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Case Report

A Case of Tumor Embolization for Metastatic Bone Tumor and Stanford Type A Aortic Dissection under Direct Carotid Puncture

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Objective: A case of metastatic bone tumor difficult to approach via the transfemoral route in which preoperative tumor embolization through a small cervical incision was effective is presented.

Case Presentation: The patient was a 73-year-old male being treated for liver cancer. A mass 60 mm in maximum diameter that rapidly grew inside and outside the cranium was noted in the parietal region. Since the lesion was difficult to approach transfemorally because of the history of Stanford type A aortic dissection, a sheath was inserted into the common carotid artery through a small incision in the neck, and tumor embolization was performed by settings similar to the transfemoral approach. No procedural complication was observed, and the control of hemorrhage during tumor resection was adequate.

Conclusion: Tumor embolization by direct carotid artery puncture through a small cervical incision was a safe and effective approach.

Keywords ▶ direct carotid puncture, cut down, hybrid room, endovascular treatment, tumor

Introduction

Tumor embolization is usually performed by the transfemoral artery approach. However, if this approach is difficult to use, the transbrachial artery approach or direct puncture of the carotid artery is selected. Direct carotid puncture is performed percutaneously or through a small cervical incision, and each method has its merits and demerits. In the case presented here, we performed tumor embolization by direct carotid puncture through a small cervical incision and achieved a favorable outcome.

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Case Presentation

The patient was a 73-year-old male exhibiting a rapidly growing mass in the left parietal region. He had histories of hypertension, chronic hepatitis C, liver cirrhosis, hepatocellular carcinoma, and Stanford type A aortic dissection (chronic false lumen occlusion type). There was no particular familial history.

The patient was undergoing chemotherapy with sorafenib tosylate for hepatocellular carcinoma. He noted a mass that grew rapidly over a period of 1 month in the left parietal region, and as it became painful, he was referred to our department.

The blood test results on admission were as follows: red blood cells (RBC), 501 × 104/μL; hemoglobin (Hb), 16.3 g/dL; hematocrit (Hct), 48.8%; platelet (PLT), 10.8 × 104/μL; aspartate aminotransferase (AST), 143 IU/L; Alanine aminotransferase (ALT), 137 IU/L; prothrombin time (PT), 13.0 s; PT, 77.2%; PT international normalized ratio (INR): 1.19; alpha fetoprotein (AFP): 60105 ng/mL; and protein induced by vitamin K absence/antagonist-II (PIVKA-II), 3886 mAU/mL, indicating thrombocytopenia,

