A Case with Small Renal Tumor Complicated with Pulmonary Oil Embolism after Transcatheter Arterial Embolization

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Abstract

An 85-year-old gentleman was diagnosed with a small right renal cell carcinoma by a radiologist. The patient opted for cryotherapy instead of partial nephrectomy. One day before the scheduled cryoablation, the patient received trans-catheter arterial embolization (TAE) with lipiodol and it was complicated with tumor rupture and peri-renal hematoma formation. The patient was discharged under a stable condition after 12-day’s conservative treatment. However, upon arriving home, the patient lost consciousness and was sent to our ER, and presented with asystole. Emergent CT revealed hypoxic-ischemic encephalopathy and pulmonary embolism with bilateral lungs filled with lipiodol. We herein describe a very rare case with complication after treating renal cell carcinoma and review the relevant literature.

Keywords: Pulmonary embolism, renal cell carcinoma, transcatheter arterial embolization

INTRODUCTION

Renal cell carcinoma (RCC) accounts for approximately 2%-3% of all cancers. In 2012, RCC incidence rate was 115.2/100,000 people, 65,150 new cases of kidney and renal pelvis cancer were reported in the USA, which resulted in 13,680 deaths, with approximately 1.5:1 male predominance.[1]

Many specialists treated small RCC with partial nephrectomy, which is comparable to radical nephrectomy in terms of cancer-specific survival and overall survival and better than radical nephrectomy in terms of the preservation of renal functions.[2]

In addition to partial nephrectomy, several treatment options are available for small RCCs. In cases with clinical T1a RCCs, in addition to partial nephrectomy and surveillance, ablative techniques including radiofrequency ablation (RFA) and cryoablation provide promising oncological outcomes compared with partial nephrectomy. Furthermore, both ablative techniques are reported to result in infrequent complications; however, RFA and cryoablation are both effective and safe for treating renal masses, measuring ≤3 cm.[3,4]

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Here, we report a case of a patient with a small renal mass, highly suspected to be RCC, treated through nonsurgical intervention, which was followed by a rare complication.

**Case Report**

An 85-year-old man came to our urology clinic after he was incidentally diagnosed with a right RCC confirmed by a radiologist, cT1aN0M0 [Figure 1]. Treatment options included robotic-assisted laparoscopic partial nephrectomy, cryotherapy, and observation; the patient opted for cryotherapy.

The day before the scheduled cryoablation, the patient received transcatheter arterial embolization (TAE) with lipiodol for marking the margin of the tumor within the renal parenchyma. The next day, the patient complained of acute right lower abdominal pain and dizziness. An emergency computed tomography (CT) revealed tumor rupture with perirenal hematoma formation. Nonetheless, no active bleeding was found; close observation and monitoring of vitals were recommended.

One day after tumor rupture, the patient complained about mild dyspnea and tachycardia. Blood tests, including cardiac enzyme tests, revealed only mild anemia. Moreover, no increase in oxygen demand was observed. One week after conservative treatment, the patient was discharged while being in a stable condition. One hour after returning home, the patient lost consciousness and was sent to our emergency department immediately. Initially, the patient exhibited asystole. Emergency whole-body CT revealed hypoxic-ischemic encephalopathy and right upper and lower main pulmonary artery filling defect, and thus pulmonary embolism was likely to be the case. In addition, some hyperintense lesions were observed in the bilateral lower lungs, lipiodol most likely being the lesion [Figure 2]. Due to ischemic encephalopathy, extracorporeal membrane oxygenation was not administered. Due to shock and severe acidosis, the patient expired 1 day later.

**Discussion**

Most patients with early-stage RCC usually undergo either partial or radical nephrectomy. Observation may be a treatment option if the tumor is at a very early stage or the patient has a high mortality risk with operation.\(^2\) In early-stage organ-confined RCC, some studies have demonstrated comparable oncological outcomes between cryoablation and surgical intervention.\(^3,4\) However, some studies have demonstrated that the local recurrence rate is higher for cryoablation than for partial nephrectomy.\(^5\) As a consequence, many institutes, including ours, opted for partial nephrectomy over cryoablation more often in cases of clinical T1 RCCs.\(^5\) TAE with lipiodol before cryoablation led to better visualization of the tumor margin of the endophytic tumor with an acceptable decline in renal function.\(^6\) However, a retrospective comparison of percutaneous cryoablation with or without TAE demonstrated no significant difference in the complication rate, renal function, estimated glomerular filtration rate, and hematocrit between the groups, concluding the objective benefit of the precryoablation TAE.\(^6\)

Our patient died unexpectedly 1 day after TAE. TAE, however, is more often performed in patients with inoperable hepatocellular carcinoma than in patients with RCC. Thus, complications following TAE have been mostly studied in patients with inoperable hepatocellular carcinoma. Sakamoto et al. reported a 4.4% complication rate per procedure for a total of 2300 procedures. Iatrogenic dissection of the artery was the most common complication (1.52%). The rates of tumor rupture and pulmonary embolism were 0.04% and 0.17%, respectively.\(^7\) Mechanisms underlying tumor rupture after TAE include the following: first, acute ischemic necrosis of the capsule of superficial tumors, echoing that a tumor close to the liver surface or with a thin capsule was at risk of rupture after TAE, as reported by Nakao et al.\(^8\) Second, some tumors may invade the venous system or directly compress the drainage vein, causing the intratumoral pressure to increase. Third, direct injury to the feeding artery of the tumor may cause the tumor to rupture. Sakamoto et al. reported that vascular injury was the most common complication following TAE.\(^7\) Fourth, some TAE agents may cause vasculitis of the feeding artery, making it vulnerable. Acute angitis and inflammatory cell infiltration with thickening of the arterial wall had been reported embolization using gelatin sponge particles.\(^9\)

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**Figure 1:** (a) Axial view of the renal tumor, (b) Coronal view of the renal tumor  
**Figure 2:** Pulmonary embolism with lipiodol, black arrowhead: lipiodol
TAE-related pulmonary embolism, especially lipiodol embolism, has previously been reported.\textsuperscript{[10]} Two factors may contribute to the risk of oil embolism after TAE. First, Shiah et al. found a positive correlation between the length of hospital stay and the amount of lipiodol injected during TAE among those who survived pulmonary embolism. Moreover, it is recommended that a safe dose of lipiodol is 15–20 mL per patient to be administered.\textsuperscript{[10]} Second, intratumoral arteriovenous shunting may facilitate the occurrence of lipiodol pulmonary embolism. Conversely, the tumor could directly invade the venous system, in our case, the renal vein, causing lipiodol to drain into the vena cava and then to the right atrium, causing a pulmonary embolism.\textsuperscript{[10]}

In our case, the patient had an exophytic tumor. Precryotherapy TAE may have led to the necrosis of the capsule, resulting in tumor rupture. This facilitated intratumoral arteriovenous shunting caused a catastrophic pulmonary embolism.

We learned the following lesson: although TAE is a widely performed procedure and the complication rate is as low as 4\%, we must remember and inform the patient of the slim chance of a catastrophic complication such as pulmonary embolism. Particularly, if arteriovenous shunting is suspected through pre-TAE CT, we must consider the likelihood of these events. Alternatively, we can choose a treatment modality other than TAE.

To the best of our knowledge, this is the first case of a patient with RCC having tumor rupture leading to pulmonary embolism following TAE.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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