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Case Report

Hepatic artery chemoembolization with distal transradial access for primary hepatocellular carcinoma: a novel interventional therapy for peripheral tumors

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Abstract: Objective: To investigate the feasibility and safety of hepatic artery chemoembolization via the distal transradial access (dTRA). Methods: The clinical data of 130 patients with primary hepatocellular carcinoma treated in The First Hospital of Jilin University between August 1, 2020 and December 31, 2020, were retrospectively analyzed. Patients were confirmed to have primary hepatocellular carcinoma by preoperative imaging or pathology, with Child-Pugh Grade A or B and persistently palpable distal radial pulses. After a negative Allen test, patients underwent transcatheter arterial chemoembolization (TACE) via dTRA. The puncture success rate, the average number of needles, puncture time, distal radial occlusion and wrist hematoma were used to evaluate the treatment efficacy in the patients. Results: All the punctures were performed using 21G steel needles. 5F sheaths were used for 84 cases, and 4F sheaths for 46 cases. The total was 130 cases. Among the 130 cases, 112 cases (86.2%) were successful in the puncture, 18 cases (13.8%) failed in the puncture. The success rate of the descending aorta selection using an MPA1 catheter (Cordis, Santa Clara, CA, USA) was 96.2% (125/130). In the remaining 5 cases, the selection succeeded after a 5F pigtail catheter was used instead. The success rate of the celiac trunk or superior mesenteric artery selection using an MPA1 catheter was 100%. No bleeding or hematoma occurred after 2-4 hours of compression following distal radial artery puncture, and both distal and proximal radial artery pulses were palpable. No arterial dissection or pseudoaneurysm was found, and there was no distal radial artery occlusion. Fourteen patients underwent 2 sessions of distal radial artery punctures, and no vascular occlusion was found in these patients either. Conclusions: TACE via the dTRA is feasible and safe for primary hepatocellular carcinoma.

Keywords: Primary hepatocellular carcinoma, distal radial artery access, transcatheter hepatic artery chemoembolization

Introduction

Hepatocellular carcinoma (HCC) is the fourth most common malignant tumor and the third leading cause of tumor death in China [1, 2]. HCC is a morphologically heterogeneous tumor with variable structural growth patterns and different histological subtypes. According to relevant reports, among all cancers, the global HCC incidence rate of men ranks fifth, and the global HCC incidence rate of women ranks ninth, accounting for more than 50% of new or fatal liver cancer cases in China every year [3]. Primary hepatocellular carcinoma (PHC) is one of the top 10 malignant tumors in the world, with the characteristics of insidious onset, high malignancy, high recurrence rate and poor prognosis [4]. There are about 700,000 new cases every year, and the incidence of the disease has shown a significant upward trend in recent years due to increased work pressure, and changes in living habits and living environment. In addition, a large number of patients have reached an advanced stage when PHC is diagnosed. Statistics have shown that the average 5-year survival rate of PHC patients is only 10-15% [5, 6]. At present, there are many treatment methods for PHC, such as liver resection, liver transplantation, local ablation therapy, interventional therapy, radiation therapy and drug therapy, but the prognosis is still not ideal, so it is crucial to find effective treatments to

Figure 1. The patient's position.

help the patients obtain a promising prognosis [7].

Transcatheter arterial chemoembolization (TACE) is the preferred treatment option for advanced PHC [8]. Conventionally, it is performed via transfemoral access (TFA) [9]. The thick femoral artery allows repeated punctures for TACE and thus it is a good approach for various endovascular treatments. However, it also has many shortcomings, including prolonged bed rest after surgery, long compression time at the puncture sites, severe discomfort, inconvenience in eating and toileting, high risk of lower extremity deep vein thrombosis and complications at the puncture site. Treatment through the distal radial artery has achieved good results in other diseases [1]. Therefore, we tried to change the puncture path from the femoral artery to the distal radial artery of the upper extremity for TACE. Therefore, TACE via the distal transradial access (dTRA) has been performed in our center. In turn, this approach provided a better solution for treating PHC. Here, we summarized our experience in investigating the feasibility and safety of hepatic artery chemoembolization via dTRA.

Methods

General data

We retrospectively analyzed the clinical data of 130 patients with PHC who were treated in The First Hospital of Jilin University between August 1, 2020 and December 31, 2020. The patients received a total of 130 distal radial artery punctures. There were 106 men and 24 women aged 38 to 73 years (mean age: 58.6 years). The mean body weight was 64.8 kg (52-87 kg) and the mean height was 168.5 cm (158-184 cm).

This study was approved by the Ethics Committee of The First Hospital of Jilin University.

