Solitary pancreatic lesion as the initial metastasis from osteosarcoma: Report of a rare case

Ikuta, Kemmei ; Kawamoto, Teruya ; Hara, Hitomi ; Fukase, Naomasa ; Morishita, Masayuki ; Kuroda, Ryosuke ; Akisue, Toshihiro

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Introduction

Osteosarcoma is the most common malignant bone tumor in childhood and adolescence, and its treatment consists of a combination of chemotherapy and surgical resection. The disease has a high metastatic potential, and common locations of metastasis are the lungs, pleurae, and bones; metastasis to the pancreas is extremely rare [1, 2]. We present a 42-year-old woman with an osteosarcoma in the proximal fibula who was found to have a pancreatic lesion as the initial metastasis on ^{18}F-fluorodeoxyglucose-positron emission tomography/computed tomography (FDG-PET)/CT 2 years after surgical treatment of the primary lesion. Pancreatic metastasis from osteosarcoma is extremely unusual; however, because surgical resection of metastatic lesions may have a survival benefit for the patient, surgeons treating patients with osteosarcoma must be aware of the pancreas as a potential metastatic site of osteosarcoma.

The patient was informed that data from the case would be submitted for publication, and gave us consent for possible academic use of the clinical information.

Case report

A 42-year-old woman was admitted to our hospital with pain and swelling in the lateral aspect of the right knee that had progressively worsened over 2 years. A physical examination on admission revealed slight swelling and tenderness around the proximal right fibula and the patient had pain on weight-bearing. The range of motion of the right knee was not limited, and weakness of muscles including the tibialis anterior was not observed.

Laboratory findings including white blood cell count, C-reactive protein, alkaline phosphatase, and lactate dehydrogenase levels were unremarkable. A plain radiograph (Fig. 1) and magnetic resonance imaging (MRI) scans (Fig. 2) of the right knee demonstrated an osteolytic destruction with irregular periosteal reaction and a diffuse abnormal signal in the marrow of the right fibular head. An open biopsy was performed, and histological examination showed that neoplastic osteoid production was present within fascicles of atypical spindle cells with hyperchromatic nuclei and mitotic figures. The diagnosis of osteosarcoma was confirmed histologically.

The patient received neoadjuvant chemotherapy with two cycles of high dose methotrexate 10,000 mg/m^2 alternating with doxorubicin 30 mg/m^2 on days 1 and 2, and

cisplatin 100 mg/m^2 on day 1 (MAP), and then she underwent wide resection of the right proximal fibula followed by reconstruction of the lateral collateral ligament of the right knee (Fig. 3). The histology of the resected specimen confirmed the diagnosis of osteosarcoma with 40-50% necrosis rates (Fig. 4). After the surgery, the patient underwent adjuvant chemotherapy with two cycles of MAP with addition of ifosfamide 15,000 mg/m^2, and follow-up images of radiography, computed tomography (CT), MRI, and whole body ^{18}F-fluorodeoxyglucose-positron emission tomography (FDG-PET)/CT indicated no evidence of local recurrence or distant metastasis.

However, 2 years after the surgical treatment, FDG-PET/CT showed abnormal uptake in the tail of the pancreas with a standardized uptake value (SUV) of 6.9 without other abnormalities (Fig. 5). The patient was asymptomatic and laboratory examination results were within normal values. Dynamic CT revealed an enhancement of the lesion in the pancreatic tail at the late phase (Fig. 6). Endoscopic ultrasound-guided fine needle aspiration from the mass was performed (Fig. 7), and the section showed tumor composed of polygonal and spindle-shaped cells with hyperchromatic nuclei. The features were compatible with metastatic osteosarcoma. Laparoscopic distal pancreatectomy was then performed, and histopathological examination of the resected tissue showed atypical spindle cells; this finding was similar to the histology of the

primary lesion in the right proximal fibula, and the diagnosis of metastatic osteosarcoma was confirmed (Fig. 8).

One year after surgical treatment for the pancreatic metastasis, metastases occurred in both lungs and the patient underwent chemotherapy with three cycles of gemcitabine-docetaxel combination (gemcitabine 900 mg/m^2 on days 1 and 8, and docetaxel 70 mg/m^2 on day 8 given after gemcitabine), then surgical resection of the metastatic lesions in the lungs was performed. The patient remains well without local recurrence or other metastases over 1 year following surgical treatment for the lung metastases.

Discussion

Osteosarcoma is the most common malignant bone tumor of childhood and adolescence, and has a high metastatic potential. The most common sites of metastasis are the lungs, pleurae, and bones. Less commonly, the liver, brain, and regional lymph nodes are sites of metastasis, but metastases to the gastrointestinal system are rare [1-3].

Metastases to the pancreas are extremely rare, and only 2% of all pancreatic tumors are metastatic lesions [4-7]. The primary sites of pancreatic metastasis are epithelial tissues including the kidney, stomach, lungs, liver, breasts, ovaries, and thyroid; and non-epithelial tissues such as the hematopoietic system, retroperitoneum, and bone and soft

tissues [4-7]. Among these, pancreatic metastasis from osteosarcoma is especially unusual; moreover, pulmonary metastases usually occur before pancreatic involvement [8], and a solitary pancreatic lesion as the initial metastasis from osteosarcoma has never been reported, to the best of our knowledge.

