gastrointestinal tract[2-3]. They correspond to approximately 0.1-3.0% of all neoplasms of the gastrointestinal tract and account for 5.7% of sarcomas[4]. Up to 1983, these tumors were included in the first group of mesenchymal neoplasms and usually classified as leiomyomas or leiomyoblastomas, since its histogenesis, microscopic and immunohistochemical characteristics were unknown. From then on, by means of electronic microscopy and immunohistochemistry, new markers were identified demonstrating a distinct histogenetic origin[4].

The GIST derive from Cajal's interstitial cells that are gastrointestinal tract pace-makers, located in the muscularis propria[1,4]. Morphologically, these neoplasms have a fusiform pattern in 70-80% of cases (figure 1) and an epithelioid pattern in 20-30%[2]. In some cases there might be a paraganglioma- or carcinoid-like growth pattern. There are characteristic immunohistochemical properties, and the most important and specific marker is the c-KIT oncogene product (CID-1 17). Mutations in this gene result in a

Study carried out at Department of Imaging of the Hospital Israelita Albert Einstein – HIAE – São Paulo (SP), Brazil.

[1] Graduate student at the Department of Imaging, Hospital Israelita Albert Einstein – HIAE – São Paulo (SP), Brazil.

[2] M.D. Assistant physician at the Department of Imaging, Hospital Israelita Albert Einstein – HIAE - São Paulo (SP), Brazil.

[3] M.D. Assistant physician at the Department of Pathological Anatomy, Hospital Israelita Albert Einstein – HIAE - São Paulo (SP), Brazil.

[4] M.D. Department of Surgery, Hospital Israelita Albert Einstein – HIAE - São Paulo (SP), Brazil.

[5] M.D. Assistant physician at the Department of Imaging, Hospital Israelita Albert Einstein – HIAE - São Paulo (SP), Brazil.

[6] M.D. Coordinator of the Department of Imaging, Hospital Israelita Albert Einstein – HIAE - São Paulo (SP), Brazil.

Corresponding author: Fabiano Elias Porto - Al. dos Maracatins, 1011 - apto. 42 - Moema - CEP 04089-013 - São Paulo (SP), Brazil - e-mail: faporto@ibest.com.br

Received on June 24, 2005 – Accepted on August 28, 2005

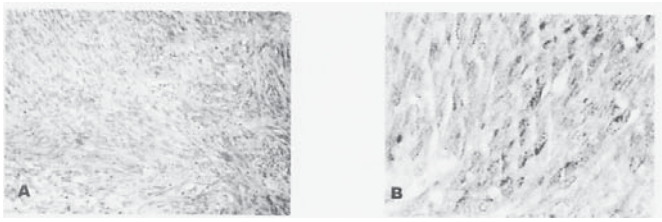

Figure 1. Gastrointestinal stromal tumor characterized by fusiform cells with large and eosinophilic cytoplasm (A). Cytoplasmic positivity for c-KIT or CD-117 of the gastrointestinal stromal tumor cells (B), confirming diagnosis of GIST

continuous stimulation in tyrosine-kinase activation and, consequently, in uncontrolled cell proliferation. The majority of these tumors also expresses CD34 protein[1,2].

The importance of positivity for c-KIT protein in these neoplasms is not limited to diagnosis. The binding protein is also an excellent therapeutical target for new specific drugs that inhibit this protein, such as imatinib[5].

The GIST generally affect individuals aged over 50 years and they are rare in those aged under 40 years. They are usually solitary lesions and may occur throughout the gastrointestinal tract[3]. The stomach is involved in 70% of cases, followed by the small intestine, in 20-30% of cases. Other less frequent sites include anorectal (7%), colon (5%), esophagus (less than 5%), mesenterium, omentum and retroperitoneum[3,5].

The objective of this study was to describe the main aspects of this lesion that are relatively frequent, emphasizing the benefits provided by a multiplanar reconstruction by multislice computed tomography (CT) and magnetic resonance imaging (MRI).

