Combined radiofrequency-surgical debulking of advanced abdomino-pelvic tumors

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Abstract

**Background:** Advanced abdomino-pelvic tumors are often unresectable using surgery alone. The current study evaluated a combination of radiofrequency (RF) ablation (RFA) and surgical debulking for such lesions.

**Methods:** Between July 2003 and November 2004, we treated 16 patients. Fourteen had either pelvic side wall (n = 8), sacro-iliac joint (n = 4), or vertebral (n = 2) fixation. One tumor engulfed root of mesentery, the last involved stomach-liver-vena. All patients had received prior treatment. The RF probe was placed in the center of the tumor, a 4- to 6-cm tissue core ablated, and the core curetted out or aspirated. This was repeated centrifugally out to the tumor capsule.

**Results:** Control of the target lesion for more than 6 months was achieved in 10 (62%) patients; 2 died within 3 months, and 4 had tumor progression in less than 6 months. Median survival is 18+ months.

**Conclusions:** Combined RFA–surgical debulking was feasible and beneficial in 62% of patients with otherwise inoperable abdomino-pelvic tumors. © 2006 Excerpta Medica Inc. All rights reserved.

**Keywords:** Abdomino-pelvic tumors; Radiofrequency ablation; Surgical debulking

Locally advanced abdominal or pelvic tumors that are unresectable because of anatomic constraints (tumor fills the pelvis, or is adherent to aorta, vertebrae, or root of mesentery, etc.), limited patient reserve, or refusal of necessary surgery, are usually incurable. This is particularly so if the tumor has failed to respond to irradiation, chemotherapy, or both modalities.

Over the years, we periodically attempted to debulk such lesions using a combination of standard electrosurgery and stepwise debridement. The approach routinely failed because of tissue dessication or charring around the electrode, resulting in limited tumor ablation and poor control of bleeding at any depth.

Radiofrequency (RF) ablation (RFA) is an emerging technology for tissue destruction that leads to less dessication/charring around the electrode, and deeper tissue heating, than standard electrosurgery. With it, one can ablate much larger and deeper seated tumors than in the past. RFA is employed when resection is either not feasible or is deemed excessively morbid. Most experience to date has been with RFA of liver tumors, although there is increasing use in other sites [1]. Suitable targets can be treated by open surgery, laparoscopically, or percutaneously, and the ablated tissue is left in situ, to absorb over time. However, complete ablation of tumors over 4 to 5 cm has often proven difficult with this approach. Furthermore, it can result in abscesses and/or damage to surrounding structures when used for tumors outside the liver [2–4].

We postulated that these barriers to treatment of extrahepatic disease might be overcome by piecemeal removal of ablated tissue and stepwise reapplication of the RF probe. The present report is an institutional review board–approved review of our initial results.

**Material and Methods**

Between July 2003, and November 2004, 16 patients were treated (9 men, 7 women, age range 28 to 84 years). Five had primary tumors, 11 had recurrent cancer. Histology was adenocarcinoma in 8 patients, sarcoma in 6, adre-
nocortic cancer in 1, and squamous carcinoma in 1 patient. All patients had prior therapy: irradiation alone (n = 2), chemoirradiation (n = 12), chemotherapy alone (n = 2). Nine patients had significant preoperative pain; 4 rated their pain as 4 to 6 on a 10-point scale, and 5 as 7 to 10. None had bowel or bladder obstruction.

The reasons patients were considered unresectable are listed in Table 1. Thirteen patients had only local disease at the time of surgery. Two had limited upper abdominal metastases that were resected prior to RFA—surgical debulking of a fixed paravertebral, or iliac fossa tumor. One patient had small bilateral liver metastases accompanying a painful 14-cm recurrent iliac fossa sarcoma.

Methods

All patients had open surgery. When possible, temperature probes were placed at the periphery of the lesion to protect adjacent tissue. The RF probe was initially placed in the center of the tumor and heated for 10 to 12 minutes to create a 4- to 6-cm necrotic core. The ablated tissue was removed by curettage or aspiration, depending on consistency. The probe was reapplied and the heat/curette–aspirate cycle repeated in a stepwise centrifugal manner out to the tumor “capsule” (Fig. 1). The “capsule” (hopefully sterilized) was peeled away from surrounding structures if possible but left in situ if this did not occur easily. The bed was then drained.

This approach was taken rather than overlapping application of the RF probe to the intact tumor for several reasons: (1) to ensure more precise probe placement, and tissue ablation, in the depth of the tumors; (2) to limit thermal damage when approaching surrounding structures; and (3) to minimize the amount of retained necrotic tissue.