Most patients with pancreatic metastasis do not have signs or symptoms [4-7] and our patient was also asymptomatic. In the present case, the metastatic lesion in the pancreas was detected by FDG-PET/CT but not by plain abdominal CT. FDG-PET/CT can be helpful for systemic screening in the management of patients with cancer; however, its sensitivity for pulmonary metastases may be lower than that of dedicated chest CT. Moreover, the combined metabolic and morphological information from FDG-PET/CT allows high diagnostic accuracy for the detection and staging of musculoskeletal tumors compared with MRI [9-10], and several studies reported that FDG-PET/CT had a sensitivity of 90% (86–93%) and a specificity of 85% (81–87%) to detect distant metastatic lesions of bone sarcoma [11]. And, for evaluation of osseous metastases in osteosarcoma, Hurley *et al*. reported that FDG–PET/CT demonstrated superior sensitivity over bone scintigraphy [12].

However, the ability of FDG-PET/CT to differentiate between malignant and benign tumors has been controversial because of false-positive and false-negative lesions [13].

Known false-positive lesions include some aggressive benign tumors, such as giant cell tumor of the bone and osteoid osteoma. And, desmoid fibromatosis, inflammatory lesions, and low grade malignant tumors, such as liposarcoma and chondrosarcoma, can be false-negative lesions. In addition, lung metastases consisting of small nodules have been reported to have little to no FDG uptake [11, 13, 14]. Therefore, for the depiction of small lesions, other imaging modalities including CT and/or MRI, should be considered [14]. Controversy still exists about the application of FDG-PET/CT in the management of sarcoma patients, mainly because of its high cost. FDG-PET/CT is usually much more expensive than other examinations [15]. The cost of FDG-PET/CT is about US $850 (=100,000 Yen), while that of plain chest CT is $150, of enhanced MRI is $250, and of bone scintigraphy is $400 under the current medical environment in Japan [15], however cost-effectiveness of FDG-PET/CT was reported for staging, management of metastases and/or treatment evaluation in several cancers [16, 17]. Although there are few data about its cost-effectiveness in the management of sarcoma patients, FDG-PET/CT can be useful to detect unknown distant metastasis, especially uncommon sites of metastasis, since blood or serum tests are often not effective in the detection of local recurrence or disease dissemination [18].

Survival of patients with metastatic osteosarcoma is reported to be significantly

109 correlated with patient age, site of the primary tumor, histological response of the
110 primary tumor to preoperative chemotherapy, numbers and locations of metastases, and
111 completeness of surgical resection of all of the tumor sites, including metastatic lesions
112 [19]. The surgical approach to gastrointestinal system metastases is less well established
113 compared to that for the resection of pulmonary metastases; however, it has been
114 reported that long-term survival can be achieved by resection of isolated pancreatic
115 metastases [20, 21]. Treatment of primary or secondary pancreatic tumor is often
116 considered by the clinical stage of the patient and the resectability of the lesion, which is
117 determined by the size and the anatomic location [21, 22]. In primary pancreatic ductal
118 adenocarcinoma, only 20% are resectable, because 80% of patients present with
119 metastatic disease and/or with a locally advanced tumor at the initial diagnosis [23]. In
120 resectable cases, clinical outcome shows superior survival rate and less complication in
121 the patients with the lesion located in the pancreatic body/tail, compared to patients with
122 the lesion in the pancreatic head [23]. However, in some cases in the pancreatic
123 body/tail lesion, poorer survival appears to be due to delayed diagnosis with advanced
124 stage, caused by the lack of specific symptoms [23]. In the present case, the small
125 metastatic lesion in the tail of the pancreas was detected in the early stage by FDG-
126 PET/CT, and laparoscopic distal pancreatectomy could be performed with no

127 complication, and resulting in favorable clinical outcome.

128 In conclusion, we present a rare case of a solitary pancreatic lesion as the initial
129 metastasis from osteosarcoma in the proximal fibula. Although pancreatic metastasis
130 from osteosarcoma is extremely unusual, the surgeon responsible for patients with
131 osteosarcoma must be aware of its possibility because pancreatic resection may have a
132 survival benefit for patients. For systemic screening in the management of osteosarcoma
133 patients, FDG-PET/CT should be considered as an additional examination in regular
134 radiographic follow-up of patients with osteosarcoma, especially for early detection of
135 unusual metastases.

136

137 **Figure Legends**

138 Fig. 1: A preoperative radiograph of the right knee.

139 Fig. 2: Preoperative magnetic resonance imaging scans of the right knee.

140 Fig. 3: A postoperative radiograph of the right knee.

141 Fig. 4: Histopathological images of the resected right fibula. Hematoxylin-eosin
142 staining, ×200.

143 Fig. 5: Whole body fluorodeoxyglucose-positron emission tomography with computed
144 tomography showing abnormal uptake in the tail of the pancreas (*white arrow*).