CASE REPORTS

1. A 33-year-old female patient, complaining of a ill-defined transient pain, in the left iliac fossa for some weeks. She was initially submitted to a multislice computed tomography with oral administration 1500 ml of iodine contrast solution and 100 ml of intravenous iodine contrast. A large, oval, solid lesion was observed with necrotic areas inside, occupying the left flank, in contact with the posterior gastric wall, pancreatic tail and descending colon, and measuring approximately 11.0 x 10.0 x 7.0 cm. Multiplanar reconstructions were performed (figure 2) to better define the lesion limits and its relation with adjacent structures. Two other solid hepatic nodules were observed, measuring 5.0 cm and 2.5 cm, respectively.

The patient was submitted to magnetic resonance imaging of the upper abdomen to better clarify the etiology of hepatic lesions. Three nodules were observed suggesting hemangiomas and two of them corresponded to those previously seen in CT. On MRI multiplanar sequences, the gastric tumor had well-

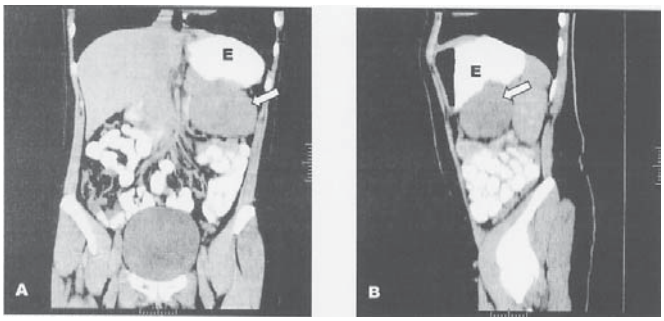

Figure 2. Multislice computed tomography with coronal (A) and sagittal (B) reconstructions shows a large heterogeneous low-attenuation solid lesion (arrows) in contact with the gastric body posterior wall. E= stomach

defined limits with no signs of adjacent structure invasion, except for no distinction of its limits close to the gastric wall, thus favoring its origin in the submucosal layer of the stomach (figure 3).

The patient was submitted to complete resection of the lesion (figure 4). The pathological study revealed

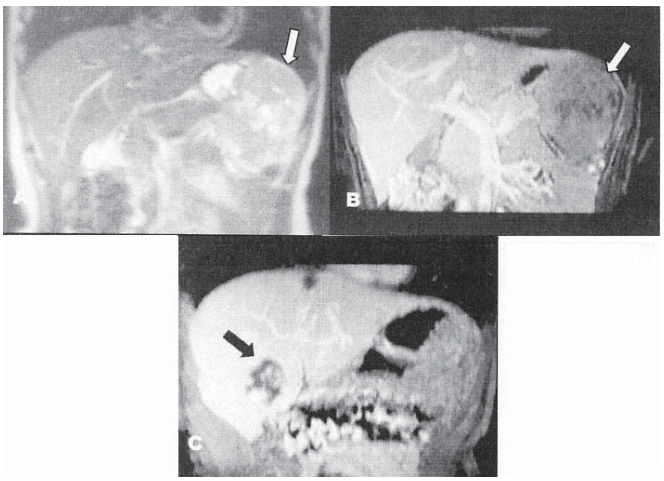

Figure 3. Large gastric stromal tumor (white arrows) on coronal T2-weighted magnetic resonance imaging sequence (A) and coronal post-contrast volumetric reconstruction (B). A hepatic hemangioma is observed in (C) (black arrow)

a predominantly fusiform mesenchymal neoplasm with focal epithelioid areas organized in bundles, and focal ischemic necrosis and hemorrhagic areas. The immunohistochemical panel demonstrated positivity for c-KIT and CD34 (figure 5), and negativity for desmin, S-100 protein and smooth muscle actin. These findings are compatible with gastrointestinal stromal tumor.

