

Transcatheter Arterial Ethanol Embolization under Closed Renal Circuit for large renal cell carcinoma

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introduction

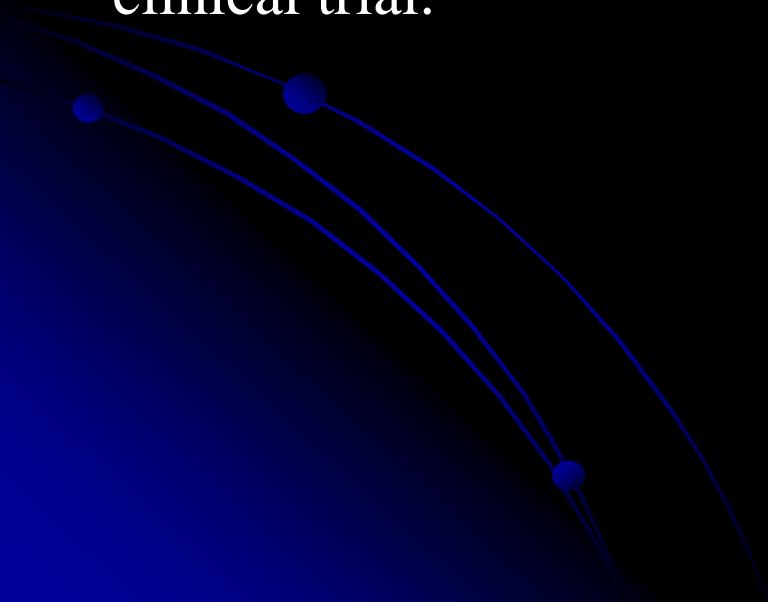
Transcatheter renal artery embolization (TAE) for renal cell carcinoma is widely employed for preoperative or palliative ablation of the kidney. In 1980, Ellman et al. reported the use of TAE with absolute ethanol for renal tumors. Initial clinical reports suggested that an ethanol dose of 0.56 mL/kg body weight was usually adequate to ensure complete renal ablation.

However, in clinical reports over the last two decades the dose of ethanol used has been approximately 0.2 mL/kg body weight because of potential toxicity, including coagulopathy and acute alcohol intoxication. Our clinical experience has shown that large RCCs are not adequately embolized by TAE at this ethanol dose.

We therefore developed a modified TAE while aspirating the renal venous outflow after it has been occluded using an occlusion balloon, a process we named TAE under closed renal circuit (TAE-CRC) -- to permit the use of higher doses of ethanol.

Purpose

Purpose of this study is to assess the safety and efficacy of closed renal circuit for renal embolization with absolute ethanol (TAE-CRC) in clinical trial.



Material and Method

From 1999 to 2006, 25 patients with renal cell carcinoma were treated by TAE-CRC.

The dosage of ethanol ranged from 0.2 to 0.5 ml/kg increased in a stepwise manner.

Serum ethanol concentrations in the systemic venous circulation were monitored in 14 patients.

Toxicity and survival rate were investigated.

Patients characters

	resection (n=9)	non-resection (n=16)	overall (n=25)
Demographic factors			
Age, years*	61 (46-75)	71 (57-78)	67 (46-78)
M/F	8/1	14/2	22/3
Tumor size, cm			
>5 to <7/>7 to <10/>10	2/2/5	4/7/5	6/9/10
mean (SD)	10.5 (3.9) cm	8.4 (2.6) cm	9.2 (3.2) cm
Stage			
pT1b/pT2/pT3a/pT3bc/pT4	2/2/3/2/0	2/1/11/0/2	4/3/14/2/2
I/II/III/IV	2/2/2/3	2/0/3/11	4/2/5/14
Other characteristics			
(1) metastases	n=3	n=10	n=13
lung	1	5	6
bone	2	6	8
others	1	7	8
(2) other cancers	n=1	n=7	n=8
colon cancer	0	3	3
hepatocellular carcinoma	0	2	2
others	1	2	3
(3) both (1) and (2)	n=0	n=4	n=4
(4) renal AVF**	n=0	n=2	n=2