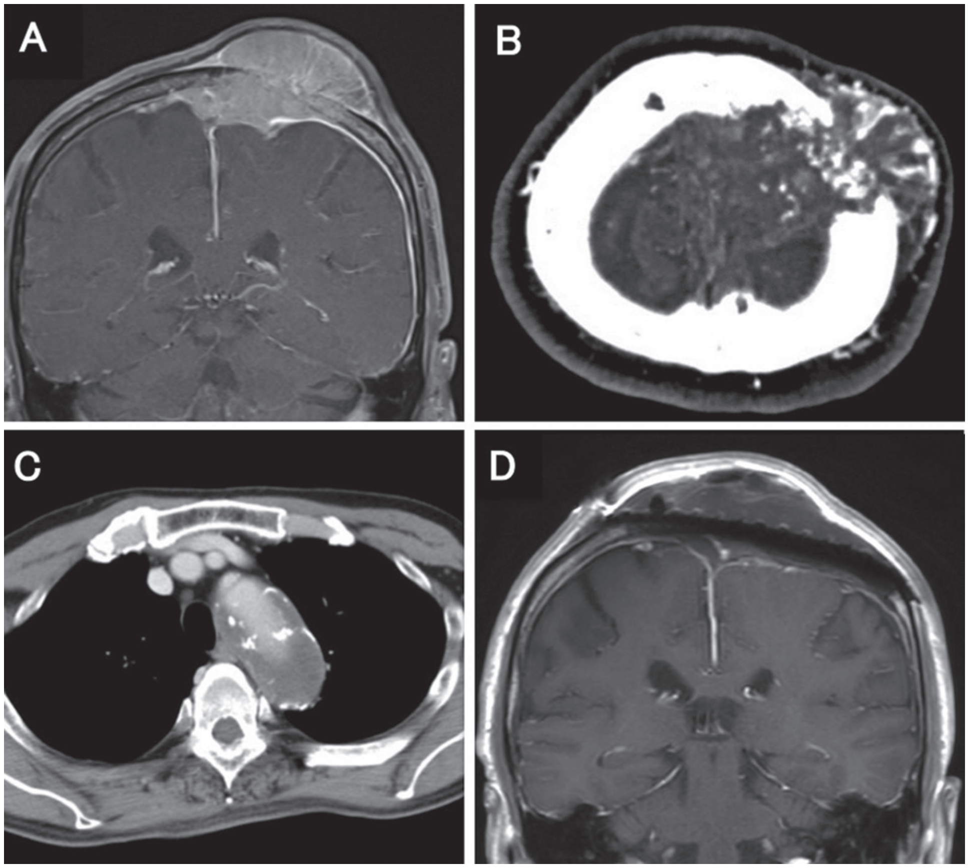

Fig. 1 Pre- and postoperative images. Preoperative gadolinium-enhanced brain MRI shows mass lesion (**A**). Original image of brain 3D-CTA shows vascular-rich tumor (**B**). Original image of chest 3D-CTA shows Stanford type A aortic dissection (**C**). Postoperative gadolinium-enhanced brain MRI shows good resection of the tumor (**D**).

elevated liver enzyme levels, and elevated tumor marker levels.

Regarding neuroradiological findings, brain MRI showed a mass 60 mm in maximum diameter primarily involving the bone but rapidly growing inside and outside the cranium near the superior sagittal sinus in the left parietal region (**Fig. 1A**). On 3D-CTA, the mass showed a very high vascularity (**Fig. 1B**). Chest contrast-enhanced CT revealed false lumen thrombotic occlusion type dissection from the aortic arch to the abdominal aorta (**Fig. 1C**). The dissection did not extend to the common carotid artery.

Therapeutic strategy

A diagnosis of cranial metastasis of hepatocellular carcinoma was made from the course and imaging findings. Since the life expectancy was estimated to be half a year or longer, and since the tumor grew rapidly, resisting chemotherapy, it was judged to be an indication for surgical resection. Because of the history of Stanford type A aortic dissection (chronic false lumen occlusion type), which had been detected 15 years before and had thence been managed conservatively, the cardiology department judged that wire manipulation in the aorta would be risky due to the possibility of recanalization. Direct puncture of the carotid artery was judged to be possible as dissection did not extend to the common carotid artery. In addition, as the platelet count was reduced due to the effects of hepatocellular carcinoma and liver cirrhosis, the lesion was decided to be approached via a small cervical incision in consideration of the possible difficulty of hemostasis by the percutaneous approach.

Endovascular treatment

In the hybrid operation room, the head was rotated about 30° to the right and fixed on a cutout cushion under general anesthesia (**Fig. 2A**). A longitudinal incision about 5 cm long was made along the anterior margin of the sternocleidomastoid muscle in the left cervical region, and the left

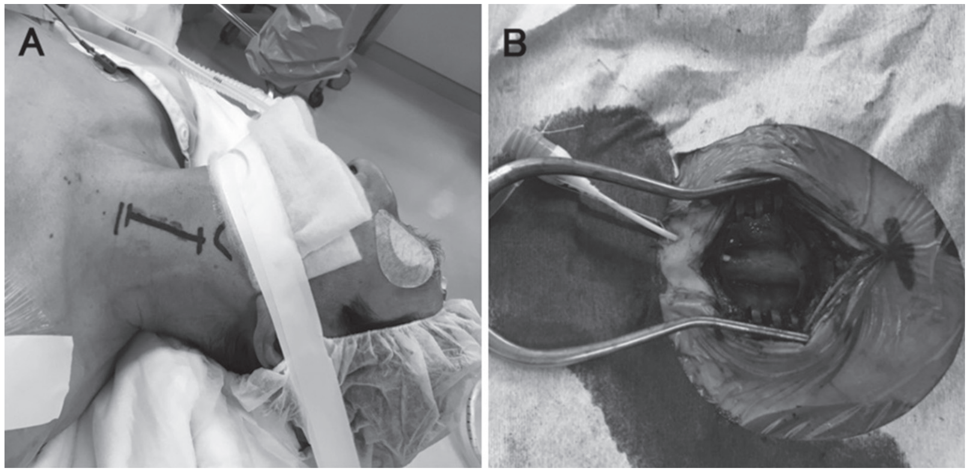

Fig. 2 Intraoperative photographs. Photograph of skin incision (**A**) and insertion site (**B**).