2. A 71-year-old female patient submitted to multislice CT that showed a solid, homogeneous intraluminal formation with a polypoid aspect, located in the gastric body and measuring approximately 2.0 cm (figure 6).

Forty-five days later, a partial gastrectomy was performed and the surgical specimen was submitted to pathology. The morphological findings were compatible with gastrointestinal stromal tumor, with

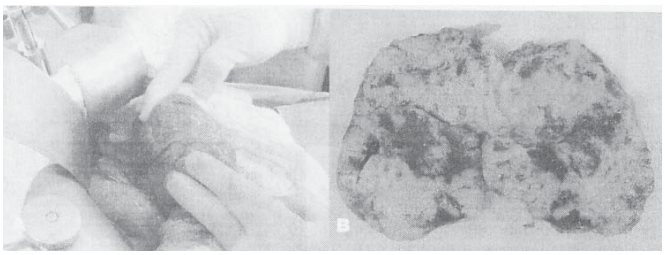

Figure 4. Surgical specimen during surgery (A), and macroscopic view after complete resection with longitudinal section (B)

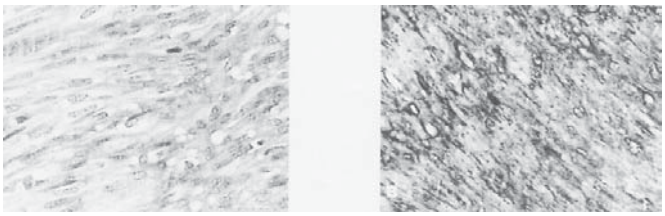

Figure 5. Gastrointestinal stromal tumor characterized by elongated nuclei with moderate pleomorphism (A) and intense cytoplasmic positivity for c-KIT or CD-117 in neoplasic cells (B)

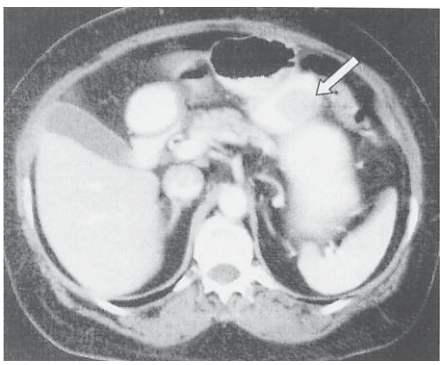

Figure 6. A solid polypoid tumor (arrow) characterized in an axial CT section. Gastric stromal tumor confirmed by immunohistochemical study

no signs of cell atypia, mitotic activity, necrosis, hemorrhage or adjacent mucosal ulceration. The immunohistochemical study showed positivity for c-KIT and CD34 and negativity for other antibodies investigated, and these findings are enough to confirm the diagnosis of GIST.

3. A 34-year-old male patient presented a large mass in multislice CT, with a liquefied central component and contrasting solid areas in the periphery, extending from the left subdiaphragmatic region up to the ipsilateral iliac fossa. They were in close contact with the greater curvature and peritoneum (figure 7), and measured roughly 24 x 14 x 10 cm. A voluminous ascites was also observed. A CT-guided aspiration was perfomed with an 18-G needle and a 16-G Tru-Cut. The pathological examination showed fusiform and epitheliod cells with mild desmoplasia and myxoid areas, with no signs of necrosis and absence of mitotic

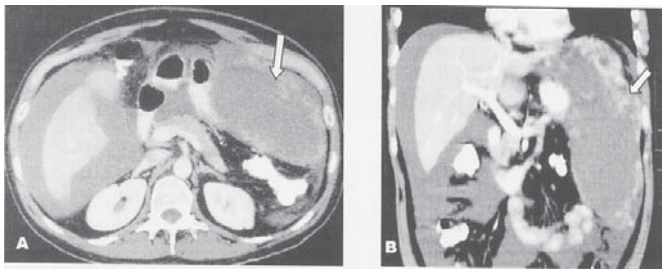

Figure 7. Multislice computed tomography demonstrating a large gastric tumor lesion (arrows), which is heterogeneous, with hypodense areas confirmed as myxoid degeneration areas in GIST, and observed in axial section (A) and coronal reconstruction (B). Note: presence of ascites

activity. The immunohistochemical panel revealed positivity only for c-KIT and CD34, suggesting a gastrointestinal stromal tumor.