*mean, **arteriovenous fistula

Systemic ethanol concentration and used dosage

	resection (n=9) (9 sessions)	non-resection (n=16) (18 sessions)	overall (n=25) (27 sessions)
Total dose of absolute ethanol			
mean (SD)	0.31 (0.10) ml/kg	0.36 (0.10) ml/kg	0.34 (0.10) ml/kg
range	0.2 - 0.45	0.2 - 0.5	0.2 - 0.5
Systemic ethanol concentration	n=5	n=9	n=14
<0.1 mg/ml	5	7	12
≥0.1 to <0.2 mg/ml	0	2	2
≥0.2 mg/ml	0	0	0
dose of ethanol*	0.33 (0.2-0.45) ml/kg	0.35 (0.2-0.5) ml/kg	0.34 (0.2-0.5) ml/kg

*, mean (range), In cases whom measured ethanol concentrations

Angiography

	resection	non-resection	overall
	(n=9)	(n=16)	(n=25)
Feeding arteries			
renal artery	9	16	25
capsular artery	5	8	13
Parasitic feeding arteries	n=3	n=8	n=11
lumbar artery	3	5	8
adrenal artery	1	6	7
including inferior phrenic artery)			
splenic artery	1	2	3
superior mesenteric artery	1	0	1
Occluded vein			
renal vein	7	16(18)*	23(25)*
capsular vein	2	0	2

