Efficacy and Safety Comparison between Drug-eluting Beads CalliSpheres and Conventional Transcatheter Arterial Chemoembolization in Treating Renal Angiomyolipoma Patients

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Research

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Abstract

Background: There is a lack of evidence of standard or superior treatment among renal angiomyolipoma (RAML) patients**.** This study aimed to compare the short-term efficacy and safety using CalliSpheres microspheres (CSM) with conventional transcatheter arterial chemoembolization (cTACE) in treating Chinese patients with RAML.

Methods: A total of 54 patients with RAML treated by TACE from February 2018 to April 2020 were retrospectively analyzed. These included 17 cases in the CSM-TACE group and 37 cases in the cTACE group. The clinical efficacy, tumor reduction rate and complications were compared between the two groups. Furthermore, blood routine indexes and kidney function test were compared between the two groups before and at the third day after the operation.

Results: The embolization was performed successfully in all patients without serious adverse events and death. Except for abdominal pain (p=0.044) and white blood cell (WBC) (p=0.047), there were no significant differences in baseline characteristics (p>0.05). As for treatment efficacy, 42 patients with RAML had tumor size reduced after embolization. Compared with CSM-TACE group (0.12±0.34), tumor volume reduction rate was slightly higher in cTACE group (0.32±0.31) with p value 0.047. As for treatment safety, postoperative WBC and creatine level in two groups were both in normal range and not significantly different (p=0.114 and 0.659). Besides, no significant differences were observed in complication and length of stay after the operation between the two groups (p=0.347 and 0.593).

Conclusions: CSM could be a safe and good option for embolization therapy in treating Chinese patients with RAML in clinical practices. Large cohort perspective study is still needed in the future.

Background

Renal angiomyolipoma (RAML) is a hamartomatous tumor that consist of variable amounts of thick-walled blood vessels, smooth muscle, and mature adipose tissue (1). RAML is the most common type of all benign mesenchymal neoplasm of kidney with the estimated incidence 0.13% in the general population, and it has been linked to substantial morbidity because of the enhanced health awareness and widespread use of imaging techniques (2–4). Though a benign tumor, RAML may pose a grievous threat to life owing to its unique characteristics and subsequent complications including renal impairment, compression, so spontaneous rupture, retroperitoneal hemorrhage, and even death, hence aggressive interventions has become extremely essential (5–7). Current RAML interventions are mainly based on surgical resection, but increasingly younger patients prefer the minimally invasive transcatheter arterial chemoembolization (TACE) therapy as their strong willingness of kidney conservation.

TACE is a well-established and common interventional technique that can directly release both embolic agents and chemo-agents to the lesions through feeding arteries, thus cut off blood supply of the tumor (8, 9). TACE is always considered as the first-line treatment for both malignancies and benign lesions due to its advantages such as less cost, safety, and significant clinical efficacy (10–15). The increasing

demand for TACE is of great interest to the development of novel embolization agent with better therapeutic effect and less systemic side effect. Thus, drug-eluting beads (DEB) are gradually applied to clinical practices in recent years as its outstanding property of sustained drug release over conventional lipiodol emulsion mixed with chemotherapeutic agents (15–17). To date, there are several microsphere products in clinical practice such as Embosphere microspheres (ESM) (Biosphere Medical, Roissy, France), Contour SE (Boston Scientific, Natick, USA), Bead Block (Biocompatibles, Farnham, UK), LC Beads (Biocompatibles, Farnham, UK), EmboGold (Merit Medical Systems, South Jordan, USA), Embozene (Boston Scientific, Natick, USA), Quadrasphere (Merit Medical Systems, South Jordan, USA) (12). However, no study has demonstrated the superiority of one embolic agent over another with regard to treat RAMLs, preventing hemorrhage, or treating symptoms.

CalliSpheres® Microsphere (CSM) is the first DEB product independently developed in China in 2015 and most previous studies focused on its use in treating Chinese patients with primary liver cancer and colorectal liver metastases. Several lines of evidence suggested that CSM could achieve superior treatment response and progression-free survival for liver cancer in both human and animal model (13–15, 18). Besides, Ren et.al reported better treatment efficacy and safety of CSM without obvious adverse outcomes compared with Embosphere microspheres (ESM) in porcine renal artery embolization model (12). However, very few studies report the use of CSM in treatments for human renal tumors. Therefore, this retrospective study of 54 RAML patients was conducted to explore the clinical efficacy and safety of CSM and compare it with traditional Lipiodol-bleomycin (BLM) therapy.

