tion (RFA), high intensity focused ultrasound (HIFU), laser and microwave coagulation. These new modalities are currently being administered laparoscopically or percutaneously; ultimately, completely extracorporeal techniques may be feasible.

The primary mechanism of tissue destruction with RFA is thermonecrosis. Radio-frequency energy causes high frequency current flow from the needle electrode into the surrounding tissue. This causes ionic agitation, molecular friction, cellular warming with rapid dessication and cell death. The size and configuration of the lesion are related to the amount of energy delivered, ablation time, tissue impedance, electrolyte content of the tissue and surface area of the electrode. It is a major technical challenge to control for each of these variables independently.

The major concern with RFA and related ablative technologies is the ability to image the destructive process precisely as it is being administered, thereby minimizing injury to normal adjacent parenchyma while assuring complete tumor ablation. Since a surgical specimen is not removed for pathologic study, histologic documentation of complete tumor destruction and accurate tumor staging/grading are not available. Meticulous long-term clinical and radiographic follow-up of treated patients is ultimately needed to validate the efficacy of ablative techniques such as RFA for treating renal malignancy.

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PII: S1078-1439(01)00169-7

Laparoscopic partial nephrectomy: the European experience. Rassweiler JJ, Abbou C, Janetschek G, Geschke K, *Department of Urology, Klinikum Heilbronn, University of Heidelberg, Germany*

Urologic Clinics of North America 2000;27:721–36.

Laparoscopic partial nephrectomy is technically difficult but oncologically effective. The operation should be performed in centers with expertise. Hemostasis can be achieved using bipolar coagulation and fibrin glue-coated cellulose. Further studies will determine whether less invasive alternatives (focused ultrasound, cryotherapy) will meet the high standard of open (or laparoscopic) nephron-sparing surgery for small renal cell carcinoma.

Commentary

The technique of laparoscopic partial nephrectomy for the treatment of renal cell carcinoma (RCC) is in its very early stages. The cumulative experience reported in the literature comprises fewer than 100 cases and these have been confounded by a lack of standardized technique and variable experience. There has been difficulty in reproducing the essential elements of open partial nephrectomy using contemporary laparoscopic instrumentation. In this large multicenter European study, hemostasis was achieved with bipolar coagulation and fibrin-coated cellulose. Notwithstanding that case selection was limited to very small ($\leq$3 cm) peripheral renal tumors, the morbidity of partial nephrectomy in this study was greater than that of open partial nephrectomy for small peripheral tumors.

At the Cleveland Clinic, we have recently developed a technique for laparoscopic partial nephrectomy which duplicates established open surgical principles. The key technical steps in this approach include:

1. Preparation of the renal hilum,
2. Renal mobilization preserving the perinephric fat covering the tumor,
3. Laparoscopic flexible ultrasonography,
4. Scoring the renal parenchyma along the proposed line of resection,
5. Intravenous mannitol,
6. Clamping the renal artery and vein,
7. Ice-slush hypothermia (if needed),
8. Excision of the tumor,
9. Suturing of the collecting system if necessary, and
10. Repair of the parenchymal defect using surgical bolsters and mattress sutures.

Since August 1999, this technique has been used to perform laparoscopic partial nephrectomy in 36 patients with small, exophytic renal tumors. Mean tumor size was 2.9 cm (range 1.4–7.0 cm). The operation was successful in all cases without any open conversions. Mean operative time was 2.9 h, warm ischemia time was 20 min and blood loss was 237 ml. Formal calyceal suture repair was performed in 7 patients. Mean hospital stay was 1.7 days. The final pathology revealed renal cell carcinoma in 20 patients and other tumors in the remainder. All margins of resection were negative for tumor.

Our initial experience suggests that laparoscopic partial nephrectomy can be performed for small exophytic renal tumors with adherence to established principles and techniques of the open surgical approach and with significant benefits for the patient.

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PII: S1078-1439(01)00170-3