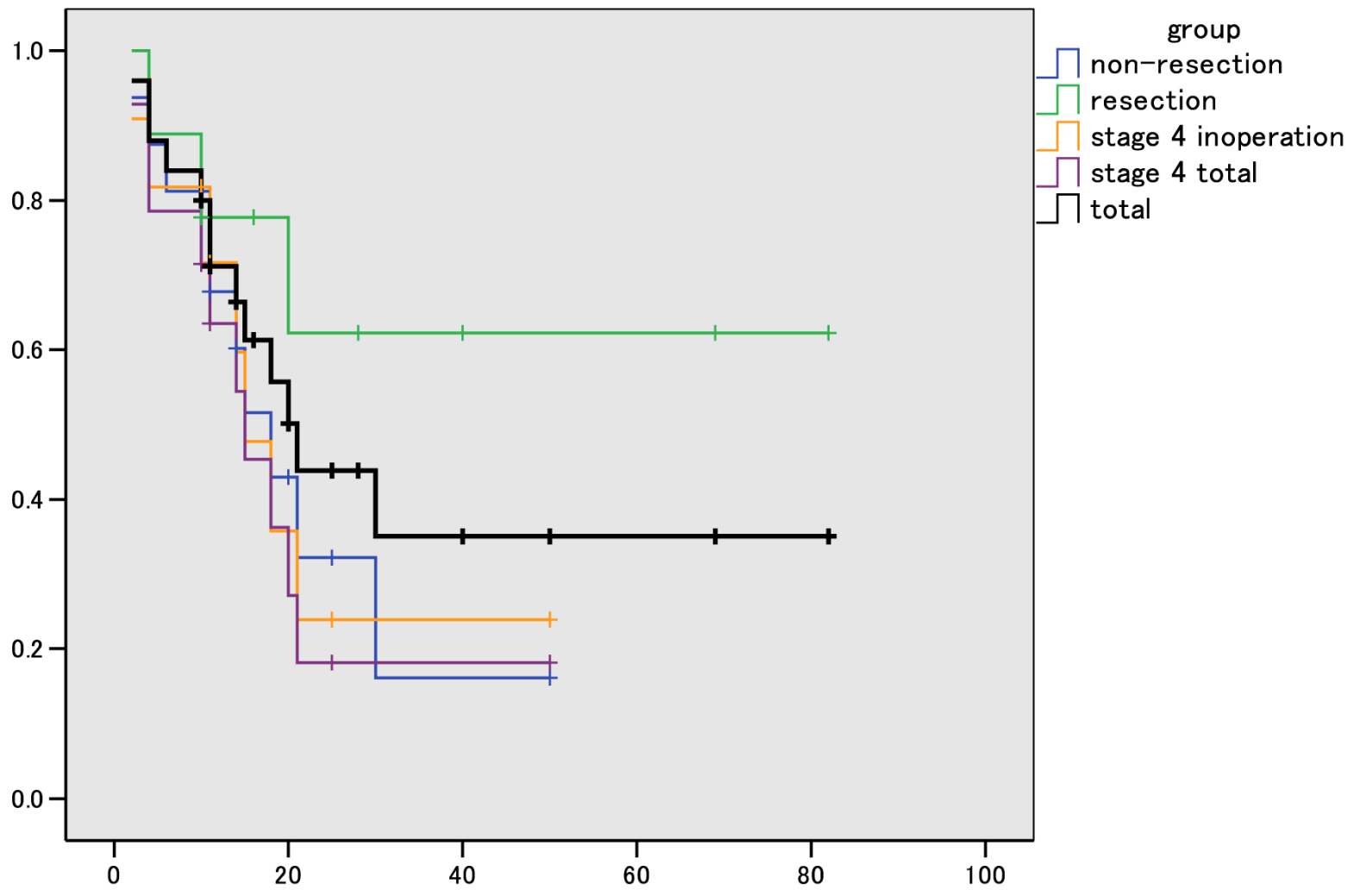
*, total sessions

Toxicity grade due to TAE-CRC

Toxicity	Number of patients (27 sessions in 25)	Grade			
		I	II	III	IV
Cardiovascular					
Injury	0	0	0	0	0
Thrombosis/Embolism	0	0	0	0	0
Hypertension	8 (29.6%)	7	1	0	0
Gastrointestinal					
Nausea	4 (14.8%)	4	0	0	0
Vomiting	1 (3.7%)	1	0	0	0
Others					
Pain*	11 (40.7%)	3	8	0	0
Infection (abscess)	0	-	-	0	0
Fever*	20 (74.1%)	16	4	0	0
Renal dysfunction	6 (22.2%)	4	2	0	0

