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Clinical Study on the Application of Yashiro and RH Catheter for Transcatheter Arterial Chemoembolization

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Abstract: We analyze the impact on the post-operative syndrome of application of Yashiro and RH catheters to TACE. We analyze the superselective success rate of Yashiro and RH catheters in terms of hours and epiphenomenon and the impact on the post-operative syndrome of application of both of these catheters using blood test, objective indices. The superselection was successful 45 times using Yashiro catheter and the success rate was 93.75%, and 41 times using RH catheter, and the success rate 78.84%. The average time until the superselection was 347.39±29.44(s) in Yashiro catheter and 652.97±203.36(s) in RH catheter. And there were 6 cases (16.6%) of the prolongation of the operating time due to vascular spasm in RH catheter group. In Yashiro catheter group the moderate increase of transaminase and ESR was observed 7 days after operation, then it returned to the baseline on 14^{th} day. But in RH catheter group the severe increase of these indices was observed 7 days after operation, and then it has been decreasing gradually on 14^{th} day.($p<0.05$). Our study suggests that TACE using Yashiro catheter is relatively safe approach in terms of postoperative syndrome, because it increases success rate of superselection and reduces the overall operating time.

Keywords: Hepatocellular Carcinoma (HCC), Transcatheter Arterial Chemoembolization (TACE), Yashiro Catheter, RH Catheter

1. Introduction

Hepatocellular carcinoma (HCC) is a major health problem. It is the sixth most common cancer and the third leading cause of cancer-related deaths in the world [1]. Nowadays, with development of medical scientific technique, 30–40% of patients with HCC are diagnosed at an early stage, when the disease is amenable to treatment approaches such as surgical resection, liver transplantation, and local ablation [2].

In recent years, the Barcelona Clinic Liver Cancer (BCLC) classification has emerged as the standard classification system for clinical management of patients with HCC [3]. According to the BCLC staging system, transcatheter arterial chemoembolization (TACE) is the current standard of care for patients with intermediate-stage disease. Liver circulation is unique because of the dual blood supply by the portal vein and hepatic artery. [13] The portal vein is responsible for 80%of the blood supply to healthy liver tissue. In contrast, 99% of the blood supply to hepatic tumors is delivered by the hepatic artery. Based on this observation, transcatheter arterial embolization (TAE) for HCC is appropriate for patients for whom surgical or percutaneous ablative treatment is contraindicated. TAE, first described by Doyon et al. in 1974 [7], is a treatment method in which embolic agents are injected into the hepatic artery to induce ischemic necrosis of a tumor. In the 1980s, iodized oil (Lipiodol Ultrafluide, Laboratoire Guerber, Aulnay-Sous-Bois, France) injected into the hepatic artery was found to selectively accumulate and be retained for long periods in hypervascular hepatic tumors. However, TACE, interventional radiological treatment developed in 1990s, involves injection of anticancer drugs and iodized oil into the hepatic artery, followed by the administration of embolic agents [8, 9]. The antitumor effect of TACE is greater than that of either anticancer drugs [10] or iodized oil [11, 12] administered alone. Some randomized control studies reported that TACE prolonged survival and allowed control of symptoms in HCC [4–6].

TACE is often recommended for advanced HCC because these patients require therapy that is more effective than systemic chemotherapy or conservative treatment. Superselective catheterization makes the distribution of drugs to focus on the tumor tissue by getting catheter to bring close to the tumor feeding vessels as possible to reduce the damage of normal liver parenchyma by embolization, side-effects and epiphenomenon of TACE. Nowadays, catheters often used in clinical practice include RH, Yashiro, microcatheter and SP catheters for TACE(15). It is easier for superselecting with microcatheter and SP catheters than others because they have narrow diameters. But it induces prolonged operating time and makes wrong diagnosis for difficulties in the infusion of contrast agent. During the application of Yashiro catheter, there has a little damage of the vascular endothelium and good retaining of the shape of catheter, even though the repeated procedures because Yashiro catheter is more flexible. It produces convenience for the infusion of drugs and the shortness of the operating time because of narrow diameter of catheter, and it leads to reduction in the radiological damage to doctors and patients. The aims of this paper are to analyze the impact on the post-operative syndrome of application of Yashiro and RH catheters to TACE, to highlight several problems associated with a kind of catheters, and to discuss technical improvements in TACE for HCC.

