Case report

Successful transcatheter arterial embolization to control intratumoral hemorrhage in clear cell sarcoma of the kidney

Running title: TAE for hemorrhage in CCSK

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Abstract

Clear cell sarcoma of the kidney (CCSK) is a rare aggressive pediatric renal tumor. Intratumoral hemorrhage and tumor rupture are considered as oncologic emergencies, requiring a quick and appropriate response. Herein, we report the case of an 11-year-old boy, who visited our hospital with abdominal distension that started a month earlier. Computed tomography (CT) revealed a tumor in the left kidney (size: 200 mm), and a diagnosis of CCSK was established with a biopsy. Chemotherapy was initiated to shrink the large and densely vascularized tumor before surgical removal. Two days after initiating chemotherapy, the patient developed abdominal and back pain, anemia, and hypotension. The CT scan showed intratumoral bleeding. Emergency transcatheter arterial embolization (TAE) was performed to control the bleeding. Three tumor feeding vessels were identified: an ascending branch from the celiac artery, an intermediate branch from the left renal artery, and a descending branch from the inferior mesenteric artery, of which the intermediate and descending branches were large and bleeding profusely; therefore, the intermediate branch was injected with ethanol and the descending branch was subjected to gel-foam embolization.

Chemotherapy was resumed, and the patient's condition stabilized gradually. The tumor began to shrink, and subsequent chemotherapy progressed well. In week 12 of chemotherapy, the patient underwent tumor resection and left nephrectomy. Postoperative chemotherapy was completed without complications, and there was no recurrence during a 6-year follow-up. Therefore, TAE can effectively control intratumoral bleeding in pediatric solid tumors and consequently prevent an unnecessary high-risk open surgical procedure.

Key words: Transcatheter arterial embolization, Clear cell sarcoma of the kidney, hemorrhage, anemia

Introduction

Clear-cell sarcoma of the kidney (CCSK) is a rare pediatric malignant tumor, which accounts for 5% of all primary renal tumors and is mostly observed in children under 2–3 years of age¹. The occurrence of CCSK is rare in Japan, with only one to four cases being reported annually². The most common symptoms of CCSK are abdominal masses, abdominal pain, and hematuria. It is an aggressive renal tumor with a poorer prognosis than Wilms' tumor. Late recurrences can also occur¹. The selective embolization of pediatric tumors has been used as an adjunct to chemotherapy and in oncologic emergencies to reduce tumor size or manage intratumoral hemorrhage preoperatively^{3–5}. Although bleeding due to spontaneous tumor rupture is infrequent, it can be fatal if there is massive blood loss. This is an example of an “oncologic emergency” and requires a quick and an appropriate response to ensure patient survival.

Here, we report the case of a patient of an atypical age with CCSK, who sustained an intratumoral hemorrhage with severe abdominal and back pain and lowered blood pressure. Early transcatheter arterial embolization (TAE) therapy controlled the bleeding, prevented tumor rupture, and allowed

chemotherapy and surgery to be performed safely later.

Case report

An 11-year-old boy presented with a 1-month history of abdominal bloating. He did not have dysuria or gastrointestinal symptoms. Computed tomography (CT) and magnetic resonance imaging (MRI) revealed a tumor in the left kidney (Fig. 1a). CCSK was diagnosed based on an open biopsy by the central review system of Japan Children's Cancer Group. Bone marrow examination, bone scintigraphy, gallium scan, chest CT, and cranial MRI showed no observable metastasis. The tumor was large, approximately 20 cm along its long axis. It was so densely vascularized that there was a risk of damaging the surrounding large blood vessels intraoperatively (Fig. 1 a, b). Therefore, operating without preoperative chemotherapy was deemed difficult. A diagnosis of National Wilms' Tumor Study (NWTS) stage III was made and upfront chemotherapy was started in accordance with Japan Wilms' Tumor Study-2 protocol regimen I, which is based on the standard treatment NWTS-5 protocol⁶.

On the second morning after initial chemotherapy with intravenous

vincristine, the patient complained of severe abdominal and lower back pain. His systolic blood pressure decreased, and his hemoglobin level dropped rapidly from 11.8 g/dL on the previous day to 8.2 g/dL. He, therefore, required multiple red blood cell transfusions. Contrast-enhanced abdominal CT showed tumor enlargement and contrast agent leakage within the tumor (Fig. 2). Active intratumoral bleeding was suspected, and emergency TAE was performed to control bleeding, prevent tumor rupture, and stabilize the patient.

Three tumor-feeding vessels were identified: an ascending branch from the celiac artery, an intermediate branch from the left renal artery, and a descending branch from the inferior mesenteric artery (Fig 3a, b). Of these, the middle and descending branches were thicker and showed massive bleeding. The middle branch was injected with ethanol, and the descending branch was subjected to gel-foam embolization (Fig. 4a, b). This helped in controlling the persistent bleeding. Post-TAE, the abdominal and back pain was alleviated. Signs of tumor lysis syndrome, including elevated uric acid levels, were not observed. However, the patient developed dyspnea due to temporary tumor expansion and circulatory failure, possibly due to

intratumoral hemorrhage. Chest radiographs revealed pulmonary congestion. We administered diuretics, albumin replacement therapy, and thrombomodulin α for hypercoagulability. Chemotherapy was resumed 3 days post-TAE. Catecholamines were administered during this time. After resuming chemotherapy, the patient's respiratory status improved gradually and the tumor began to shrink with no further complications. Tumor resection and complicated left nephrectomy were performed in week 12 of chemotherapy (Fig. 5). After that, radiation therapy (10.8 Gy) and chemotherapy were completed without complications until week 24, when the last chemotherapy session was conducted. There were no late complications or recurrence during a 6-year follow-up.