Methods

Patients

The institutional review board of Peking University First Hospital approved this retrospective study and waived the requirement for patient informed consent. A total of 81 patients diagnosed with RAML were treated in our hospital from February 2018 to April 2020. The inclusion criteria were as follows: (1) aged 18 and older; (2) pathological or radiological confirmed diagnosis of RAML; (3) at least one tumor with the maximum diameter 3 cm or greater by enhanced computed tomography (CT) or magnetic resonance imaging (MRI); (4) no history of tumor embolization in the past 6 months. Patients were excluded if (1) they were in pregnancy or lactation, or planned for pregnancy; (2) they needed other surgeries such as nephrectomy; (3) they had willingness of conservative treatment rather than invasive surgery; (4) they had history of atherosclerosis related coronary heart disease, myocardial infarction, or cerebral infarction; (5) they had treatment history of mTOR inhibitors, such as rapamycin, sirolimus or everolimus; (6) they had serious heart, lung, or kidney disease that were not able for interventional therapies.

Preoperative preparations

We performed routine treatments regarding rehydration therapy for all patients before conventional TACE (cTACE) or CSM-TACE operation. For cTACE group, the chemotherapy drug solution contained 10 ml lipiodol and 15 mg bleomycin solution, and 8Spheres® particles (Jiangsu Hengrui Medicine Co. Ltd., Jiangsu, China) were used as embolization agents. And for CSM-TACE group, we used CalliSpheres® Beads (CB) (Jiangsu Hengrui Medicine Co. Ltd., Jiangsu, China) with diameter of 100 to 300 μm or 300 to 500 μm according to the presence of arteriovenous shunt or the size of arterial fistula. CB was loaded in bleomycin solution with concentration of 20 mg/ml after all liquid supernatant was pushed out, then was mixed with nonionic contrast agent at a ratio of 1:1. The mixture was shaken and placed for 5 minutes before using. In addition, 2.6 F and 2.7 F microcatheters (Merit Maestro, Merit Medical System Inc., South Jordan, UT, USA) were used in both cTACE and CSM-TACE operations.

TACE procedure

All operation process referred to Chinese Clinical Practice Guidelines for Transarterial Chemoembolization of Hepatocellular Carcinoma (2018) (21). All patients received renal angiography before and 10 minutes after the operation.

cTACE group: First, clarified the location, number and form of bilateral renal artery incision, as well as the presence of participation in blood supply for accessory renal artery, lumbar artery, renal capsule artery, phrenic artery, or other systemic vessels. Second, applied microcoil to the lesion before precise embolization for patients comorbid with aneurysm. Third, mixed lipiodol emulsion was injected into the tumor-feeding artery through a microcatheter, then 8Spheres® blank particles were used for supplementary embolization. The endpoint of cTACE procedure was the stasis of blood flow of target artery observed.

CSM-TACE group: First, clarified the location, number and form of bilateral renal artery incision, as well as the presence of participation in blood supply for accessory renal artery, lumbar artery, renal capsule artery, phrenic artery, or other systemic vascular. Second, 100 to 300 μm or 300 to 500 μm CalliSpheres® Beads loaded with bleomycin solution was manually injected into the tumor-feeding artery slowly and carefully to avoid reflux of the mixture into non-targeted vessels. The endpoint of CSM-TACE procedure was the stasis of blood flow of target artery observed. Five minutes after the observation of stasis of blood flow, perform angiography again to confirm the embolization effect.

Data collection

All patients' data were collected from electronic medical records (EMR) which included (1) demographic features: age and gender; (2) clinical features: comorbidity, postoperative complications and length of stay (LOS), tumor status, tumor location (left kidney, right kidney or bilobar), tumor distribution, preoperative and postoperative tumor size in three dimensions; (3) blood routine indexes: white blood cell (WBC); (4) kidney function indexes: creatinine (Cre); (5) embolization materials and location.

Evaluation of efficacy and safety

Evaluation of clinical efficacy was performed before and after DEB-TACE or cTACE treatment by enhanced CT or MRI examination. Preoperative and 3-month postoperative tumor size from left-right (LR), anterior-posterior (AP), and superior-inferior (SI) directions were recorded. Tumor volume was measured using an ellipsoid formula (π/6*LR*AP*SI) from the imaging results and volume change rate was calculated (22).

Safety evaluation included WBC while creatinine and its change as the assessments of kidney function according to the laboratory indices at the third day after the operation. Also, adverse events in the perioperative period were documented.

Statistical analysis

Continuous variables were expressed as mean or median±standard deviation for normally distributed and non-normally distributed ones, separately. Numerical differences between two groups were assessed by chi-square test for categorical variables, and t test or Wilcoxon rank-sum test for continuous variables. The threshold for significance was P=0.05. All statistical analyses were conducted using SPSS, Version 19.0 (SPSS Inc., Chicago, IL, USA).

Results

Basic characteristics

A total of 81 patients diagnosed with RAML were included in this study and the embolization was performed successfully in all patients. 15 were excluded due to missing imaging results and 3 were excluded as no recorded embolization materials. Besides, we also excluded 9 emergency cases which only bland embolization was performed. 54 RAML patients were eventually enrolled in the safety and efficacy analysis, including 17 treated by CSM-TACE and 37 treated by cTACE.