2. Materials and Methods

Patients

From 2008 to 2015, we managed 79 patients with hepatocellular carcinoma using TACE to analysed superselective success rate of Yashiro and RH catheter in Pyongyang Medical College Hospital,

Kim Il Sung University.

The baseline characteristics of cases treated with TACE are summarized in Table 1.

Table 1. *Baseline characteristics of patients.*

age (years)	51.03±6.04
sex (m/f)	78/1
Child classification (A/B/C)	67/12/0
HBs-Ag(pos/neg)	72/7
platelet	
≧100000/ mm^3	64
≦100000/mm^3	15
AFP	
≧20ng/ml	49
≦20ng/ml	30
TNM (T1/T2/T3)	62/16/1
Yashiro/RH	43/36

According to the EASL(European Association for the Study of the Liver) criteria, the diagnosis of hepatocellular carcinoma was confirmed by non-invasive criteria involving AFP and imagine technique in 79 cases. Exclusion criteria were age older than 70 years, evidence of extrahepatic metastases (based on the coincident findings of at least two imaging techniques) and/or segmental or lobar portal venous thrombosis, uncontrolled underlying liver disease (gastrointestinal bleeding, encephalopathy, refractory ascites, bacterial infection), severe clotting impairment (platelet count less than 50000/mm^3, renal failure. The size, number of lesions and their location in the liver were established in all patients by US and CT.

Among them, in 65 cases tumors were present in right lobe of the liver, in 9 cases in left lobe and in 5 cases in both right and left lobes, and all tumors were hypervascular. In 79 patients, the frequency of TACE using Yashiro catheter was 48 times in 43 cases (38 cases had TACE one time,5 cases 2 times)and RH catheter 52 times in 36 cases(22 cases TACE one time,12 cases 2 times and 2 cases 3times).14 times of TACE was performed by microcatheter.

3. Methods

TACE was performed at the initial digital subtraction angiography (DSA) under local anesthesia. An intra-arterial catheter (5F Yashiro or RH catheter) was percutaneously inserted from the right femoral artery by Seldinger's method to celiac artery and contrast medium was infused.

DSA showed that the tumor vessels mainly originated from the proper hepatic artery. During the arterial phase, tumor staining was observed and no intraportal venous thrombosis was found during the venous phase. After the catheter was inserted selectively into the main feeding artery,20 mg Mitomycin-C, 50 mg Doxorubicin and 80 mg cisplatin dispersed in 10~20 mL iodized oil contrast medium injected into the tumor over several minutes. The success rate of the two catheters were tested by the chi-square test.

4. Results

4.1. Superselective Success Rate

Table 2. *Success rates of Yashiro and RH catheter.*

index / catheter	Frequency of TACE(time)	Frequency of success(time)	Success rate(%)
Yashiro	48	45	93.75*
RH	52	41	78.84

*p<0.05

Table 2 shows that the frequency of superselection using Yashiro catheter was 45 times and success rate 93.75%, and that using RH catheter 41 times and 78.84%, respectively. Residual 14 times of TACE was performed using microcatheter.

4.2. Analysis with Superselective Time

The average superselective time of TACE using Yashiro catheter was 347.39±29.44(s) and that using RH catheter 652.97±203.36(s). (Table3)

Moreover the prolongation of operating time due to vascular spasm was observed in 6 cases (16.6%) of the group

using RH catheter.

