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Palliative Radiofrequency Ablation for Recurrent Prostate Cancer

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Abstract

Percutaneous radiofrequency ablation (RFA) is a minimally invasive local therapy for cancer. Its efficacy is now becoming well documented in many different organs, including liver, kidney, and lung. The goal of RFA is typically complete eradication of a tumor in lieu of an invasive surgical procedure. However, RFA can also play an important role in the palliative care of cancer patients. Tumors which are surgically unresectable and incompatible for complete ablation present the opportunity for RFA to be used in a new paradigm. Cancer pain runs the gamut from minor discomfort relieved with mild pain medication to unrelenting suffering for the patient, poorly controlled by conventional means. RFA is a tool which can potentially palliate intractable cancer pain. We present here a case in which RFA provided pain relief in a patient with metastatic prostate cancer with pain uncontrolled by conventional methods.

Keywords

Palliation; Prostate cancer; Radiofrequency ablation

Percutaneous radiofrequency ablation (RFA) is a minimally invasive local therapy for cancer. Its efficacy is now becoming well documented in many different organs, including liver, kidney, and lung. The goal of RFA is typically complete eradication of a tumor in lieu of an invasive surgical procedure. However, RFA can also play an important role in the palliative care of cancer patients. Tumors which are surgically unresectable and incompatible for complete ablation present the opportunity for RFA to be used in a new paradigm. RFA for palliation of metastatic bone pain was described as early as 1998 and RFA for soft tissue tumor pain palliation as early as 2000 [1-4]. Goetz and coworkers also described the use of RFA in a multicenter trial for the treatment of painful metastases [5].

RFA is a tool which can potentially palliate intractable cancer pain. Cancer pain runs the gamut from minor discomfort relieved with mild pain medication to unrelenting suffering for the patient, poorly controlled by conventional means. We present here a case in which RFA provided pain relief in a patient with metastatic prostate cancer with pelvic pain uncontrolled by conventional methods.

Case Report

A 72-year old man presented with urinary retention and hematuria. He underwent a transurethral resection of the prostate for Gleason grade VII prostate cancer. Six months later, he received radiation therapy for sacral pain from bone metastases. He responded to weekly taxotere and thalidomide until stopping the protocol secondary to peripheral neuropathy. Four years later, he presented with metastatic prostate cancer, refractory to hormone blockade, in

the pelvis and sacrum. The 5.4 × 4.0 cm soft tissue mass abutting the bladder caused significant pain, hematuria, and interference with quality of life (Fig. 1).

The pain caused by the soft tissue mass was unrelieved by pain medications including opioid analgesics and was not amenable to surgical removal. RFA was offered as potential palliative treatment. The patient underwent extensive office consultation and written informed consent was obtained.

The patient was placed in a supine position in the interventional CT suite, general anesthesia was used, and the subcutaneous tissues were anesthetized with 1% lidocaine. The monopolar RF alternating current was delivered by a 17 gauge single needle probe with a 200 watt, 480 kilohertz RF generator (Radionics, Burlington, MA, USA) (Fig. 2). The current was initially set to 1.0 amp for 1 min to heat the tissue slowly. A rectal thermometry probe was placed (Celsion, Columbia, MD, USA). Current was on for a total of 10 min, but treatment was interrupted by two elevations in rectal temperature with subsequent cooling [6]. Necrotic tissue was seen in the tumor immediately after RFA (Fig. 3).

The patient reported a pre-RFA worst pain level of 5 on a 10-point scale, which subsequently decreased to 2/10 at 24 hr post-RFA. Although patients typically experience pain in the hours immediately following RFA, the patient in this case reported minimal pain after the procedure. Interference with sleep went from 5/10 pre-RFA to 0/10 at 24 hr post-RFA. These changes remained the same 1 week later. The Gracely pain intensity scales (digital and verbal 1-20 pain sensation and tolerability scales) went from 10/20 (“strong and very unpleasant”) to 2/20 (“faint”) at 24 hr and 5/20 (“slightly unpleasant and mild”) at 1 week post-RFA. Pelvic pain at a 5 week follow-up was minimal according to the patient. He reported occasional gross hematuria at that time. He continued to take rofecoxib, acetaminophen, and oxycodone tablets for non-pelvic pain. A follow-up CT scan at 8 months post-RFA revealed increasing enhancement within the tumor (Fig. 4), but the patient stated his pain had continued to improve gradually, and he was nearly pain-free at this point. Pain at a 2 year follow-up was again reported by the patient to be minimal. He reiterated being extremely satisfied with the results of the procedure. At the most recent follow-up, nearly 3 years after the procedure, the patient stated that his pelvic pain has returned, and he characterized it as “mild”. He now also has pain at the sites of new bony metastases.