* , temporary symptoms

Survival Rate



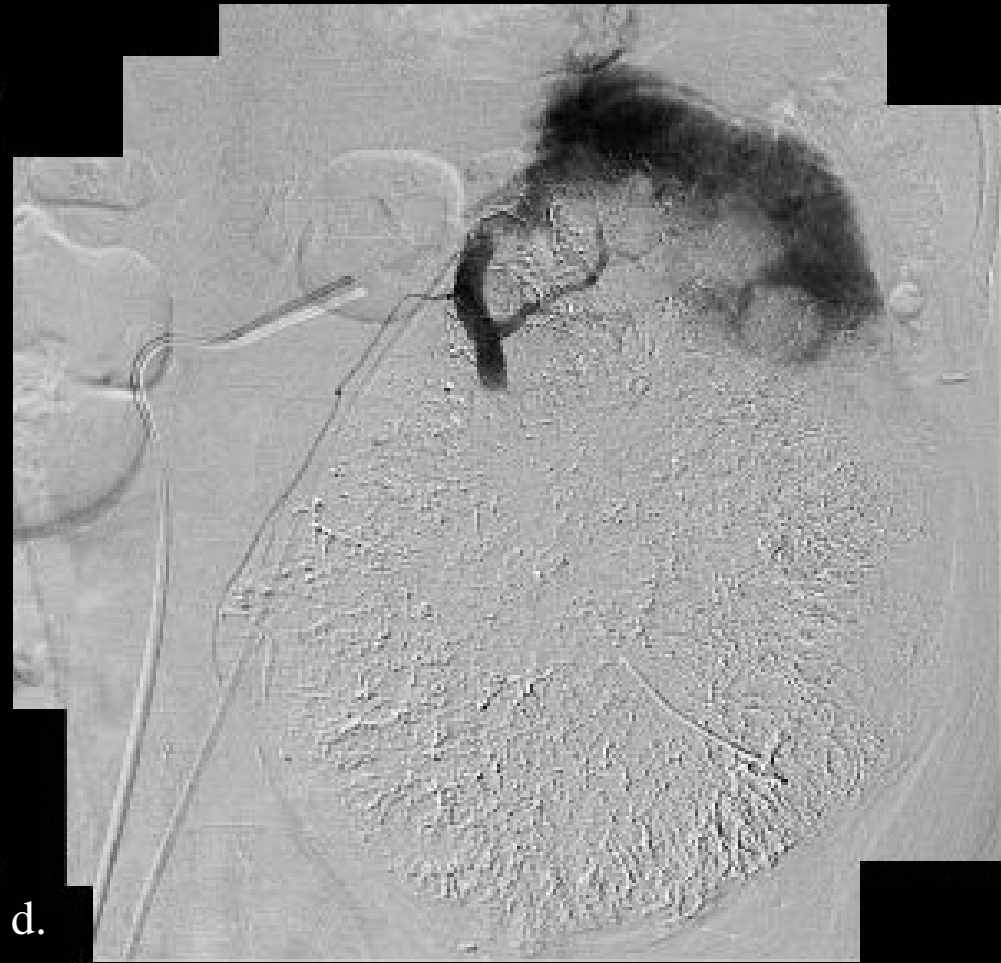
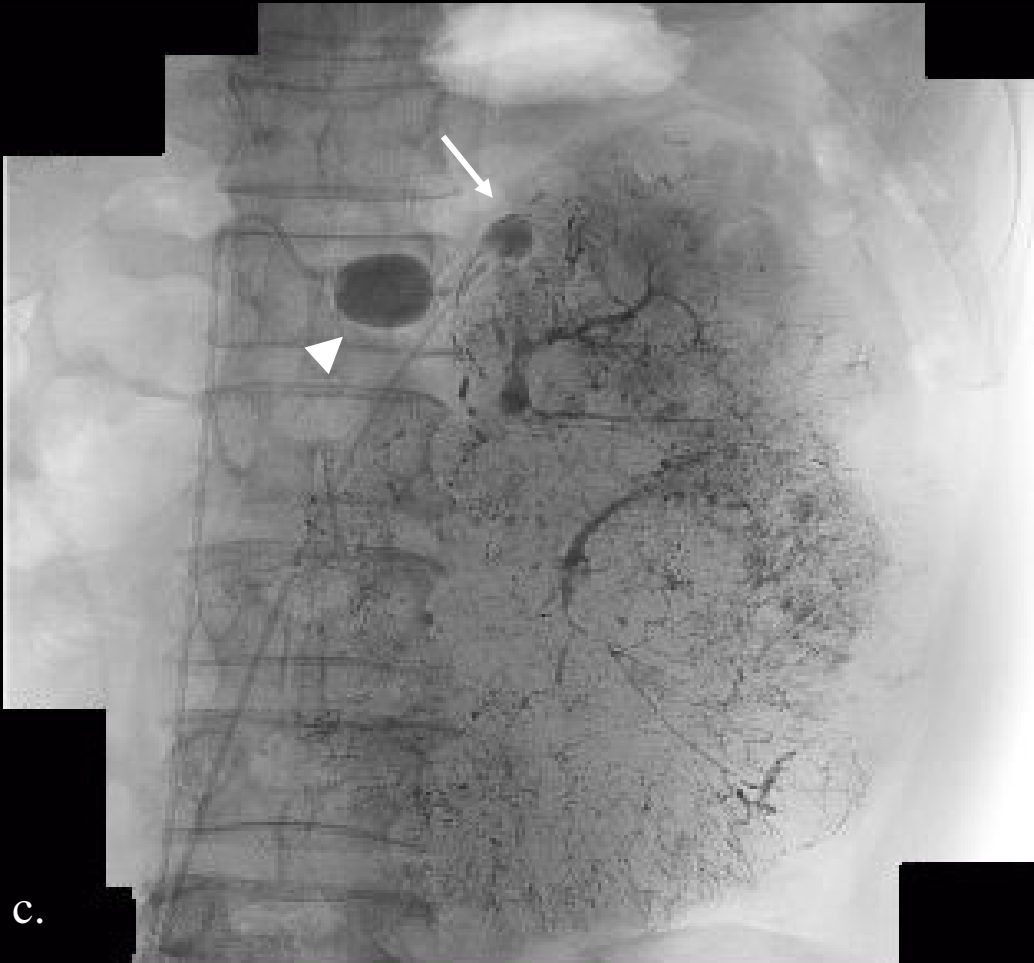
	1y	3y	5y		1y	2y	3y
total	71	35	35	stage 4 (non-resection)	72	24	24
resection	78	62	62	stage 4 (total)	64	18	18
non-resection	68	16					