DISCUSSION

Approximately 10 to 30% of GIST are malignant[6-7]. Despite some controversies in the literature, any GIST is considered potentially malignant. The risk of more aggressive behavior is greater in extragastric lesions, diameter greater than 5 cm, high mitotic index and expansion to adjacent organs[4,6]. The main metastatic site is the liver, followed by the peritoneum. Lungs, bones and lymph nodes may also present metastatic disease[1,4].

Due to excellent spatial resolution and multiplanar evaluation capacity, multislice computed tomography and MRI provide excellent studies of these neoplasms and complement endoscopic assessment. These lesions can be appropriately studied, in particular when there is an adequate distension of the organ with water or oral contrast medium, and this is easily obtained in gastric tumors. Optimizing the use of intravenous contrast medium and of collimation/reduced slice thickness are other important factors to improve quality of the exams. Apart from being complementary tools for endoscopic methods, CT and MRI are responsible for GIST staging, by providing data on presence of metastases, extension to adjacent organs and relation with surrounding vital structures, such as visceral arteries[6].

RADIOLOGICAL FINDINGS

The most common GIST pattern is exophytic tumoral growth, and the mass projects outside the original organ[2]. This presentation may not be detected by endoscopy if the mucosa is intact. In a conventional radiography, eventually a mass may be observed with unspecific attenuation of soft tissues, with an expansive effect in adjacent structures, such as a stomach tumor deviating the gastric air bubble. Calcifications are rarely observed[3].

The barium-contrast radiological examinations show regular filling failure, with the margin forming an obtuse angle with the visceral wall, suggesting a submucosal mass with intact mucosa. Ulcerations may be observed, primarily in benign or malignant lesions larger than 2 cm. A very uncommon presentation is an intraluminal polypoid formation[3,7].

CT of these tumors can present a homogeneous attenuation similar to that of muscles, and a heterogeneous aspect with central hypodense areas suggesting necrosis or cystic degeneration. Moreover, CT enables assessing possible metastatic sites, such as liver and lymph nodes, in case of malignant tumors. Enhancement varies and it presents predominantly peripheral, homogeneous or heterogeneous patterns and areas of necrosis and low-attenuation cystic degeneration[2,6].

The MRI findings vary, since grade of necrosis and hemorrhage significantly interfere in magnetic resonance images; in that, the solid portions of the tumor present low signal in T1 weighted sequences and high signal in T2 weighted sequences, with enhancement after intravenous administration of gadolinium. The signal in hemorrhagic areas vary from low to high, both in T1 and T2 weighted sequences, depending on age of bleeding. Necrotic and cystic degeneration areas present high signal in T2 weighted sequences and no show intravenous contrast impregnation[2].

Some advantages of MRI reside in the fact of being a multiplanar examination, with high tissue contrast capacity, and it is useful, particularly in large tumors, to determine the original organ and the relation with adjacent structures. Multislice tomography may also be considered a multiplanar method by means of reconstructions at the same MRI levels. The disadvantage of MRI is the use of ionizing radiation and the impossibility of using an intravenous contrast in patients with history of allergy or renal disease patients.