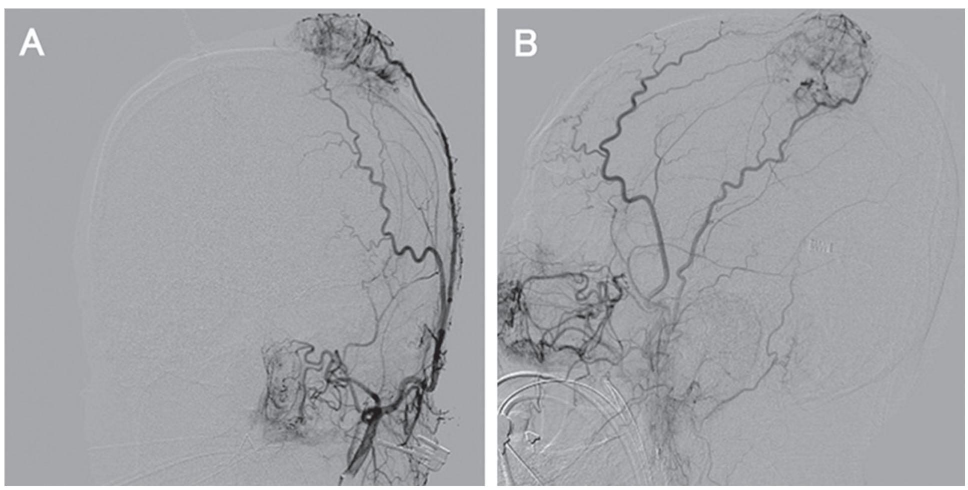

Fig. 3 Preoperative DSA. External carotid angiography shows tumor stain (**A**) anteroposterior view, (**B**) lateral view.

common carotid artery was exposed. Puncture was performed under direction vision by penetrating the subcutaneous tissue by about 5 cm from the caudal side of the skin incision, and a 4-French short sheath (Terumo, Tokyo, Japan) was inserted under fluoroscopic guidance (**Fig. 2B**). Heparin was administered at 3000 units, and the activated clotting time was adjusted to ≥200 seconds. A 4.2-French distal access catheter (FUBUKI; Asahi Intecc, Aichi, Japan) was navigated to the left external carotid artery, and marked tumor stain was confirmed from the left middle meningeal and superficial temporal arteries (**Fig. 3A** and **3B**). First, a microcatheter (Excelsior 1018; Stryker, Kalamazoo, MI, USA) was navigated to the left middle meningeal artery using a 0.014-in microguidewire (CHIKAI; Asahi Intecc) (**Fig. 4A**), and tumor embolization was carried out using Embosphere 100–300 µm (Nippon Kayaku Co., Ltd., Tokyo, Japan). After confirming near disappearance of tumor stain from the middle meningeal artery, the trunk of the middle meningeal artery was occluded using two coils (Orbit Galaxy Xtrasoft 2 mm × 8 cm; Codman, Johnson & Johnson, CA, USA). Then, Excelsior 1018 microcatheter was guided to the peripheral area of the parietal branch of the left superficial temporal artery (**Fig. 4B**), and embolization was performed using Embosphere (100–300 µm). After confirming near disappearance of tumor stain from the superficial temporal artery, the trunk of the superficial temporal artery was occluded using three coils (Orbit Galaxy Xtrasoft 2 mm × 8 cm; Codman). The disappearance of tumor stain from the external carotid artery was confirmed on the final angiography (**Figs. 4C** and **4D**).