Case 1, 55 y.o. man



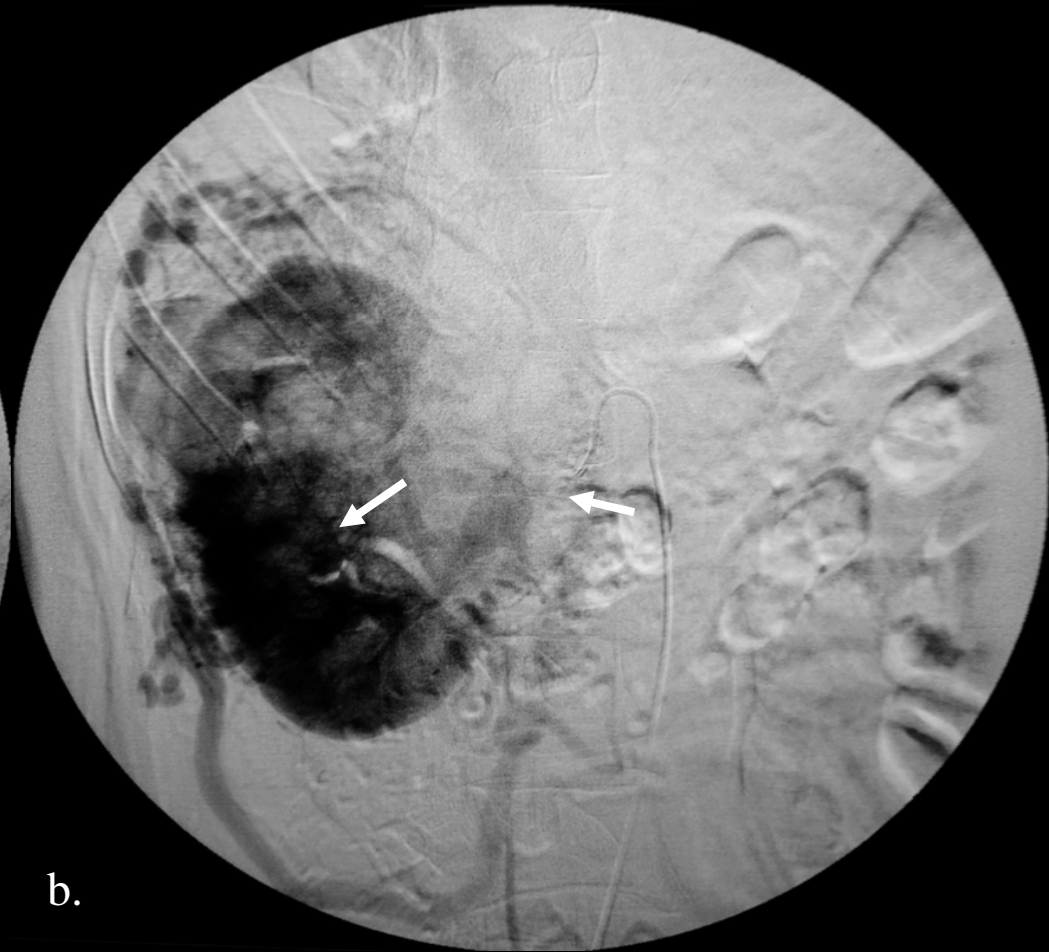
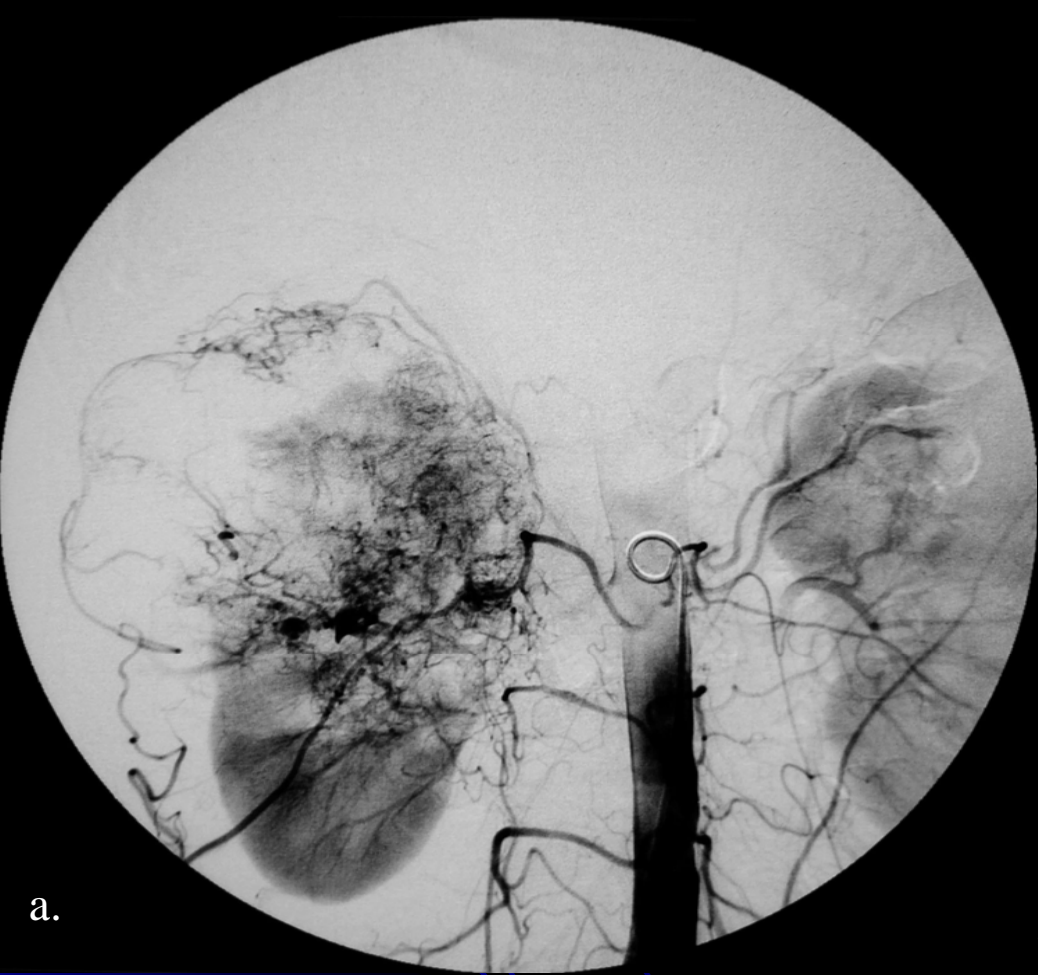
Case 1. A fifty-five-year old man with left RCC (pT3a). A dynamic enhanced CT (a) demonstrates huge tumor (pT3a) in the left kidney. Left renal arteriography demonstrates a huge hypervascular tumor (b).