For the study, success was considered control of the target lesion for at least 6 months. Failure was death from any cause within 3 months of surgery, or tumor progression in the treatment field within 6 months. Nonfatal complications and overall survival were also evaluated; GraphPad Prism, Version 4 for Windows (GraphPad Software, San Diego, CA) was used for the latter.

Results

Ten patients (62%) are considered a success (Table 2; 5 (31%) remain free of disease at 27 to 30 months. Two of these patients had large pelvic tumors (sarcoma, adenocarcinoma) felt resectable only by hemi-corpectomy. A third presented with a 10-cm mesenteric desmoid that splayed out, and was adherent to, the proximal superior mesenteric artery and vein. A fourth patient had gastric cancer directly invading and occupying most of the left lobe of the liver that was adherent to the vena cava. The final patient in this group had recurrent rectal cancer adherent to the sacrum at S2. Two of these patients (pelvic sarcoma, mesenteric desmoid) had a second debulking 6 and 12 months after the first.

Five patients were controlled locally for 6 months but then progressed: 3 at local and at distant sites, 2 at only distant sites. The 3 local failures were in patients with high lateral pelvic or sacro-iliac disease, and who refused hemipelvectomy. The other 2 patients had fixed peri-aortic disease.

Six patients were failures at the outset. Two (peri-aortic or pelvic sarcoma) survived surgery, but died of failure to thrive within 3 months, and are considered local treatment failures. Four others died of uncontrolled local disease (n = 4), or local and distant disease (n = 1) between 3 and 6 months. Two of these patients had advanced iliac wing tumors, 1 had a large pelvic cancer, and the last had peri-aortic disease. Taken together the total local failure rate was 9 of 16 (56%).

Nine patients had significant pain at the outset; 5 (55%) had a 50% or greater reduction in analgesic requirements after treatment. Three (19%) patients had significant complications: osteonecrosis of the iliac wing (n = 1), damaged external iliac artery requiring a stent (n = 1), nonhealing posterior buttock flaps (n = 1). Overall survival is shown in Fig. 2; the median is 18+ months.

Comments

Curative resection of abdominal and pelvic malignancies has traditionally involved en bloc removal of the tumor and a margin of normal, uninvolved, tissue, i.e., an outside-in approach. With some exceptions, lesser procedures, such as debulking, have had limited benefit. However, the en bloc

Table 1

<table>
<thead>
<tr>
<th>Reasons patients were “unresectable”</th>
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<tbody>
<tr>
<td>Tumor fills pelvis; no room for exposure (n = 3)</td>
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<tr>
<td>Adherence to sacro-iliac joint or lateral pelvis; hemipelvectomy refused (n = 5)</td>
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<tr>
<td>Peri-aortic disease fixed to vertebrae (n = 4)</td>
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<tr>
<td>Adherence to sacrum at S2 (n = 1)</td>
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<tr>
<td>Lesion engulfs root of mesentery (n = 1)</td>
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<tr>
<td>Adherence to pelvic side wall and prostate; refuses exenteration (n = 1)</td>
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<tr>
<td>Tumor involves stomach, liver, vena cava (n = 1)</td>
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Table 2

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<th>Site (no. of patients)</th>
<th>Success</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>True pelvis (5)</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>False pelvis (5)</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Peri-aortic (4)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Root of mesentery (1)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Stomach-liver-vena cava (1)</td>
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tients, it was not possible to adequately coagulate tumors abutting the aorta or vena cava, which acted as heat sinks, protecting the lesion. In a third patient, we were unable to adequately heat the periphery of a large tumor filling the pelvis and invading the side wall. Conversely, in 3 cases, overheating of adjacent tissue did occur (despite presence of temperature probes), resulting in osteonecrosis, or damage to a major artery.

Because of this, determining the best candidate for such treatment is difficult at present, as both successes and failures occurred in similar clinical situations. Hopefully, this will be less of a problem in the future.

The finding of 31% long-term survival is encouraging, but, not readily explained. It suggests that perhaps up to one third of patients who present with seemingly isolated bulky abdominal or pelvic tumors, in fact, have no distant metastases at that time. Thus, if their local disease can be eliminated by one means or another, they become long-term survivors.

References

Discussion
Courtney Scaife, M.D. (Salt Lake City, UT): This approach is an older technique with a new and unique application. I have 3 questions. First, in these patients you quote the survival as the outcome as far as recurrence of disease in these patients, but were these patients symptomatic and did your treatment afford any benefit in symptoms or quality of life of these patients? Second, what was the benefit of...
aspiration of the cavity? That’s a unique approach to radiofrequency ablation. Did that improve your margin control and how did that modify your radiofrequency ablation technique? Third, have you considered adjuvant treatment to this cavity? For example, the injection of chemotherapy or ethanol ablation after the radiofrequency ablation of this cavity?