Fig. 6: A late-phase image of abdominal dynamic computed tomography showing a mass with enhancement in the tail of the pancreas (*white arrow*).

Fig. 7: An image from endoscopic ultrasound.

Fig. 8: Histopathological images of the resected pancreas. Hematoxylin-eosin staining, ×200.

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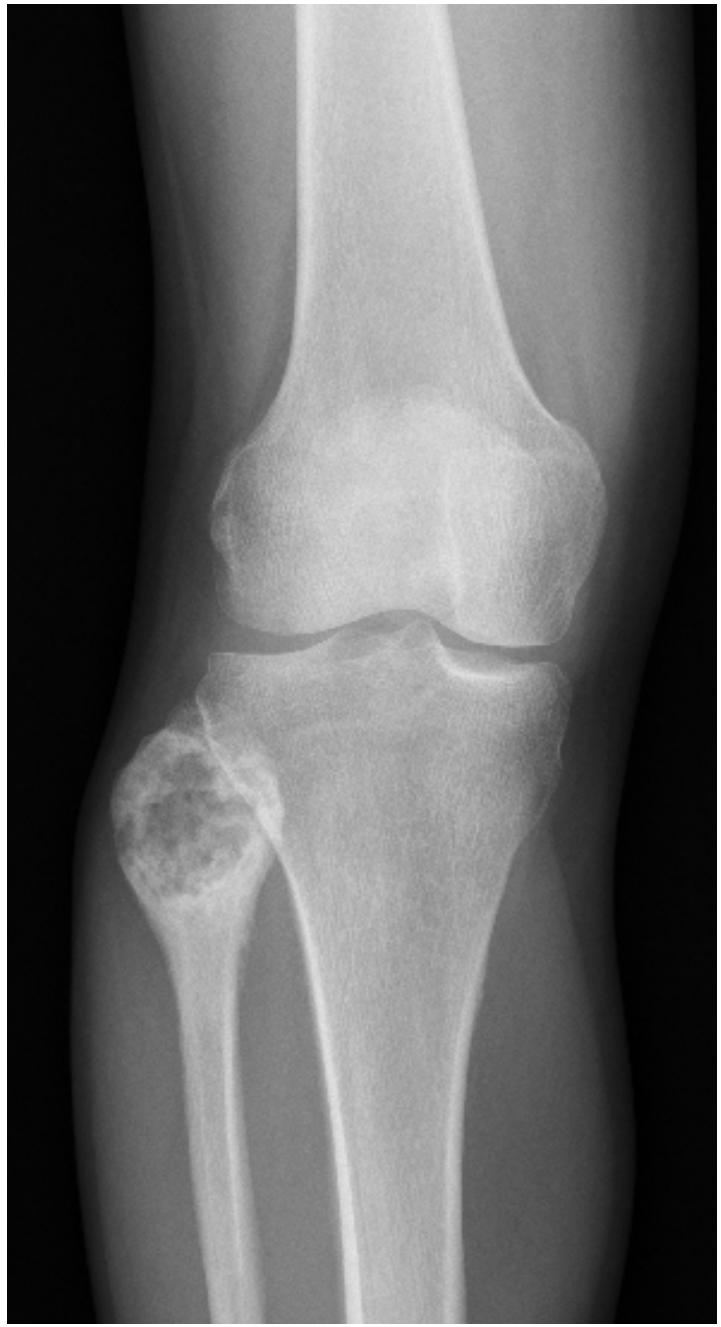
Fig. 1