The mean age was 43.4 years (ranges from 27 to 68) and there were 12 male (22.22%) and 42 female (77.78%). Baseline characteristics were displayed in Table 1. There were slight differences in preoperative abdominal pain and WBC between the two groups with p values 0.044 and 0.047, separately. No other significant difference between the two treatments was found for other clinical features at admission (Table 1).

Table 1
Baseline characteristics of patients with RAML at admission

Parameters	CSM-TACE (n = 17)	cTACE (n = 37)	P-value
Age (years)	49 (33–56)	39 (34–48)	0.284
Gender (male/female)	3/14	9/28	0.732
Tuberous sclerosis (n)	3 (17.65%)	6 (16.22%)	1
Abdominal pain (n)	4 (23.53%)	20 (54.05%)	0.044
Tumor rupture (n)	3 (17.65%)	6 (16.22%)	1
Hematuresis (n)	4 (23.53%)	11 (29.73%)	0.751
Tumor location (n)			
Left kidney	2 (12.50%)	12 (32.43%)	0.202
Right kidney	6 (37.50%)	11 (29.73%)	
Bilobar	8 (50.00%)	14 (37.84%)	
Tumor distribution (n)			
Unifocal	5 (29.41%)	17 (48.57%)	0.494
Multifocal	10 (58.82%)	18 (51.43%)	
Tumor size (cm^3)	96.76 (56.74-146.98)	142.96 (42.73-251.12)	0.346
Blood routine			
WBC (*10^9 cell/L)	4.55 (4.28–5.33)	5.50 (4.85–7.40)	0.047
Kidney function			
Cre (μmol/L)	68.68 ± 12.64	68.36 ± 12.98	0.914

CSM-TACE, CalliSpheres® Microsphere transcatheter arterial chemoembolization; cTACE Group, conventional Lipiodol-bleomycin (BLM) transcatheter arterial chemoembolization; WBC, white blood cell; Cre, creatinine.

Data were presented as mean (standard deviation), median (25th -75th quantiles), or count (%). Comparison between 2 groups was determined by t test, Wilcoxon rank-sum test or χ^2 test. The threshold for significance was P = 0.05 and significant results are shown in boldface.

Treatment Response

Figure 1 displayed preoperative and 3-month postoperative enhanced CT results of one case from CSM-TACE group, showing the significant reduction of tumor size after the operation. Clustered column charts were drawn to demonstrate tumor reduction rate as shown in Fig. 2. A total of 42 patients with RAML had tumor size reduced after the operation (Fig. 2) with 12 (70.59%) and 30 (81.08%) in CSM-TACE group and cTACE group, respectively (Fig. 3). There were no significant differences in preoperative and postoperative tumor size between the two groups (p = 0.346 and 0.970). When compared with CSM-TACE group (0.12 ± 0.34), tumor volume reduction rate was slightly higher in cTACE group (0.32 ± 0.31) with p value 0.047 (Table 2).

Table 2
Comparison of treatment response between CSM-TACE group and cTACE group

Parameters	**CSM-TACE (n = 17)**	**cTACE (n = 37)**	**P-value**
Tumor size (cm^3)	88.66 (34.04-134.95)	81.19 (30.03-159.01)	0.970
Tumor size change (n)			
Reduce	12 (70.59%)	30 (81.08%)	0.486
Increase	5 (29.41%)	7 (18.92%)	
Tumor volume reduction rate	0.12 ± 0.34	0.32 ± 0.31	0.047
Blood routine			
WBC (*10^9 cell/L)	11.67 ± 3.28	9.98 ± 3.11	0.114
Kidney function			
Cre (μmol/L)	69.02 (57.53–81.07)	73.30 (61.78–81.80)	0.659
Change in Cre (%)	4.82 ± 10.35	4.59 ± 10.74	0.947
Postoperative complications (n)	9 (52.94%)	14 (37.84%)	0.347
Length of stay (days)	3 (2–3)	3 (2–4)	0.593
CSM-TACE, CalliSpheres Microsphere transcatheter arterial chemoembolization; cTACE Group, conventional Lipiodol-bleomycin (BLM) transcatheter arterial chemoembolization; WBC, white blood cell at the third day after the operation ; Cre, creatinine at the third day after the operation.			
Data were presented as mean (standard deviation), median (25th -75th quantiles), or count (%). Comparison between 2 groups was determined by t test, Wilcoxon rank-sum test, or χ^2 test. The threshold for significance was P = 0.05 and significant results are shown in boldface.			

Safety

There was no significant intergroup difference in WBC (p = 0.114) at the third day after the operation (Table 2). And for evaluation of kidney function, creatine in two groups were both in normal range, postoperative creatinine level (p = 0.659) and its change (p = 0.947) between the two groups were not significant. The most common postoperative complication was post-embolization syndrome including fever, nausea and abdominal pain, which occurred in 9 patients in the CSM-TACE group and 14 patients in the cTACE group without significant difference (p = 0.347) (Table 2). Median of LOS were both 3 days in two groups.