Inclusion criteria: (I) patients who were confirmed to have PHC by preoperative imaging (abdominal contrast-enhanced computed tomography or dynamic contrast-enhanced magnetic resonance imaging) or pathology, with a Child-Pugh class of A or B; (II) patients with persistently palpable pulses at distal radial artery and a negative Allen's test. Exclusion criteria: (I) patients with impalpable pulses at the distal radial artery; (II) patients with palpable pulses but with radial artery fistula created for hemodialysis; (III) patients whose preoperative ultrasound results revealed a tortuous and folded radial artery that could hamper the passage of a guidewire.

The puncture devices included a 21G micropuncture needle (Merit Medical System Inc., Beijing, China), a MPA catheter (125 cm in length; Merit Medical System Inc.), an APT microcatheter (125 cm in length; Hunan APT Medical Devices Co., Ltd., Hunan, China), and a 0.035-inch guidewire (180 cm in length; Merit Medical System Inc.).

Methods

The patient was placed supine on a DSA bed, with the left palm flat on the middle of the lower abdomen (**Figure 1**). After local anesthesia with 0.5 mL of 2% lidocaine in the traveling area of the left distal radial artery (with a wait for a few minutes if the pulse could not be palpated), a 21G puncture needle was applied to puncture the radial artery (**Figure 2**). An 0.018-inch guidewire was introduced when blood was seen to spurt out caudally. The puncture needle was withdrawn, and a 5F micropuncture sheath was applied instead. The dilator and short guidewire were removed.

For sheath flushing, the sheath was slowly rinsed with 200 μg of nitroglycerin (concentration: 1%, 2 mL) and then with lidocaine. Afterwards, 3,000 units of heparin sodium injection were applied to flush the sheath.

To establish the dTRA, an MPA catheter (125 cm in length) and an 0.035-inch guidewire (180 cm in length) were introduced into the left upper limb artery and then entered the aorta through the brachial, axillary and subclavian arteries. The guidewire and catheter were used to select the descending aorta. If the selection

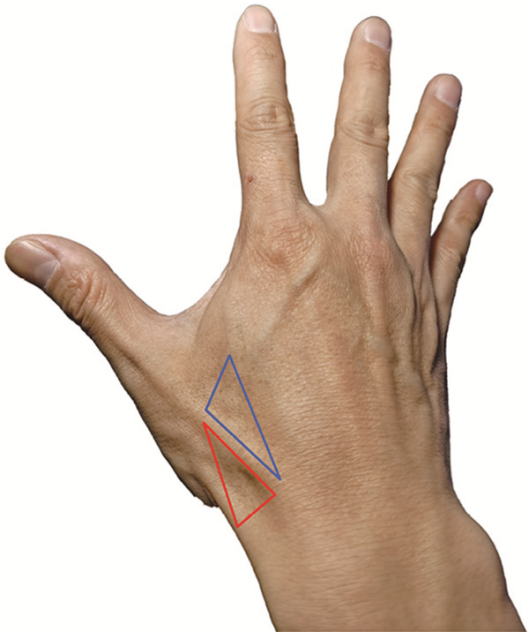

Figure 2. The location of the puncture sites.

Figure 3. The covering of the puncture sites after the operation.

was difficult, the pigtail catheter was used instead to assist the passage. The MPA catheter was used to find the opening of the celiac trunk and select the common hepatic artery. After successful selection, the catheter was slowly inserted, and the guidewire was withdrawn. A high-pressure syringe was applied for angiography, and a 150 cm microcatheter was applied to super-select into the feeding vessels of tumors, which was followed by chemoembolization. After the operation, the puncture sheath was withdrawn, and the puncture site was covered with an elastic bandage to stop bleeding (**Figure 3**). The compression time was 2-4 hours.

Evaluation indicators: puncture success rate (number of successful punctures/total number of punctures), the average number of needles, puncture time, distal radial occlusion and wrist hematoma.

Statistical analysis

SPSS 18.0 statistical software was used for processing the data. The count data were expressed as percentages and analyzed by χ^2 test.

Results

All the punctures were performed using 21G steel needles. 5F sheaths were used in 84 cases and 4F sheaths in 46 cases. In 130 cases, the puncture was successful for 112 cases (86.2%), and the puncture failed for 18 cases (13.8%). The mean number of punctures per patient was 2.6 (range: 1-11), with an average puncture time (based on the anesthesia time) of 143 seconds (range: 10-300 seconds).

The success rate of descending aorta selection using an MPA1 catheter (Cordis, Santa Clara, CA, USA) was 96.2% (125/130). In the remaining 5 cases, the selection succeeded after a 5F pigtail catheter was used instead. The success rate of the celiac trunk or superior mesenteric artery (SMA) selection using an MPA1 catheter was 100%. The mean duration of catheterization (calculated from the time the catheter entered the sheath to the time of selection into the target artery) was 210 seconds (50-450 seconds). In one case, the celiac trunk was occluded, and the feeding artery of the tumor was supplied by a tortuous collateral branch of the SMA communicating with the hepatic artery, which could not be reached by the microcatheter and thus could not be embolized. No bleeding or hematoma occurred after 2-4 hours of compression following distal radial artery puncture, and both distal and proximal radial artery pulses were palpable. No arterial dissection or pseudoaneurysm was found, and there was no distal radial artery occlusion (RAO). Fourteen patients underwent 2 sessions of distal radial artery punctures, and no vascular occlusion was found in these patients either.