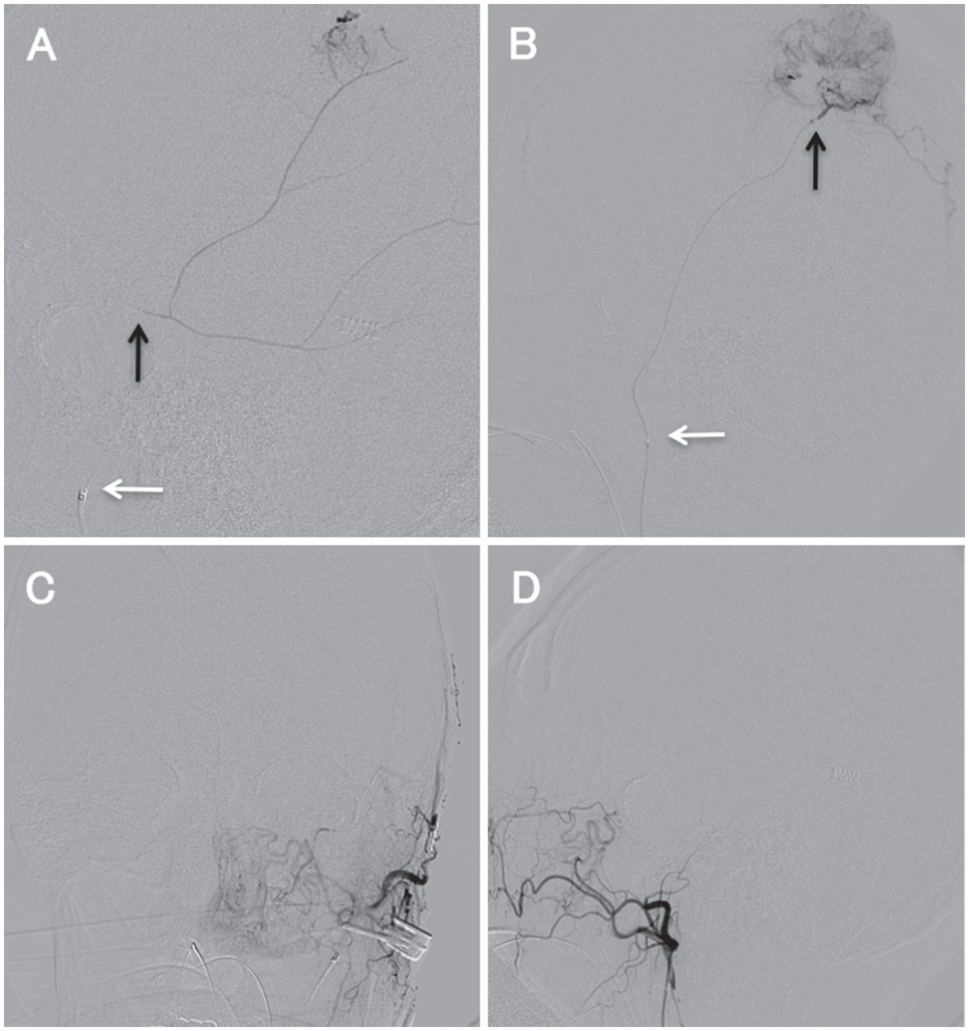

Fig. 4 Intraoperative and postoperative DSA. Microcatheter DSA (lateral view) of middle meningeal artery (**A**) and superficial temporal artery (**B**) shows tumor stain (white arrow: tip of 4.2-French FUBUKI, black arrow: tip of Excelsior 1018). External carotid angiography shows no tumor stain (**C**) anteroposterior view, (**D**) lateral view.

The sheath was removed after securing the common carotid artery using bulldog forceps, its lumen was sufficiently cleaned, two stitches were applied using a 5-0 Mononylon suture while checking the lumen, and hemostasis was confirmed. Tumor resection was carried out 3 days after embolization. Hemorrhage from the tumor could be readily controlled, and macroscopic total resection except for the superior sagittal sinus area was accomplished with hemorrhage of about 100 mL. Satisfactory resection was confirmed by postoperative brain MRI (**Fig. 1D**), and the patient was discharged to home without complications, being able to walk without assistance (modified rankin scale [mRS]: 0). The findings in permanent pathological sections did not contradict metastasis of hepatocellular carcinoma.