Discussion

Traditionally, studies reported the use of CalliSpheres® Microsphere in colorectal liver metastases, primary hepatocellular carcinoma, bronchogenic carcinoma, and breast cancer (13–15, 18–20). To our knowledge, this is the first study to explore the potential benefit of CSM in treatment of renal tumors. Our preliminary findings demonstrated that CSM loaded with bleomycin is able to inhibit tumor growth while ensuring a normal kidney function, and is expected to be an alternative ideal interventional therapy besides cTACE with lipiodol emulsion.

We excluded 9 bland embolization cases as they all had acute hemorrhage in admission and performed symptoms such as abdominal pain, retroperitoneal hematoma, increased WBC, decreased hemoglobin, and even hypotensive shock. Thus, these 9 patients received emergency surgery for stanching and would have significant baseline clinical difference from other patients in terms of embolism materials and endpoints evaluation. Table 1 displayed slight statistical difference in baseline WBC and abdominal pain between CSM group and cTACE group which could be explained by the following reasons. First, WBC counts were both within the normal range for the two groups despite the difference (p = 0.047), which might be the results from the relative small sample size and it seemed that there has no clinical significance. And for the higher rate of abdominal pain in cTACE group (p = 0.044), we believed such symptom is more common among multifocal RAML cases without obvious angiography confirmed arterial fistula, under which circumstance the main embolization materials could refer to traditional chemotherapy agents in clinical practice including lipiodol emulsifier, gelfoam particles, or polyvinyl alcohol (PVA) particles (23). Tumor volume reduction rate was unexpected higher in cTACE group than in CSM group as shown in Table 2. But when look into the preoperative and postoperative imaging results of one case from CSM group (Fig. 4), obvious reduction of tumor enhancement degree was observed at follow-up despite the tumor size remained unchanged. Such situation is also commonly seen in embolization on other solid tumors (24).

DEB-TACE is a novel type of TACE that uses microspheres as both drug carriers and embolization agents (14, 25). However, clear evidence of superiority of DEB-TACE over cTACE is still lacking. As everyone knows, angiomyolipoma is always with rich blood supply and arterial fistula. Even if there is no visible arterial fistula, lipiodol emulsion sometimes enters the venous system through arteriovenous communication which may cause the embolization in unexpected areas. Thus, for those RAML patients comorbid with arterial fistula, solely use of PVA particles or gelfoam particles could avoid the

embolization in unexpected areas while chemotherapeutic drugs bleomycin would be out of its therapeutic action. Considering all these factors, we recently applied CSM to patients with angiography confirmed arterial-venousfistula in our center.

As the first novel DEB product made in China, CB was recently introduced in clinical practice. Several studies have proved the short-term efficacy of CSM in treatment for hepatocellular carcinoma with better complete response (CR), partial response (PR), objective response (OR), and progression-free survival (PFS) (13, 14, 18, 26). In addition, CB could deliver relatively higher concentrations of chemotherapy agents to an area from the bead edge for at least 1 month (15). However, very few studies reported the use of CSM in renal tumors. Ren et al. (12) compared the efficacy of CSM with conventional microspheres in renal artery embolization, but in the porcine model, and the conclusion was quite consistent with ours. The results found no obvious adverse events or deaths, and there is no difference in operation assessments between the two groups at D2, D7 and D28.

There are some limitations in this study. First, the sample size was relatively small which might lead to selection bias. Second, tumor size reduction rate was the only indicator to evaluate treatment efficacy after TACE in this study that might contribute to the lack of high accuracy. On the other hand, however, the more common assessment mRECIST is also unreliable sometimes because of the complexity of RAML internal structure and the challenge in measuring the enhancement appearances at arterial phase. Thus, a golden criteria or system is a pressing need regarding the efficacy evaluation of TACE for RAML patients.

Conclusions

In summary, this study demonstrated that, as the first novel DEB product in China, CB could be a safe and good option for embolization therapy in the treatment of Chinese patients with RAML, especially for those with arterial-venous fistula. For further study, we plan to promote risk monitoring for perioperative ectopic embolism, as well as to explore the difference in number of surgeries and rehaemorrhagia among treatments, Also, we are striving for a large cohort perspective study.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Peking University First Hospital (Beijing, China) and all subjects provided written informed consent.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analyzed during the present study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Funding information is not applicable.

Author's contributions

TL designed the present study and drafted the manuscript. JW and XT acquired and analyzed the data. TM and AZ analyzed the data and edited English language. TL and YZ interpreted the data. YZ agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors read and approved the final manuscript.

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Not applicable.