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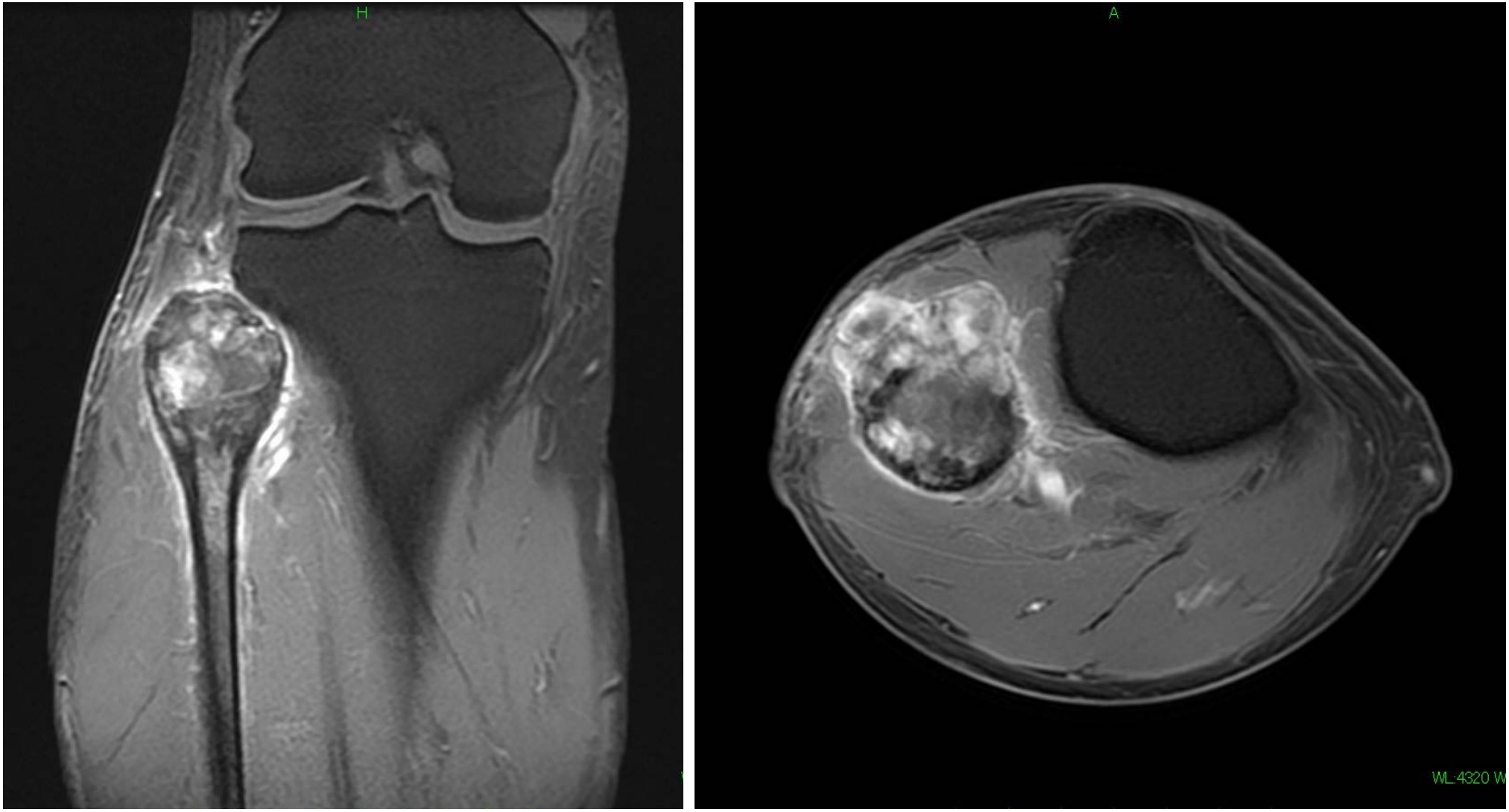

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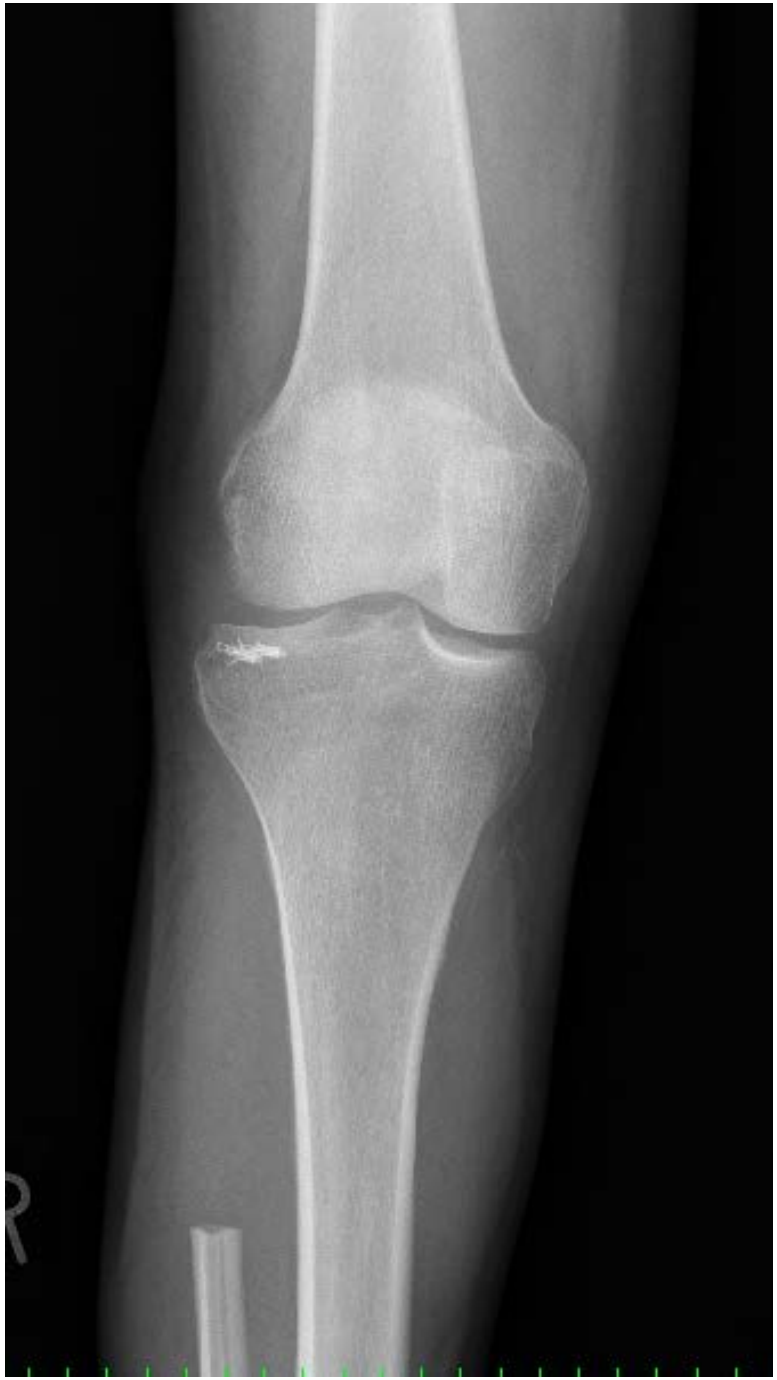

