

## Percutaneous Transfemoral Renal Artery Occlusion in the Management of Advanced Renal Carcinoma

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*This report describes renal artery occlusion as a therapeutic alternative to nephrectomy and chemotherapy in treating patients with metastatic renal carcinoma. Using a combination of Gelfoam and the Gianturco stainless steel coil, embolization was performed on 75 patients at the University of Texas System Cancer Center, M.D. Anderson Hospital and Tumor Institute with promising results. Its use is recommended 1) to facilitate surgical removal of large and difficult tumors, 2) to control local symptoms (pain, bleeding, etc), and 3) as part of a planned therapeutic program consisting of infarction, nephrectomy and progestins for patients with minimal to moderate metastatic disease.*

Because nephrectomy<sup>1</sup> and chemotherapy<sup>2</sup> have not significantly improved the prognosis for patients with metastatic renal carcinoma, there has been increased interest in renal artery occlusion as a therapeutic alternative. In the past, arterial embolization has been used for treating arteriovenous malformations,<sup>3,4</sup> aneurysms,<sup>5</sup> postbiopsy arteriovenous renal fistulas,<sup>6</sup> control of gastrointestinal and pelvic bleeding,<sup>7-9</sup> and management of bone tumors.<sup>10</sup> Almgard et al<sup>11</sup> were among the first to report promising results in the treatment of massive renal tumors by embolic occlusion of the larger renal vessels, and subsequent reports<sup>12-14</sup> have confirmed their findings.

### Materials and Methods

Although a variety of agents have been used to occlude the renal vessels (autogenous clot and tissue, Gelfoam, metal and plastic spheres, synthetic plastic compound, balloon catheters, and stainless steel coils), the technique developed at the University of Texas System Cancer Center, M.D. Anderson Hospital and Tumor Institute at Houston combines Gelfoam<sup>15</sup> and the Gianturco stainless steel coil<sup>16-17</sup> to occlude both the peripheral arterioles and the main renal artery. Initially, embolization was performed immediately after the diagnostic angiographic evaluation of the suspected renal tumor. However, in two patients renal failure developed following renal artery occlusion, and it was believed that the considerable amount of contrast media (350 cc of 76% renographic) used during the combined diagnostic and therapeutic angiographic procedures contributed to the failures. Subsequently, the procedures have been performed at least 48 hours apart without any recurrence of this problem.

### Results

Within several hours after embolization has been performed, patients usually experience a "postinfarction" syndrome consisting of pain, fever and gastrointestinal complaints (Table 1). Pain is usually localized to the affected

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renal area and is directly related to the degree of infarction achieved by the procedure and inversely related to the amount of collateral and parasitic arterial supply to the tumor. Mild to moderate gastrointestinal symptoms of nausea, vomiting and paralytic ileus frequently require restricted oral intake and intravenous fluids for two or three days. In one patient, a gas-forming infection developed within the necrotic tumor mass and resulted in his death. Since then all patients with a positive urine culture, recent urinary tract infection, or a history of renal calculous disease have been placed on prophylactic antibiotics beginning the night before the procedure.

**TABLE I**  
**Side Effects of Renal Artery Occlusion**

Type	Percentage	Mean Duration (Hours)
Pain requiring injectable narcotics	88	57 (range: 24-144)
Fever	85	83 (range: 24-264)
Nausea and vomiting	78	41 (range: 24-144)
Hypertension	5	—
Sepsis	2	—

To date, 75 patients with advanced renal carcinoma have been subjected to renal artery embolization (Table II). In 14 patients renal artery occlusion was done to facilitate removal of the renal tumors within three days of nephrectomy. We believe that surgery was simplified in these cases because of the collapse of the engorged and fragile tumor vessels and the presence of edema induced by the infarction which tended to make tissue planes more distinct. Operative time and blood loss were also reduced. Although some investigators are now recommending its use in all surgical cases of renal carcinoma, there are inherent risks. These include escape of the embolization material into the systemic circulation with occlusion of vessels resulting in arterial insufficiency, gangrene or paraplegia, as well as the morbidity and expense of the procedure. Consequently, we suggest that its use should be restricted to those with large and difficult tumors. Perhaps later we will demonstrate that it also plays a role in reducing local recurrences and subsequent metastases in patients with stage II and stage III disease by reducing intraoperative tumor dissemination.

**TABLE II**

Total Patient Population	75
With Metastases	61
Infarction / nephrectomy / progestins	35
Infarction / nephrectomy / other	3
Infarction alone	23
Without Metastases	14

Twenty-three patients with metastatic renal carcinoma underwent renal artery embolization without subsequent surgical removal. All except one patient died of disease one week to nine months later without evidence of a response. In the one patient who remained alive with disease, the procedure was performed for relief of local symptoms (pain, hematuria) which abated following the infarction. Based on these limited results, the procedure is not believed to alter survival in patients with metastatic disease if nephrectomy is not subsequently performed.