James Chandler, M.D. (Boulder, CO): In the 1960s through the early 1980s, Abraham Strauss of Chicago, George Crile Jr. of Cleveland, and John Madden of New York independently advocated extensive radiofrequency ablation for even operable low-lying rectal tumors. All three believed that the destroyed cells evoked a tumor-specific, immune reaction that greatly potentiated electrosurgicalization’s efficacy. In fact, the depth of their belief was such that Dr. Crile once told me “I should be ashamed of every abdominal perineal resection I have done because these lesions could be eliminated by this far simpler technique without sacrificing sphincter function.” About a third of your cases did considerably better than one might expect from inside-out bulk reduction. I urge you to look for tumor specific antibodies or primed killer cells in your cases.

Robert Sticca, M.D. (Grand Forks, ND): This is a very difficult group of patients. In many cases when you can resect these bulky pelvic tumors, the patient’s quality of life after resection is poor. I have 1 technical question. When you ablate these lesions, do you then cut open the tumor and scoop the tumor out. This is different than my experience with ablation as the tumor is usually not liquefied immediately after ablation—it’s just more of a solid coagulated mass. The second question—I thought the fact you had 5 people alive with no evidence of disease after almost 2 years was very interesting. That goes really against all oncologic principles that we were taught, i.e., that you need to resect tumors with at least a centimeter, and preferably two centimeter margin of normal tissue. Is there an immunologic response? How come these patients did not recur? Lastly, did you look at the quality of life in your patients? Do you feel they had a better quality of life than they would have had with a more definitive resection?

John Potts, M.D. (Houston, TX): What about collateral damage to the bowel? Would you use this approach in a tumor in which you saw loops of small or large bowel approaching and exiting?

Nathan W. Pearlman, M.D. (Denver, CO): Dr. Scaife, all patients except for one (the tumor at S2) were all symptomatic at varying degrees. Essentially everybody symptomatically improved. They didn’t have all the pain go away, but their narcotic requirements were reduced by at least 70%. Now, the benefit of aspiration—this is a conceptual issue. Traditional tumor surgery comes at the tumor from this way—outside-in—and it encompasses that if it’s going to be successful for the most part except in ovarian cancer or other debulking operations with a margin of normal tissue. Well, when the margin is the vertebral column, the aorta, the root of the mesentery, or the entire pelvis, you run up against problems with patient acceptance or anesthesiologist acceptance or the hospital acceptance of that approach. They won’t let you do these things to people any more. In the old days you could do a fair amount of hemi-coagulated mass. The second question—I thought the fact you had 5 people alive with no evidence of disease after almost 2 years was very interesting. That goes really against all oncologic principles that we were taught, i.e., that you had 5 people alive with no evidence of disease after almost 2 years was very interesting. That goes really against all oncologic principles that we were taught, i.e., that you need to resect tumors with at least a centimeter, and preferably two centimeter margin of normal tissue. Is there an immunologic response? How come these patients did not recur? Lastly, did you look at the quality of life in your patients? Do you feel they had a better quality of life than they would have had with a more definitive resection?

Dr. Sticca, in terms of why this approach might work where standard electrosurgical frying the lesions of the past hasn’t. For those of you who have tried this stuff with bovi controlling the bleeding in the depths of the lesions, it is virtually impossible. Theses things always have an extensive blood supply and it is coming up from below and turning up the bovi your electrical system accepts, it doesn’t seem to work. So the radiofrequency coagulation system works a lot better and you can go deeper with it and actually coagulate down to a certain depth. Whether the tumor is solid or liquefied depends a little bit on its consistency to start with. Liposarcomas are sarcomas in general tend to actually liquefy, you can cook the whole thing and we were having a little trouble getting it out until somebody suggested this dilatation and extraction device which since this technique of treating pregnancies that are rapidly being outlawed. Look around your hospital and hang on to these things. It works great. It is a big tube. You put it in and the tumor is gone. Solid tumors require more so you have to go in with different kinds of tools that are very precise such as an ice cream scoop or a sharpened spoon. You get down to where it starts bleeding, then you reapply the probe and go from there. Now, in terms of symptom improvement. We really didn’t look at that. Most of the patients who are alive claim they are better off than they would have been alternately. So I have to leave it at that in terms of quality of life change.

Dr. Potts, we have tried fancy temperature probes. They are okay, but they don’t measure exactly the borderline with all the bowel, so it comes down to your fingers. When your fingers get too hot at the edge of the tumor, I figure it is too hot for the bowl and that’s about it. If you can get your finger around it in places, but in other areas with the damage where we couldn’t actually get out to the vessels of the pelvic sidewall, we did create some damage. You can cook anything with this approach. The people who sell you Rita machines that you can’t create damage with it in the liver and blood vessels. You can create damage with anything.