Case 1, 55 y.o. man



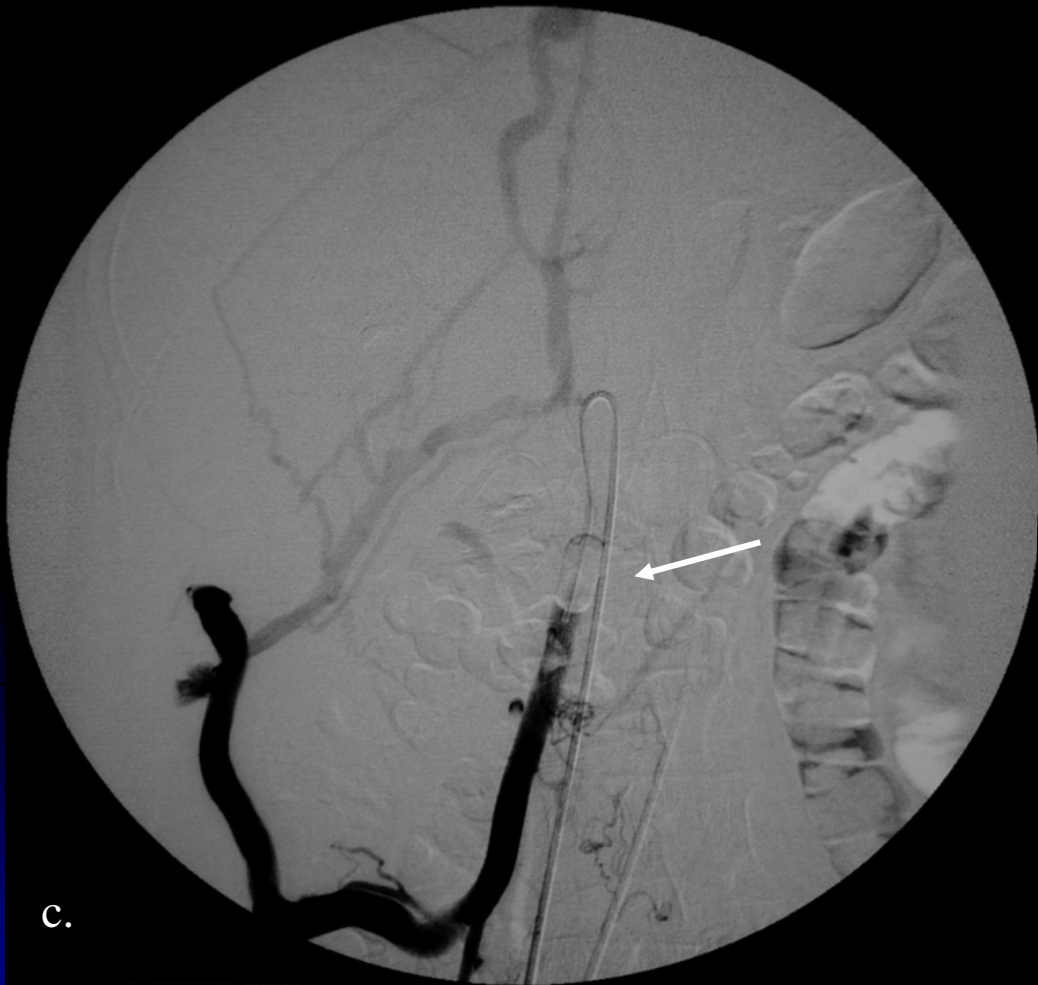
Both the left renal artery (arrow) and the left renal vein (arrow head) are occluded with 2 balloon catheters (c), and TAE-ABOD is performed with ethanol (0.45 ml/kg). After TAE-ABOD, left renal arteriography shows non-visualized tumor (d).

Case 2, 73 y.o. man



Case 2) A seventy-three-year old man with right RCC with renal vein tumor thrombus. Aortography shows a huge hypervascular renal tumor (a). Right renal arteriography in the venous phase demonstrates a collateral drainage vein (b, arrows) and obstruction of the right renal vein.

Case 2, 73 y.o. man



c.



d.

The collateral drainage vein (the capsular vein) is occluded with a balloon catheter (c, arrow) and the emulsion of 22 ml of ethanol (0.4 ml/kg) and 11 ml of Lipiodol is injected under aspiration of blood through the capsular vein. Renal arteriography after TAE-ABOD shows remained tumor vessels (d, arrows). Arrowheads (d) indicate a huge tumor.

Discussion

Two cases of 14 patients treated with TAE-CRC were detected 0.1mg/ml ethanol in the systemic circulation. There was a possible drainage which was not detected by angiogram because of large tumor.

In the literature, complication rate is 9.9% and the mortality is 3.3% after the renal embolization. In our study, no complication was occurred and no major toxicity was observed.

The survival 1-, 2- and 3-year rates are reported by some groups.

Without TAE group,	13%, 7%, 3%
With TAE group,	29%, 15%, 10%
Our result;	72%, 24%, 24% (non-resection group)

Possible cause of prolong survival: High dose of ethanol repeated TAEs

Randomized control study is required.

Conclusion

In conclusion, TAE-CRC is safe and effective treatment for large RCCs due to decreasing ethanol leakage and increasing ethanol dosage.