References

1. Bissler JJ, Kingswood JC. Renal angiomyolipomata. Kidney Int. 2004;66:924–34.
2. Fujii Y, Ajima J, Oka K, Tosaka A, Takehara Y. Benign renal tumors detected among healthy adults by abdominal ultrasonography. Eur Urol. 1995;27:124–7.
3. Sultan G, Masood B, Qureshi H, Mubarak M. Angiomyolipoma of the scrotum: report of a rarely seen case and review of the literature. Turk J Urol. 2017;43:223–6.
4. Arslan B, Gürkan O, Çetin B, Arslan ÖA, Göv T, Yazıcı G, et al. Evaluation of ABO blood groups and blood-based biomarkers as a predictor of growth kinetics of renal angiomyolipoma. Int Urol Nephrol. 2018;50:2131–7.
5. Bertolini F, Casarotti G, Righi L, Bollito E, Albera C, Racca SA, et al. Human renal angiomyolipoma cells of male and female origin can migrate and are influenced by microenvironmental factors. PloS one. 2018;13:e0199371.
6. Seyam RM, Alkhudair WK, Kattan SA, Alotaibi MF, Alzahrani HM, Altaweel WM. The risks of renal angiomyolipoma: reviewing the evidence. J Kidney Cancer VHL. 2017;4:13–25.
7. Wang C, Li X, Peng L, Gou X, Fan J. An update on recent developments in rupture of renal angiomyolipoma. Med (Baltim). 2018;97:e0497.
8. Miraglia R, Pietrosi G, Maruzzelli L, Petridis I, Caruso S, Marrone G, et al. Efficacy of transcatheter embolization/chemoembolization (TAE/TACE) for the treatment of single hepatocellular carcinoma.

World J Gastroenterol. 2007;13:2952–5.

9. Lo CM, Ngan H, Tso WK, Liu CL, Lam CM, Poon RT, et al. Randomized controlled trial of transarterial lipiodol chemoembolization for unresectable hepatocellular carcinoma. Hepatology. 2002;35:1164–71.
10. Dogan N, Nas O, Canver B, Ozturk K, Gokalp G. Selective bilateral renal artery embolization with tris-acryl microspheres in focal segmental glomerulosclerosis. Diagn Interv Imaging. 2017;98:277–8.
11. Karalli A, Ghaffarpour R, Axelsson R, Lundell L, Bozoki B, Brismar T, et al. Transarterial chemoembolization of renal cell carcinoma: a prospective controlled trial. J Vasc Interv Radiol. 2017;28:1664–72.
12. Ren B, Wang W, Shen J, Ni C, Zhu X. In vivo evaluation of callispheres microspheres in the porcine renal artery embolization model. Am J Transl Res. 2019;11:4166–79.
13. Peng Z, Cao G, Hou Q, Li L, Ying S, Sun J, et al. The comprehensive analysis of efficacy and safety of CalliSpheres® drug-eluting Beads transarterial chemoembolization in 367 liver cancer patients: a multiple-center, cohort study. Oncol Res. 2020;28:249–71.
14. Xiang H, Long L, Yao Y, Fang Z, Zhang Z, Zhang Y. CalliSpheres drug-eluting bead transcatheter arterial chemoembolization presents with better efficacy and equal safety compared to conventional TACE in treating patients with hepatocellular carcinoma. Technol Cancer Res Treat. 2019;18:153303381983075.
15. Zhang S, Huang C, Li Z, Yang Y, Bao T, Chen H, et al. Comparison of pharmacokinetics and drug release in tissues after transarterial chemoembolization with doxorubicin using diverse lipiodol emulsions and CalliSpheres Beads in rabbit livers. Drug Deliv. 2017;24:1011–7.
16. Zou JH, Zhang L, Ren ZG, Ye SL. Efficacy and safety of cTACE versus DEB-TACE in patients with hepatocellular carcinoma: a meta-analysis. J Dig Dis. 2016;17:510–7.
17. Gentil K, Lentz CS, Rai R, Muhsin M, Kamath AD, Mutluer Ö, et al. Eotaxin-1 is involved in parasite clearance during chronic filarial infection. Parasite Immunol. 2014;36:60–77.
18. Sun J, Zhou G, Xie X, Gu W, Huang J, Zhu D, et al. Efficacy and safety of drug-eluting beads transarterial chemoembolization by CalliSpheres® in 275 hepatocellular carcinoma patients: results from the Chinese CalliSpheres® transarterial chemoembolization in liver cancer (CTILC) study. Oncol Res. 2020;28:75–94.
19. Bie Z, Li Y, Li B, Wang D, Li L, Li X. The efficacy of drug-eluting beads bronchial arterial chemoembolization loaded with gemcitabine for treatment of non-small cell lung cancer. Thorac Cancer. 2019;10:1770–8.
20. Wang Z, Niu H, Li Z, Zhang J, Sha L, Zeng Q, et al. Superselective arterial embolization with drug-loaded microspheres for the treatment of unresectable breast cancer. Gland Surg. 2019;8:740–7.
21. An T, Gao S, Jin Y, Liu R, Pan J, Zhang Q. Chinese clinical practice guidelines for transarterial chemoembolization of hepatocellular carcinoma. Zhonghua Gan Zang Bing Za Zhi. 2019;27:172–81.