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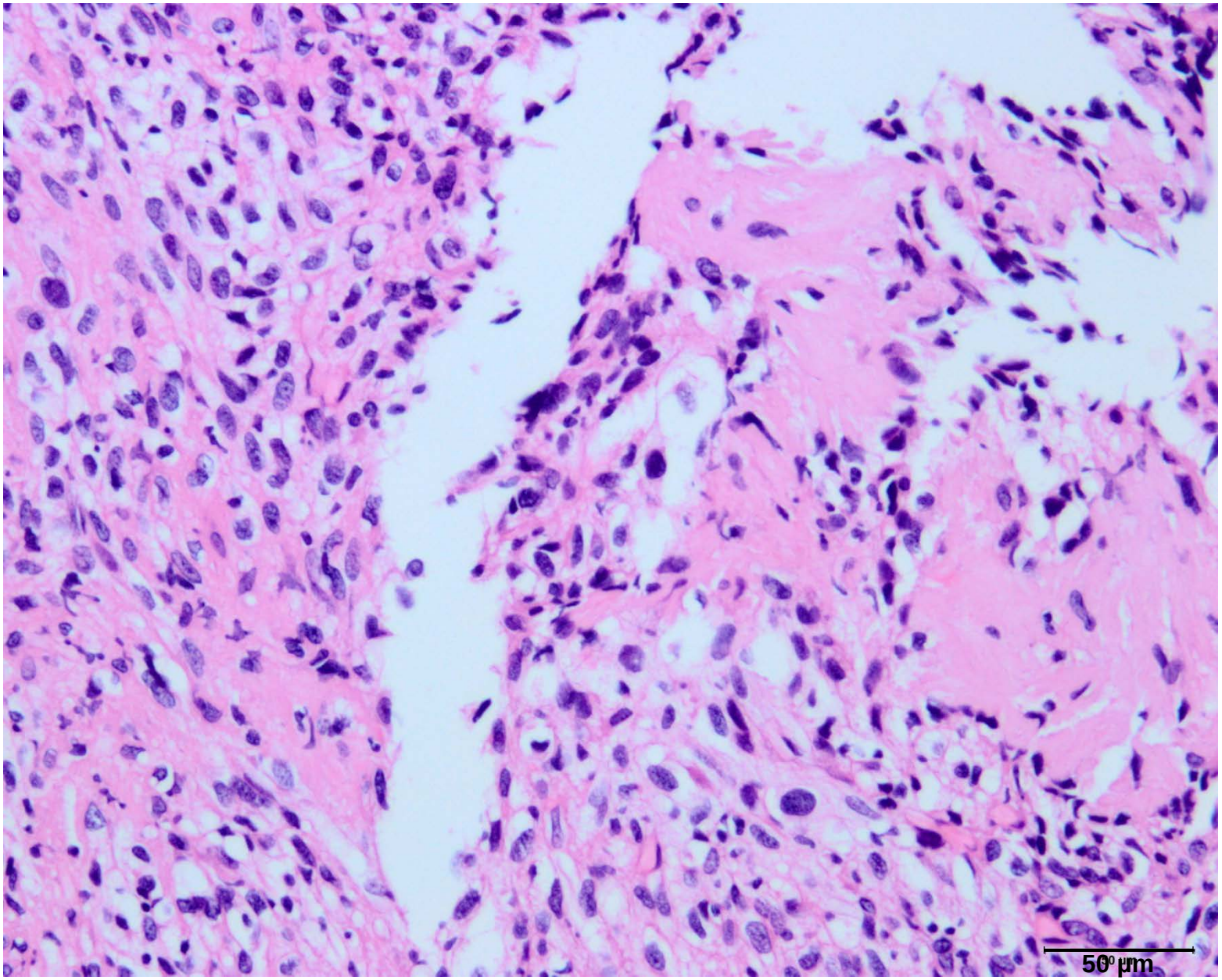
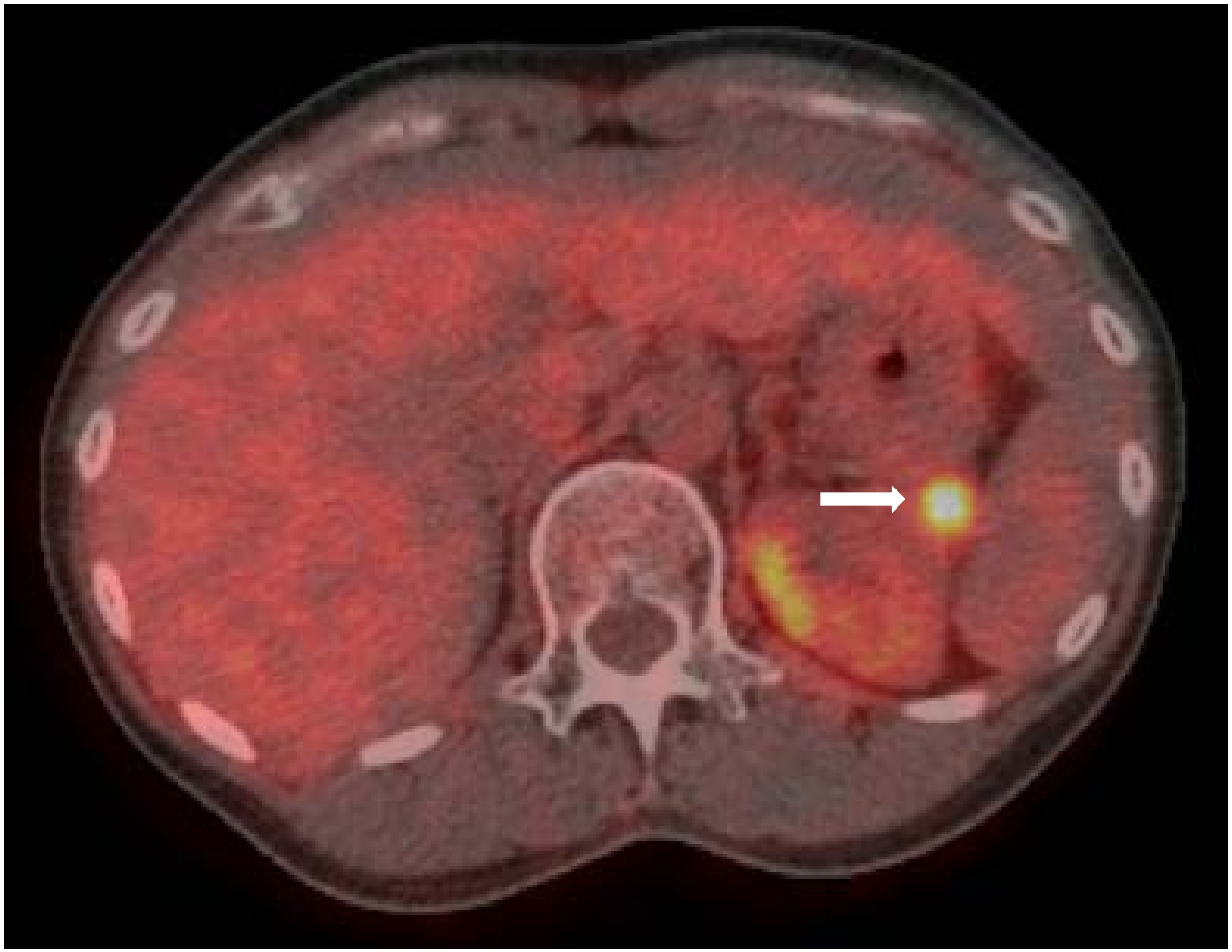