Discussion

The management of CCSK, according to the Children's Oncology Group high risk renal tumor study, involves surgery of resectable tumors, followed by administration of vincristine, cyclophosphamide, doxorubicin, and etoposide for stage I to IV disease⁶⁻⁹. All patients received postoperative radiation therapy. The outcome for patients with CCSK, treated according to the

NWTS-5 protocol, was a 5-year relapse-free survival and overall survival of 79% and 89%, respectively. The staging was found to be highly predictive of outcomes. The 5-year relapse-free survival rates for stages I, II, III, and IV were 100%, 87%, 74%, and 36%, respectively⁸. The Japan Wilms Tumor Study group developed a protocol that incorporates the NWTS treatment regimen and prioritizes surgery⁶. Because preoperative tumor rupture is a major risk for intraperitoneal relapse of the tumor, diagnosing its presence or absence is very important. Although abdominal pain, anemia, and shock are clinical findings that suggest tumor rupture, these are non-specific findings and it is difficult to discern the presence or absence of tumor rupture based on these symptoms alone¹⁰. In the case reported here, the patient was found to have a giant kidney tumor on contrast CT scans taken at the time of hospitalization and required attention due to potential tumor rupture and subsequent bleeding. We should have kept the possibility of intratumor bleeding and tumor rupture in mind. Khanna et al. reported that CT scans are useful in diagnosing the presence or absence of tumor rupture accurately. CT findings that suggest tumor rupture include, 1: tumor with unclear margins; 2: perirenal adipose tissue infiltration; 3: non-clarity of the adipose layer around

the tumor; 4: retroperitoneal fluid retention; 5: ascites; 6: peritoneal dissemination; 7: pleural effusion on one side; and 8: intratumoral hemorrhage¹¹. In particular, the presence of conditions, such as non-clarity of the adipose layer around the tumor, retroperitoneal fluid retention, and ascites lead to a strong suspicion of tumor rupture. It has also been reported that while the sensitivity of CT scans to tumor rupture is slightly low, at 54 to 80%, its specificity is at 88%¹¹. In our case, only ipsilateral pleural effusion and intratumoral hemorrhage were present and it was probable that tumor-rupture had not occurred yet. There are a few reports on children who underwent TAE to manage difficult bleeding control in renal tumors, particularly CCSK. Almgard et al.¹² first performed embolization for the treatment of renal adenocarcinoma in 1973. Since then, renal artery embolization has been increasingly used for the treatment of advanced or unresectable renal tumors in adults. Clinical studies in adults have shown that preoperative renal embolization significantly reduces blood loss during nephrectomy, especially in large hypervascular tumors^{13,14}. Renal artery embolization also has been used in the management of malignant renal tumors in children mainly reported Wilms'tumor^{15,16}. Chitnis et al.¹⁶ reported

that, although therapeutic embolization is not routinely performed for pediatric solid tumors, TAE may be effective and applicable when a patient's general condition is poor and may not be able to withstand surgery. Smith reported that bleeding from tumors so severe that the patient does not respond to blood transfusion is rare; however, such tumors become fatal and TAE may be effective in such cases³. Here, the patient had progressive anemia despite multiple blood transfusions and severe symptoms; therefore, we decided that TAE would be a more effective and less invasive option than immediate excisional surgery to control bleeding. Accordingly, in our case, tumor rupture was prevented by rapid TAE treatment. Post-TAE, the patient's general condition improved to a level where uncomplicated chemotherapy, and nephrectomy and radiotherapy at a later date were feasible. TAE is an effective tool for controlling intratumoral bleeding in pediatric solid tumors.

Conclusion

The paper reports a case of a rare pediatric renal tumor, CCSK, complicated by intratumoral hemorrhage during chemotherapy. It was successfully

managed by TAE. Use of this technique prevented an unnecessary high-risk open surgical procedure and enabled the planned chemotherapy to be employed effectively alongside a successful and less risky tumor removal procedure performed later.

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Disclosure

The authors declare no conflict of interest.

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Figure legends

Figure 1: (a) Contrast-enhanced computed tomography (CT) image at the time of diagnosis. A large tumor present in the left kidney has been indicated by the arrow. (b) Three-dimensional CT image at diagnosis. The tumor is fed mainly by the ascending branch from the celiac artery, the middle branch from the left renal artery, and the descending branch from the inferior mesenteric artery.

Figure 2: Contrast-enhanced computed tomography (CT) images performed after sudden abdominal pain and hypotension. There was an increase in the tumor size from the time of diagnosis, suggesting intratumoral bleeding. Extravascular leakage of the contrast agent into the tumor is observed, suggesting persistent bleeding.

Figure 3: Angiographic images before transcatheter arterial embolization (TAE). The tumor trophoblastic vessels were found in three branches: (a) an ascending branch from the celiac artery and an intermediate branch from the left renal artery of which the middle branch was thought to have a large amount of bleeding. (b) a descending branch from the inferior mesenteric artery which was thought to have a large amount of bleeding.

Figure 4: (a) The middle branch was injected with ethanol. The descending branch was embolized with gel-foam. Hemostasis was confirmed in this angiographic image. (b) After TAE, the middle branch from the left renal artery and the descending branch from the inferior mesenteric artery, which are the trophic vessels of the tumor, could not be delineated.

Figure 5: The tumor, of more than 20 cm in diameter and approximately 10 cm in short diameter, was resected.

Figure 1

(a)

(b)

Figure 2

Figure 3

(a)

(b)

Figure 4

(a)

(b)

Figure 5