22. Choi SM, Choi DK, Kim TH, Jeong BC, Seo SI, Jeon SS, et al. A comparison of radiologic tumor volume and pathologic tumor volume in renal cell carcinoma (RCC). PloS One. 2015;10:e0122019.
23. Flum AS, Hamoui N, Said MA, Yang XJ, Casalino DD, McGuire BB, et al. Update on the diagnosis and management of renal angiomyolipoma. J Urol. 2016;195:834–46.
24. Domaratius C, Settmacher U, Malessa C, Teichgräber U. Transarterial chemoembolization with drug-eluting beads in patients with hepatocellular carcinoma: response analysis with mRECIST. Diagn Interv Radiol. 2020;27:85–93.
25. Facciorusso A. Drug-eluting beads transarterial chemoembolization for hepatocellular carcinoma: current state of the art. World J Gastroenterol. 2018;24:161–9.
26. Wu B, Zhou J, Ling G, Zhu D, Long Q. CalliSpheres drug-eluting beads versus lipiodol transarterial chemoembolization in the treatment of hepatocellular carcinoma: a short-term efficacy and safety study. World J Surg Oncol. 2018;16:69.

Figures

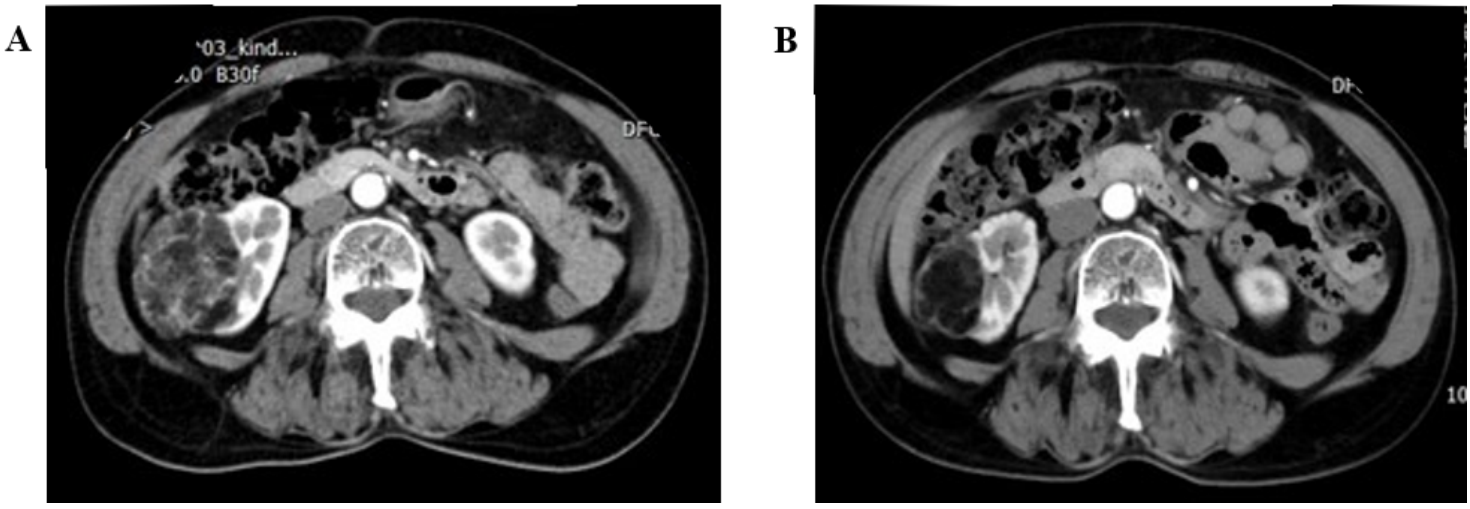

Figure 1

displayed preoperative and 3-month postoperative enhanced CT results of one case from CSM-TACE group, showing the significant reduction of tumor size after the operation. Clustered column charts were drawn to demonstrate tumor reduction rate