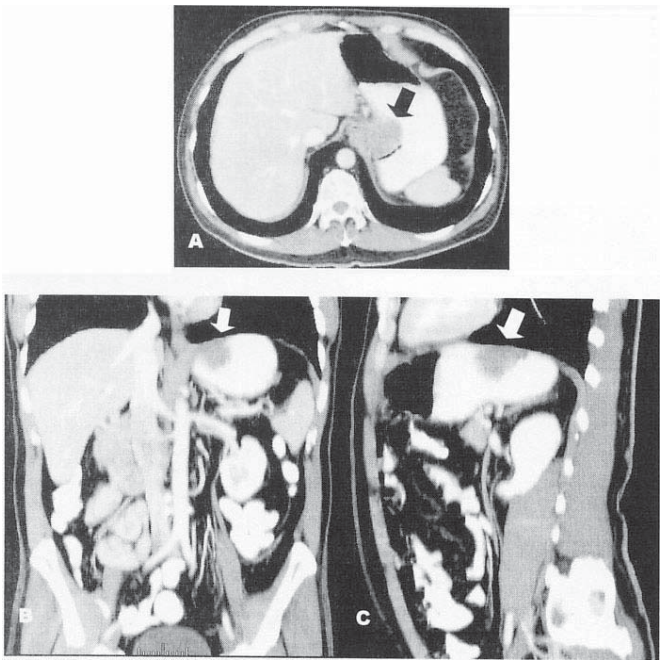

Figure 8. A solid, homogeneous and polypoid lesion (arrows). Lesions shown in the cardia in axial section (A) of multislice CT, with coronal (B) and sagittal (C) reconstructions

Figure 9. Leiomyoma characterized by elongated stromal cells with perinuclear vacuoles, forming bundles arranged in several directions

DIFFERENTIAL DIAGNOSIS

The main differential diagnoses of stromal tumors include other mesenchymal neoplasms: leiomyomas (figures 8 and 9), leiomyosarcomas, schwannomas and neurofibromas, as well as lymphomas and digestive tract adenocarcinomas[8].

GIST rarely originate from the esophagus, unlike leiomyoma and leiomyosarcoma that particularly affect this organ. Schwannoma also occurs in the stomach, but less frequently.

Gastric adenocarcinomas and lymphomas rarely demonstrate a marked exophytic growth, but they could spread through the gastroduodenal ligament to celiac lymph nodes. These findings are not observed in GIST[2-3]. Lastly, in case of small tumors projecting outside the visceral lumen, the polyps could be included in differential diagnosis.

REFERENCES

1. Rosai J. GIST: an update. Int J Surg Pathol. 2003;11(3):177-86. Review.
2. Levy AD, Remotti HE, Thompson WM, Sobin LH, Miettinen M. Gastrointestinal stromal tumors: radiologic features with pathologic correlation. Radiographics. 2003;23(2):283-304,456; quiz 532. Review.
3. Levy AD, Remotti HE, Thompson WM, Sobin LH, Miettinen M. Anorectal gastrointestinal stromal tumors: CT and MR imaging features with clinical and pathologic correlation. AJR Am J Roentgenol. 2003;180(6):1607-12.
4. Burkill GJ, Badran M, Al-Muderis O, Meirion Thomas J, Judson IR, Fisher C et al. Malignant gastrointestinal stromal tumor: distribution, imaging features, and pattern of metastatic spread. Radiology. 2003;226(2):527-32.
5. Kim HC, Lee JM, Kim SH, Kim KW, Lee M, Kim YJ et al. Primary gastrointestinal stromal tumors in the omentum and mesentery: CT findings and pathologic correlations. AJR Am J Roentgenol. 2004;182(6):1463-7.
6. Ba-Ssalamah The, Prokop M, Uffmann M, Pokieser P, Teleky B, Lechner G. Dedicated multidetector CT of the stomach: spectrum of diseases. Radiographics. 2003;23(3):625-44. Review.
7. Sharp MRI, Ansel HJ, Keel SB. Best cases from the AFIP: gastrointestinal stromal tumor. Armed Forces Institute of Pathology. Radiographics. 2001;21(6):1557-60.