Fig. 5



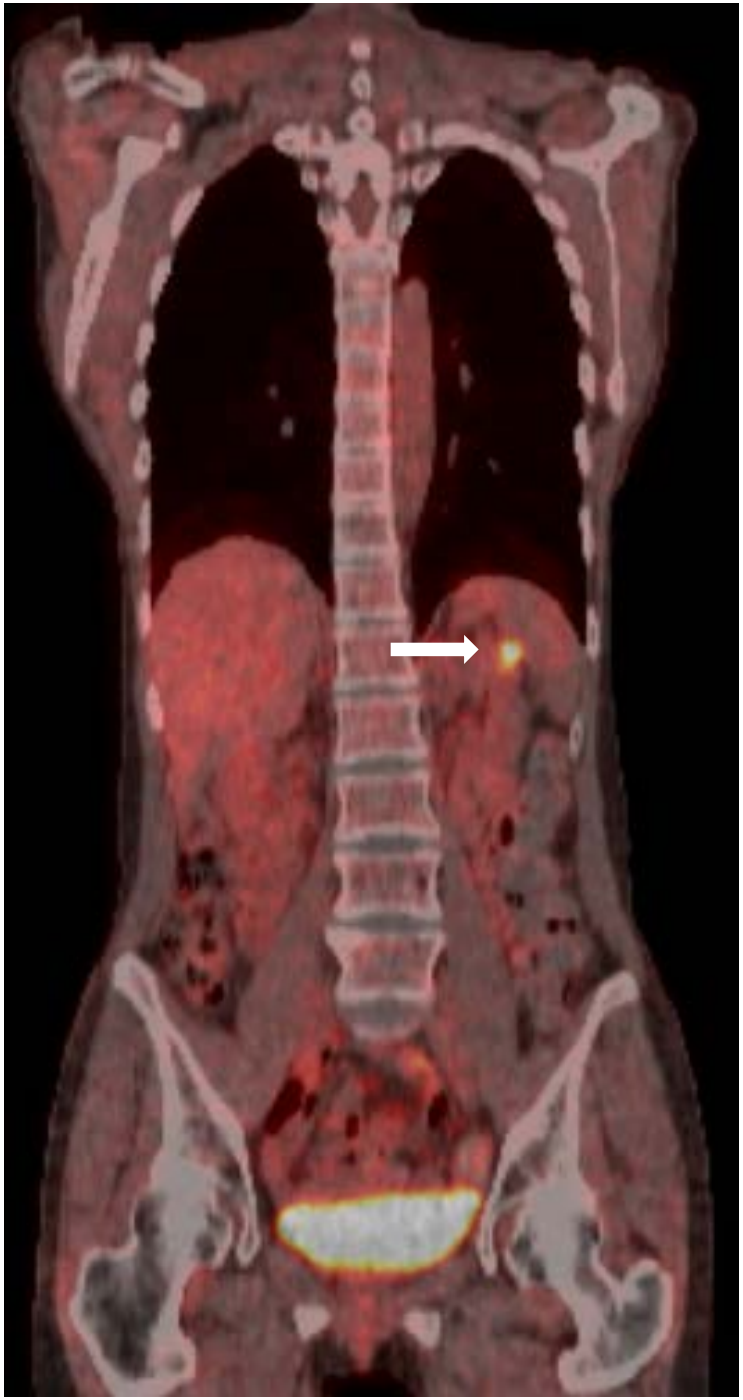


Fig. 6