Thirty-five patients with metastatic renal carcinoma have been treated with a combination of selective renal artery embolization, radical nephrectomy within five to seven days and medroxyprogesterone acetate (400 mg IM twice weekly). Twenty-eight patients are currently being evaluated. Six have achieved a complete response with disappearance of all known metastatic disease for periods ranging from 3 to 13 months, and six have had a partial response (greater than 50% reduction in the maximal diameters of all lesions). In two cases, the disease has stabilized. One patient has had a mixed response: while his pulmonary lesions disappeared, osseous metastases developed during the same period.

## Discussion

The cause for these varied responses is as yet unexplained. Whether or not an altered immune response is associated with necrosis remains speculative. Swanson,\* working our department, has suggested that the infarction may release a shower of tumor antigens into the circulation which abruptly alters the relative concentrations of tumor antigens and anti-tumor specific antibodies and thereby affects the amount and solubility of circulating immune complexes. These alterations could reduce the effective level of serum-blocking factors by clearing the complexes in the reticulo-endothelial system and / or reducing the efficiency of the blocking factors so that a net improvement in cell-mediated, tumor-specific immune response would result.

Some of our patients who had the combination of infarction and nephrectomy showed an increased reactivity in skin tests to a battery of recall antigens. Also, in a few patients there was a change in the level of circulating immune complexes after infarction but before nephrectomy using an assay which measures binding to radioiodinated Clq. While these limited results suggest that the procedure is altering the cell-mediated immune response, the system is obviously very complex and considerable work needs to be completed before we can hope to understand the exact mechanisms.

\* Personal Communication.

### Conclusion

Our early results with renal artery embolization are encouraging. At the present time, the procedure would appear to be indicated: 1) to facilitate surgical removal of large and difficult tumors; 2) to control local symptoms (pain, bleeding, etc); and 3) as part of a planned therapeutic program consisting of infarction, nephrectomy and progestins for

patients with minimal to moderate metastatic disease. While it does not offer permanent eradication of disease, the combination program does prolong survival for some patients. Consequently, until effective chemotherapeutic agents become available, its use should be considered.

### References

1. Johnson DE, Kaesler KE and Samuels ML: Is nephrectomy justified in patients with metastatic renal carcinoma? *J Urol* **114**:29, 1975.
2. Johnson DE and Samuels ML: Chemotherapy for metastatic renal carcinoma. *Cancer Chemotherapy Fundamental Concepts and Recent Advances*. Chicago, Year Book Medical Publisher, Inc. 1975, p 493.
3. Luessenhop AJ and Spence WT: Artificial embolization of cerebral arteries: Report of use in a case of arteriovenous malformation. *JAMA* **172**:1153, 1960.
4. Kricheff I, Madayag M and Braunstein P: Transfemoral catheter embolization of cerebral and posterior fossa arteriovenous malformations. *Radiology* **103**:107, 1972.
5. Almgard LE and Fernstrom I: Embolic occlusion of an intrarenal aneurysm: A case report. *Br J Urol* **45**:485, 1973.
6. Bookstein JJ and Goldstein HM: Successful management of postbiopsy arteriovenous fistula with selective arterial embolization. *Radiology* **109**:535, 1973.
7. Prochaska JM, Flye MW and Johnsrude IS: Left gastric artery embolization for control of gastric bleeding: A complication. *Radiology* **107**:521, 1973.
8. Rosch J, Dotter CT and Brown MJ: Selective arterial embolization: New method for control of acute gastrointestinal bleeding. *Radiology* **102**:303, 1972.
9. Ring EJ, Athanasoulis C, Waltman AC, Margolies MN and Baum S: Arteriographic management of hemorrhage following pelvic fracture. *Radiology* **109**:65, 1973.
10. Feldman F, Casarella WJ, Dick HM and Hollander BA: Selective intra-arterial embolization of bone tumors. *Am J Roentgenol* **123**:130, 1975.
11. Almgard LE, Fernstrom I, Haverling M and Ljungqvist A: Treatment of renal adenocarcinoma by embolic occlusion of the renal circulation. *Br J Urol* **45**:474, 1973.
12. Bracken RB, Johnson DE, Goldstein HM, Wallace S and Ayala AG: Percutaneous transfemoral renal artery occlusion in patients with renal carcinoma: A preliminary report. *Urology* **6**:6, 1975.
13. Bischoff W and Goerttler U: Current aspects of renal vascular embolization. *Dtsch Med Wochenschr* **102**:901, 1977.
14. Nakao N, Sugiki K, Inamoto K, Sakurai T, Uchida H and Nakamura H: Transcatheter arterial embolization of renal cell carcinoma. *J Jpn Coll Angiology* **17**:547, 1977.
15. Goldstein HM, Medellin H, Beydoun MT, Wallace S, Ben-Menachem Y, Bracken RB and Johnson DE: Transcatheter embolization of renal cell carcinoma. *Am J Roentgenol* **123**:557, 1975.
16. Gianturco C, Anderson J and Wallace S: Mechanical devices for arterial occlusion. *Am J Roentgenol* **124**:428, 1975.
17. Habighorst LV, Kreutz W, Klug B, Sparwasser HH and Gobel EA: The Gianturco method of spiral embolization of the renal artery. *Fortschr Geb Roentgenstr Nuklearmed* **128**:47, 1978.