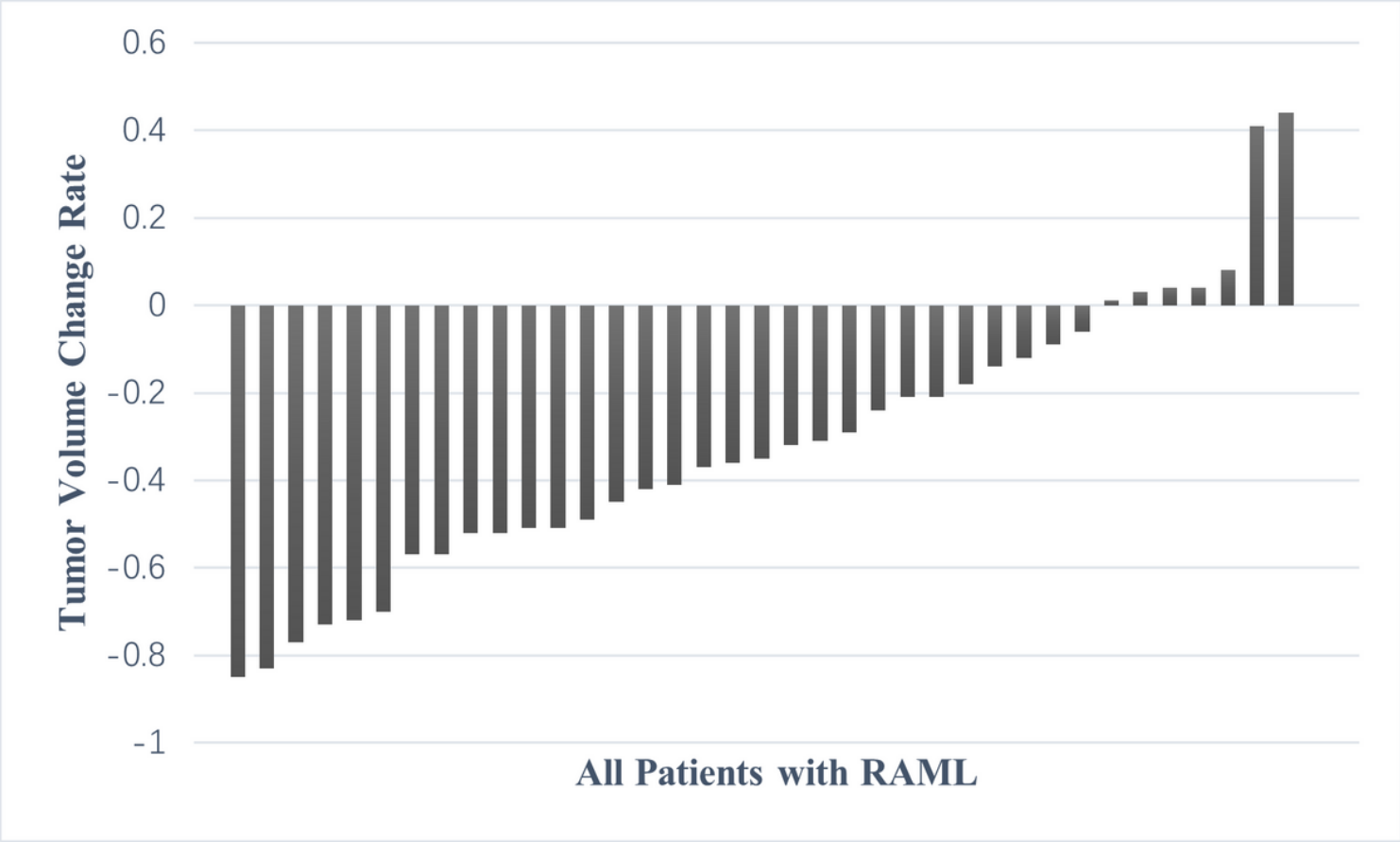

Figure 2

A total of 42 patients with RAML had tumor size reduced after the operation (Figure 2) with 12 (70.59%) and 30 (81.08%) in CSM-TACE group and cTACE group, respectively