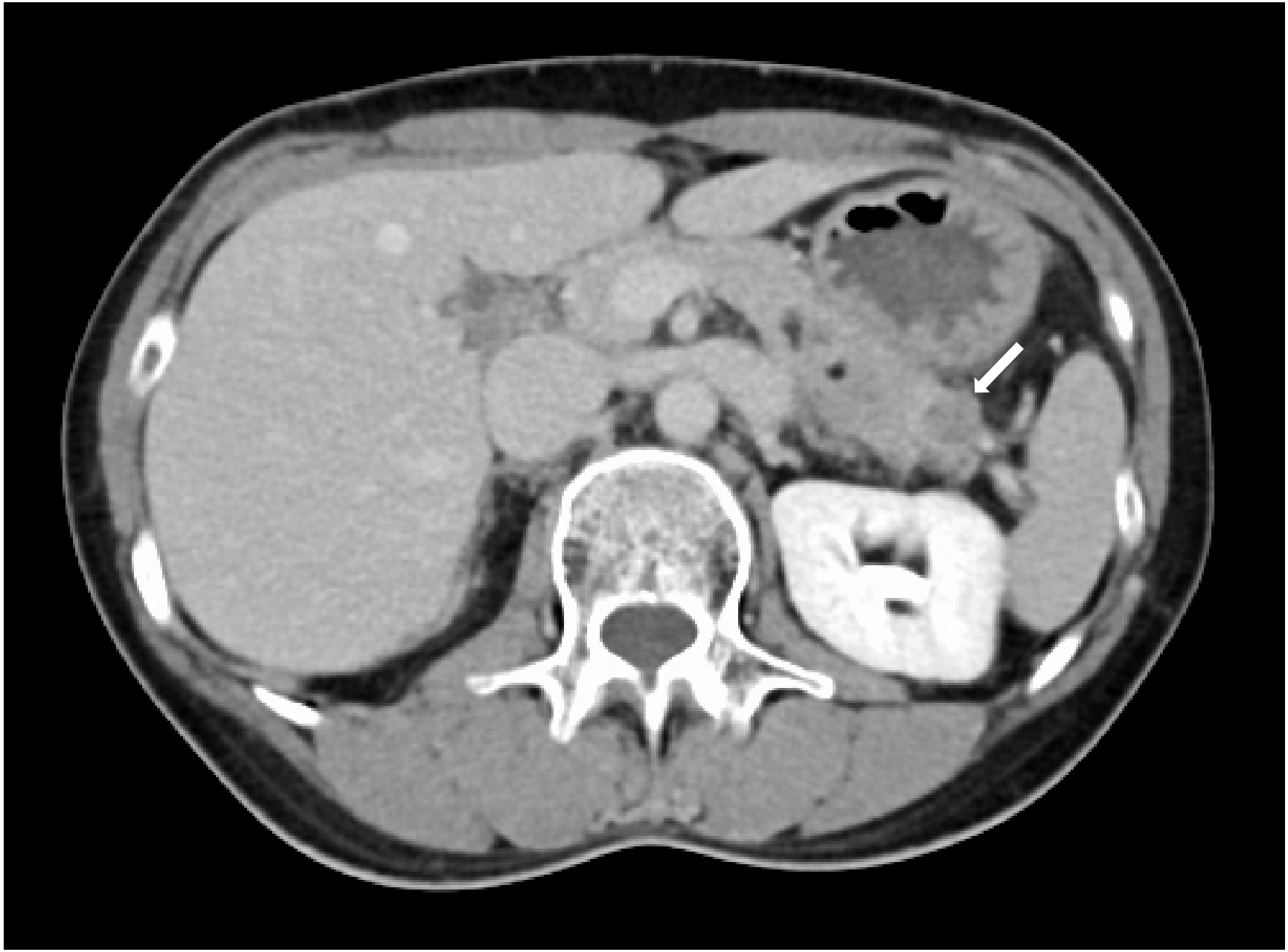


Fig. 7

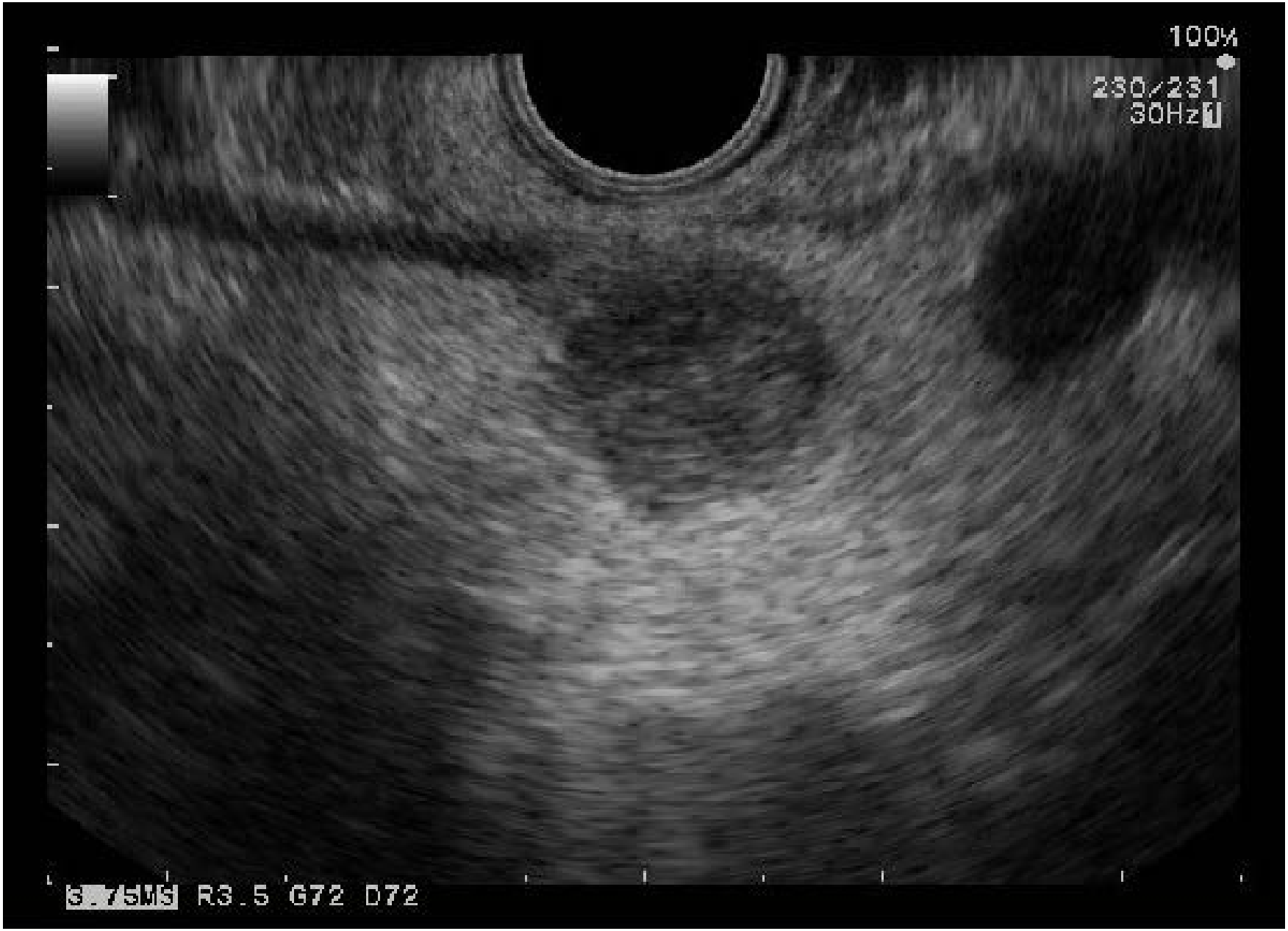


Fig. 8