The patients felt comfortable, left the catheterization room on foot, toileted themselves, and had a shorter postoperative hospital stay and a short compression time.

Discussion

PHC has high morbidity and mortality in China. Most patients have lost the indications for surgery at diagnosis [10], and the long-term prognosis is poor. With the development of interventional radiology techniques, TACE has become the preferred treatment for patients with advanced HCC [11]. It is currently considered to be safe and effective for patients who have lost the opportunity for surgery or cannot receive surgery [12]. It has a significant short-term curative effect, because it can promote tumor cells necrosis and tumor shrinkage, relieve clinical symptoms, effectively kill tumor cells, control tumor growth within a certain period of time and prolong the survival time of patients [13]. In addition, TACE can block tumor blood supply, enhance the lethality of chemotherapy drugs to tumors and help reduce the systemic toxicity of drugs. As a common treatment for tumors that cannot be removed by surgery, it shrinks the tumor and lays a good foundation for surgical resection, but there are also different adoption paths for TACE, with different effects.

In 2017, Kiemeneij [14] was the first to describe the application of dTRA, mainly for coronary interventions. In this study, we used dTRA for TACE because peripheral tumor intervention through dTRA may avoid some shortcomings of TFA. As reported in previous studies, after operation via TFA, patients often require prolonged bed rest and immobilization of both lower extremities, have high risk of deep vein thrombosis in the lower extremities, and need assistance when eating and going to the toilet. In addition, we have tried to perform TACE through transradial access, but the results were not satisfactory. The incidence of postoperative RAO reached 76.2% (16/21), probably due to insufficient heparinization (peripheral tumor interventions often do not require high-dose heparinization compared to coronary interventions). Therefore, a second TACE via transradial access is not possible. The most common complications of radial artery procedures are radial artery spasm and RAO, with a reported incidence of 1-33% [15]. In our center, 130 procedures via dTRA were performed for patients (among whom 14 successively underwent 2 procedures via dTRA), without RAO or hand complications. In one patient with kidney failure requiring dialysis, bilateral radial arteries and cephalic veins were used as the hemodialysis vascular access. After a failed attempt of the TFA, a dTRA was used. Failure of distal radial artery puncture was mainly due to the thin vessel, which resulted in radial artery spasm after the puncture. For all failed punctures, ipsilateral radial access or right femoral access was used instead. The total time of intervention showed no significant difference between dTRA and TFA. All these suggest that using dTRA for TACE has some advantages over TFA.

According to literature [16-20], the incidences of postoperative complications are as follows: distal RAO, 0.0-5.2%; hematoma, 0.8%; radial artery dissection, 0.3%; arteriovenous fistula, 0.2%; pseudoaneurysm, 0.2%. Compared to the conventional TRA, using dTRA had a lower short-term incidence of postoperative complications: RAO, 0%; wrist hematoma, 0%; and localized bruise, 5.3% (7/112). Neither radial artery dissection nor aneurysm occurred. The intermediate- and long-term complications associated with dTRA will be further explored. In general, no compression bandages or bed rest is required during TACE via dTRA, which greatly reduces the risk of acute deep vein thrombosis in the lower extremities. Theoretically, the patients do not need a caregiver because they can basically take care of themselves, and their eating and toileting will not be affected. In the future, patients with mild conditions may receive diagnosis and treatment in outpatient departments or ambulatory care clinics, which can greatly reduce avoidable hospital readmissions, the economic burden of patients and the burden of health care insurance.

While our findings may be encouraging, some limitations to this study should be addressed. First, our analysis was limited by the small sample size. Furthermore, in most HCC patients undergoing interventional treatment, their conditions are already in the advanced stages and may require repeated operations. Thus, determining whether the distal radial artery can endure these operations requires further investigation. In the future, as the sample size increases and the operation technique matures,

the puncture time may shorten, the cannulation of the ascending aorta may become easier, and the intermediate- and long-term complications of the dTRA will be better understood. Perhaps most importantly, whether this technique can be repeatedly applied in HCC patients need to be clarified. Also, the development and research in catheters with clinically appropriate and feasible tip shapes, length and support/advancement performances are also urgently needed.

In conclusion, the dTRA is safe and feasible for the TACE in PHC patients and warrants further application.

Disclosure of conflict of interest

None.

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