A simple implantation technique using coaxial catheter reservoir system without fixation of catheter tip for replaced right hepatic artery originated from superior mesenteric artery

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Purpose

The purpose of this study is to report the preliminary results of our simple implantation method with coaxial reservoir system using 2.5-Fr microcatheter without the fixed catheter tip for hepatic arterial infusion chemotherapy (HAIC) in case of replaced right hepatic artery (RHA) originated from the superior mesenteric artery (SMA).

Background

Regional HAIC via an indwelling port-catheter system remains an important treatment option for patients with advanced hepatocellular carcinoma (HCC) (1). Portal vein tumor thrombus (PVTT) and liver function are important prognostic factors that influence survival in patients with HCC (2-4). The majority of patients with advanced HCC have poor liver function at the time of the diagnosis. In patients with a replaced RHA, who have main tumors located within the right lobe or right portal vein tumor thrombus which can vastly affect prognosis, HAIC from the replaced RHA results in lower liver damage and higher local drug concentration than HAIC of the entire liver.

Replaced RHA originated from the SMA is inadequate for indwelling catheter of reservoir system using 5-Fr catheter because this often led to occlusion of RHA (5). On the other hand, the frequency of hepatic arterial obstruction or severe stenosis was lower with implantation of the 2.7-Fr shaft of the tapering indwelling catheter than with implantation of the 5-F shaft in the entire segment from the celiac to the hepatic artery (6). There have been few reports investigating implantation of a port-catheter system with a microcatheter through the superior mesenteric artery (7). We retrospectively evaluated the safety and feasibility of our simple implantation method of coaxial catheter reservoir system to a replaced RHA originated from the SMA.

Methods and Materials

Methods and Materials:

Patients

Between February 2004 and November 2008, 15 patients (12 men, mean age 62.9 y) underwent attempted implantation of coaxial catheter reservoir systems inserted into the replaced RHA in our institution. All patients had unresectable liver neoplasms. Twelve
patients had hepatocellular carcinomas, one patient had a cholangiocellular carcinoma and one patient had a metastatic liver tumor from a breast cancer. The location of tumors in the 15 patients were within the right lobe in 7 patients, including 4 patients with post left lobectomy, and bilateral lobe in 8 patients. The indications for implanting a catheter into the replaced RHA in these 8 patients were tumor thrombus of the right portal vein in 3 patients, a few tumors in the left lobe in 2 patients and implantation of two systems in 3 patients.

Procedures

All procedures were performed after the patient provided written informed consent. Using the Seldinger technique, the unilateral common femoral artery was punctured and a 4-Fr vascular sheath was inserted. Following this, celiac and superior mesenteric arteriographies were performed through the 4-Fr catheter to assess hepatic vascular anatomy. Using a combination of computed tomography during hepatic arteriography (CTHA) and computed tomography during arterial portography (CTAP), tumor locations were examined.

Before inserting the catheter, eight patients underwent transcatheter arterial chemoembolization (TACE) to HCCs supplied from feeding arteries, excluding a replaced RHA. One patient underwent coil embolization of the left hepatic artery originated from the left gastric artery and middle hepatic artery originated from the common hepatic artery to redistribute the hepatic blood flow. Two patients underwent coil embolization of caudate branch originated from the left hepatic artery or a right inferior phrenic artery which were feeding arteries of the main tumors. Two patients underwent reservoir implantation of two systems to replaced RHA originated from the SMA and common hepatic artery originated from the celiac artery due to treatment for tumors in the bilateral lobe. In these two patients, one patient underwent a single procedure and the other underwent a separate procedure.

We modified the coaxial reservoir implantation technique by Nakatuka (8) and Hamada et al. (9) to make it easy to implant without fixing a catheter tip. A 5-Fr heparin-coated catheter (Frosty catheter; Clinical Supply, Gifu, Japan) was introduced in exchanging for the 4-Fr catheter over a guide wire, and the tip of the 5-F heparin-coated catheter was placed into the superior mesenteric trunk as a parent catheter to support a microcatheter (Sniper; Clinical Supply, Gifu, Japan). Before placement of the microcatheter, a side hole was manually created at a point 0.5-3.0cm (mean 1.0cm) from the tip of the microcatheter with surgical scissors. The tip of a microcatheter, 2.9-F outer diameter of the proximal shaft and 2.5-F of the distal shaft, was advanced and implanted at distal portion of replaced RHA through the 5-F catheter without fixing the microcatheter.

Following this, in accordance with Hamada's method, the trailing end of the microcatheter was cut off at a length slightly longer than that of the 5-F catheter. The microcatheter was connected to the port (Therdica Port 3-Fr; Clinical Supply, Gifu, Japan) connector and the
5-F catheter was then slid over the microcatheter and connected to the port connector (Fig 1 on page 5). A plastic cap was used to cover both catheters and reinforce the joint. Finally, the port was implanted into the subcutaneous space in the lower abdomen wall of the puncture site.

Using this system, HAIC was started within a week after the procedure, having confirmed a good distribution to tumors by angiography and CT arteriography via the port, depending on the clinical circumstances. After initiation of HAIC, angiography and CT arteriography were also performed on the first day of the second and third intrahepatic treatment cycles.

Analysis

The following parameters were investigated retrospectively during a follow-up period: The technical success rate of the placement of the coaxial reservoir system, the mean time required for the catheter placement procedure from skin incision to closure, the term of the catheter patency and complications related to the reservoir systems.

Images for this section:
**Fig. 1**: Fig. 1 Catheter implantation; A: Arteriography from the superior mesenteric artery shows the replaced right hepatic artery. B: The tip of the microcatheter (arrow) through 5-Fr catheter is distal portion of first branch of replaced RHA. C: Arteriography from the coaxial reservoir system shows intrahepatic branches are visualized through the side hole of the microcatheter (arrow head).
Results

The technical success rate of the placement of the coaxial reservoir system was 93% (14/15 procedures) without major complications related to it. One failure had severe stenosis at the origin region of the replaced RHA due to a previous reservoir system implantation of 5Fr catheter into the replaced RHA (Fig.1 on page 7).

The mean time required for the procedure was 116 minutes (range; 90-151 minutes) including other procedures, which were CTAP/CTHA, TACE, coil embolization and two system implantation in one procedure.

A follow-up period was 68 ± 362.6 days (median ± SD, range; 13-1344 days). Catheter occlusion occurred in one patient 3 months later after placement of the reservoir system. Patency rate of catheter was 100% (14/14 systems), 85.7% (6/7), 80% (4/5) and 66.7% (2/3) at 1, 3, 6 and 12 months respectively.

No occlusion or severe stenosis of the replaced RHA occurred in fourteen patients in the follow-up periods. Three patients underwent removal of the reservoir system due to infection and massive hematoma around the reservoir port and the puncture site in two patients, which was not a characteristic complication in this reservoir system to replaced RHA, and a clinical complete response in one patient. Although acceptable dislocation of the catheter was found in four systems (29%), non-acceptable dislocation that would have been necessary for repositioning did not occur. Therefore, catheter dislocation rate was 0%.

Images for this section:
**Fig. 1:** A failure case; Arteriography from the SMA shows severe stenosis (arrow) of origin region of the replaced RHA. It was difficult to insert a microcatheter into the replaced RHA.
Conclusion

Conclusion: This simple method is easy to implant and has a high technical success rate. There was no occlusion or severe stenosis of the replaced RHA and no non-acceptable dislocation of the catheter system. This method may be feasible and useful for HAIC into the replaced RHA.

References

Reference:


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