Table 3. *Analysis with superselective times of 2 groups.*

index / catheter	hour(s)	Spasm
Yashiro	347.39±29.44(P<0.05)	-
RH	652.97±203.36	6(16.6%)

4.3. The Change of Peripheral Blood Test

Table 4 shows that there were no significant changes in the peripheral blood test before/after operation in 2 groups.

Table 4. *The change of peripheral blood test $\bar{x}$±SD.*

catheter	Frequency (time)	Before operation			7 days after operation		
		RBC (cells/mm^3)	WBC (cells/mm^3)	Plt (cells/mm^3)	RBC (cells/mm^3)	WBC (cells/mm^3)	Plt (cells/mm^3)
yashiro	45	385.42±35.26	44.15±13.25	10.54±1.64	364.59±34.84	42.98±12.64	10.35±1.42
RH	41	394.18±42.48	46.18±14.72	10.60±1.92	385.51±36.48	43.98±13.38	10.68±1.74

4.4. Impact on the Postoperative Syndrome

We analyzed the impact on the postoperative syndrome with GPT, Albumin and ESR as objective indices. (Table5)

Table 5. *The Impact on the postoperative syndrome $\bar{x}$±SD.*

catheter	No(time)	Postoperative syndrome								
		GPT(IU)			Albumin(g/dl)			ESR (mm/h)		
		Before operation	7d	14d	Before operation	7d	14d	Before operation	7d	14d
Y	45	47.28±19.44	84.22±18.75	52.34±6.58	3.45±0.12	3.52±0.15	3.50±0.11	21.8±3.46	32.4±3.22	20.4±2.51
R	41	43.78±14.25	126.39±16.45*	72.36±4.58	3.67±0.16	3.57±0.13	3.55±0.14	22.64±5.55	38.82±2.69	27.57±4.69

*p<0.05, Y: yashiro catheter, R: RHcatheter

In Yashiro catheter group, the moderate increase of transaminase and ESR was observed 7 days after operation, then it returned to the baseline on 14th day. But in RH catheter group, the severe increase of these indices was observed 7 days after operation, and then it has been decreasing gradually on 14th day.(p<0.05)

5. Discussion

According to the BCLC staging system, transcatheter arterial chemoembolization (TACE) is the current standard of care for patients with intermediate-stage disease. More than 500 articles regarding TACE of HCC are in print (14), and the variety of protocols used in different studies makes it difficult to identify an optimal strategy to perform TACE. Particularly, There is no clear answer as to the optimal application of catheter for superselection. Superselective catheterization makes the distribution of drugs to focus on the tumor tissue by getting catheter to bring close to the tumor feeding vessels as possible to reduce the damage of normal liver parenchyma by embolization, side-effects and epiphenomenon of TACE. Nowadays, catheters often used in clinical practice include RH, Yashiro, microcatheter and SP catheters for TACE(15). It is easier for superselecting with microcatheter and SP catheters than others because they have narrow diameters. But it induces prolonged operating time and makes wrong diagnosis for difficulties in the infusion of contrast agent. During the application of Yashiro catheter, there have been less damage of the vascular endothelium and good retaining of the shape of catheter, even though repeated procedures because Yashiro catheter is more flexible. It produces convenience for infusion of drugs and less operating time because the diameter of this catheter is not narrow, and accordingly it leads to reduction in the radiological exposure to both doctors and patients. The relative advantage of Yashiro catheter for superselection is proven by our data that the success rate of superselection using Yashiro catheter was 93.75%, and that using RH catheter 78.84%. And we think that our results analyzed in terms of time, epiphenomenon and postoperative syndrome highlight relative advantage of Yashiro catheter.

6. Conclusion

Our study suggests that TACE using Yashiro catheter is relatively safe approach in terms of postoperative syndrome, because it increases success rate of superselection and reduces the overall operating time. We think it is necessary to do multi-variant analysis with indices such as stages, metastasis, recurrence and survival rate and etc.

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