Discussion

Intracranial metastasis of hepatocellular carcinoma is relatively rare, and reports of cranial metastasis are particularly few.[1,2] Intracranial metastasis of hepatocellular carcinoma bleeds easily, and bone metastasis, in particular, occasionally causes extradural or subdural hemorrhage.[1,3] It is treated radiochemically or surgically, but we selected surgical resection for our present patient because the lesion was painful and grew rapidly in a short period. In addition, examinations before tumor resection demonstrated feeding vessels from the dura mater, bone, and skin via the middle meningeal and superficial temporal arteries, and massive hemorrhage during tumor resection was expected. Therefore, we decided to perform preoperative tumor embolization. However, as the approach via the femoral or brachial artery was difficult due to the presence of Stanford type A aortic dissection extending from the ascending aorta to the abdominal aorta, direct puncture of the carotid artery through a small cervical incision was selected.

Direct puncture of the carotid artery dates back to the 1960s[4] and is performed percutaneously or by a small cervical incision. While percutaneous puncture can be performed under local anesthesia and is easy, there is a risk of postoperative cervical subcutaneous hematoma, which may be a fatal complication.[5,6] There have also been reports of the risk of puncturing of atherosclerotic areas and ischemia due to manual compression[7] and the risk of vasospasm, dissection formation, and nerve injury, and troubles including the above cervical subcutaneous hematoma have allegedly occurred in 2.9%–14.0% of the patients.[5,6] Although there have been reports of the use of hemostatic devices in the common carotid artery for the prevention of hemorrhage,[5,8,9] they are off-label use and are associated with the risk of thrombus formation.[7,10] In our present patient, we judged that the percutaneous approach would be more risky than usual as a tendency of thrombocytopenia associated with liver cirrhosis was observed.

There have been a number of reports on the approach through a small cervical incision in procedures including carotid artery stenting with flow reversal, coiling of intracranial aneurysms, and treatment for carotid-cavernous fistulas. It is a safe and useful technique by which consistent hemostasis is possible regardless of the thickness of the sheath used or whether or not heparin is used.[6,11–19] Demerits of the technique are complications associated with general anesthesia and prolongation of the surgical time. However, the merit of avoidance of the risk of puncture troubles and postoperative hematoma formation is significant, warranting the preparation of an environment capable of handling cervical incision under general anesthesia. The puncture site may also be the external carotid artery, but it is difficult to puncture this site when the position of carotid bifurcation is high. In addition, as circumferential securing of the external carotid artery involves the risk of neuropathy, the common carotid artery was considered appropriate as a puncture site.

In our patient, the lesion was approached using a 4.2-French distal access catheter. Tumor embolism from the external carotid artery would have been possible using an indwelling needle and a microcatheter alone. However, the presence of a distal access catheter is advantageous when a microcatheter is navigated to a peripheral vessel or when a small-bore device, such as a 1.5-French microcatheter, is used. Also, once a parent catheter is navigated, the procedure itself can be performed with usual settings similarly to the transfemoral artery approach. Tumor embolization is often performed using an embolic material and coils. Concerning the embolic material Embosphere, the recommended particle size for the cranial nerve region is 300–500 µm, but we selected 100–300 µm particles for our present patient with bone tumor by placing priority on the embolization rate as we judged that the risk of neuropathy would be low. In addition, while we used detachable coils, pushable coils are also sufficiently effective, and their selective use depending on the site is considered necessary.

Factors that make the transfemoral approach difficult include a type III arch and meandering of the common carotid artery, occlusion of the bilateral common iliac or femoral arteries, and marked atherosclerosis or dissection of the aorta.[5–7,10,20] While the transbrachial and transradial artery approaches have become easier to establish because of the improvements in devices, direct puncture of the carotid artery is still necessary if the aorta itself has disorders. Recently, a hybrid operating room has been installed at many institutions, permitting relatively easy induction of general anesthesia and concomitant use of surgical procedures. Therefore, direct puncture of the carotid artery through a small cervical incision is expected to be employed more frequently as an approach for patients difficult to treat by a usual approach such as those with Stanford type A aortic dissection.

Conclusion

Direct puncture of the carotid artery through a small cervical incision is safe because treatment can be performed with usual settings as well as consistent arterial puncture and hemostasis. In easy-to-bleed cancer patients in whom access to intracranial lesions is difficult to obtain due to conditions such as Stanford type A aortic dissection, direct puncture of the carotid artery through a small cervical incision is useful.

Disclosure Statement

There are no conflicts of interest to disclose regarding this paper.

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