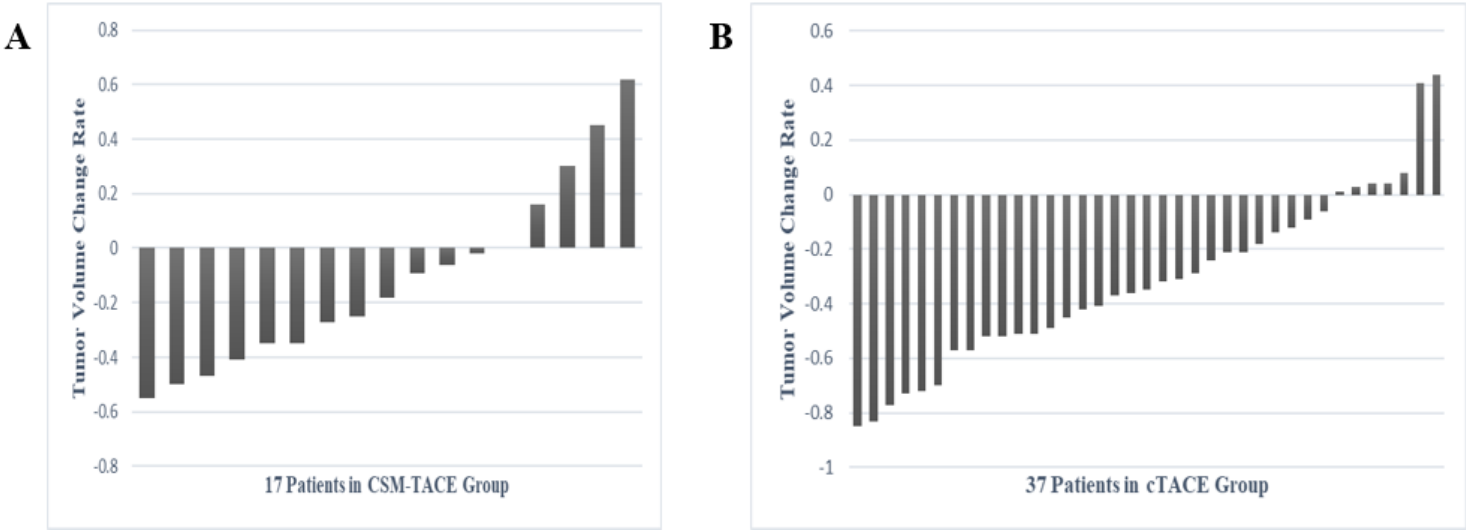

Figure 3

There were no significant differences in preoperative and postoperative tumor size between the two groups (p=0.346 and 0.970). When compared with CSM-TACE group (0.12±0.34), tumor volume reduction rate was slightly higher in cTACE group (0.32±0.31) with p value 0.047

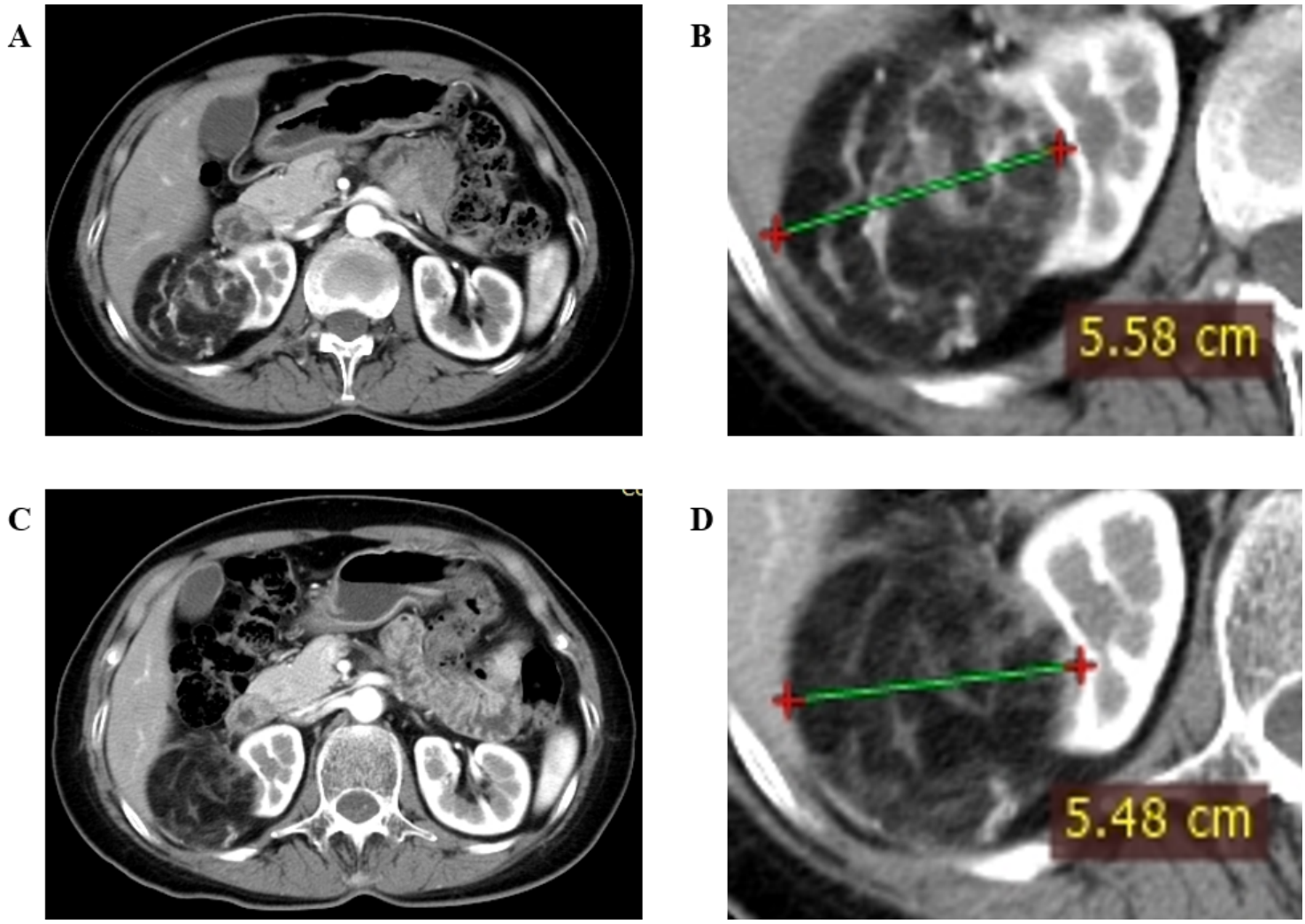

Figure 4

obvious reduction of tumor enhancement degree was observed at follow-up despite the tumor size remained unchanged. Such situation is also commonly seen in embolization on other solid tumors