Discussion

Pain control amongst cancer patients is a major health care and quality of life concern. Thirty percent of patients have pain at diagnosis, while 65-80% have pain when disease is advanced [7]. The pain associated with malignancy can be severe and resistant to conventional analgesics. Pain may be caused by a number of factors, including tumor impingement on adjacent structures or directly on nerves, increased local or intratumoral interstitial pressure, release of cytotoxic substances by the tumor, as well as side effects of antineoplastic medication. It should be noted that direct pain from growth of the primary neoplasm is an unusual cause of pain in the patient with recurrent or metastatic prostate cancer; rather, pain is more often the result of bone metastases and is multifocal.

Pain medications remain the definitive treatment for cancer-related pain. However, direct nerve impingement may not respond to these medications, requiring local debulking procedures. An effective minimally invasive technique such as RFA may prove to be an option in candidates with nerve impingement due to tumor mass or for those who do not respond to pain medications for other reasons. RFA could provide an answer for patients with few other effective options for pain associated with malignancy. RFA is less invasive and may prove to be safer and more cost-effective than traditional local treatment options for cancer such as surgical resection and

radiation. Shetty et al. [8] found that percutaneous RFA is a cost-effective treatment strategy compared with palliative care alone in the treatment of hepatocellular cancer and colorectal liver metastases.

During RFA therapy, the patient is made into a circuit with grounding pads, and monopolar alternating current in the radio-frequency range is deposited in the tissue surrounding an exposed needle. Cell death is dependent on time, temperature, and tissue type. Typically, at temperatures higher than 50 °C tissue undergoes coagulation necrosis. A rectal thermometry probe (Celsion, Columbia, MD, USA) was used in this case and has been previously described in this setting [6]. An interstitial temperature probe such as this can be used in this setting; however, adequate temperature surveillance over the entire treatment field may not always be possible because only a few probes can be placed into any given organ. As a result, MR thermometry has been gaining attention as a potential method of non-invasive thermometry, since it is possible to map heating of the target tissue as well as adjacent structures during therapy [9].

RFA may provide pain relief through a number of theoretical mechanisms: decreased tumor compression on adjacent structures, necrosis of pain fibers, a decrease in local or intratumoral interstitial pressure, and/or a decrease in cytotoxic substances released from the tumor itself. A tumor-free margin may not be required when RFA is used solely as a palliative measure. RFA often provides rapid pain relief, with many patients reporting relief of symptoms within hours or days, whereas radiation therapy typically relieves pain over the course of weeks [10].

Many ablative methods have been used to treat cancers of the liver, prostate, and kidney. Cryosurgery, microwave ablation, laser ablation, and pulsed or continuous RFA have also all been used for neurolysis as a means of pain control. Initial reports of direct soft tissue tumor ablation suggest that RFA may be effective palliative therapy [3]. In a recent study by Callstrom et al. [10], RFA was shown to be effective as a palliative measure for painful osteolytic metastasis. Relief of pain was substantial amongst the 12 patients followed over 6 months. Most patients reported reduction in their use of analgesics at some point after RFA [10]. RFA has been used with a high success rate for over 10 years to treat benign bone tumors such as osteoid osteoma and their associated pain. There is also evidence that radiofrequency neurotomy has an important role in the management of trigeminal neuralgia, nerve root avulsion, and spinal pain [11].

RFA has been used for the treatment of primary prostate malignancy as well as prostate hyperplasia [12,13]. RFA may be useful for palliation of painful prostate cancer recurrence as systemic treatment options for hormone-resistant prostate cancer are limited. Moreover, it is widely recognized that pain palliation is a clinically relevant endpoint for treatment of metastatic prostate cancer [14]. Chemotherapy, while providing palliation and improved quality of life, has minimal impact on survival. Androgen deprivation is the primary therapeutic approach, alleviates symptoms in a majority of men, and leads to objective responses in soft tissue and bone. Although hormonal therapy may modestly prolong survival, it too is palliative and has no curative potential [15]. Radiation therapy offers a significant potential toward cure and/or remission of localized prostate cancer. Adverse effects from radiation include injury to non-target tissue, similar to the potential risks of RFA.

Adverse effects are common to many cancer therapies. Treatment with orchiectomy or an LHRH analog can result in bone loss and male menopausal symptoms, including hot flashes, loss of libido, impotence, and weight gain [16]. Adverse effects of chemotherapy include nausea, vomiting, fatigue, blood cell dyscrasias, infection, and gastroenteritis. Pain

medications themselves often harbor unwanted side effects such as increasing tolerance, addiction, respiratory depression, and decreased bowel motility, limiting their effective utility.

In comparison, major complications of liver tumor RFA occur about 2% of the time and include intraperitoneal hemorrhage requiring therapy, intrahepatic abscesses, gastrointestinal wall perforation, and hemothorax. The most common minor complications, occurring less than 5% of the time, include self-limited bleeding, pain, effusion, fever, infection, and skin burn [17]. Potential complications of this case include those mentioned above as well as nerve, bowel, bladder, ureter, and vascular injury. Perforation or fistulous connection with these nearby structures is possible. The major risk in this case would be rectal wall perforation. Damage to local nerves may cause urinary incontinence or erectile dysfunction, a relatively common complication associated with conventional prostate therapies.

RFA may be effective in the short-term local control of painful bone and peripheral soft tissue tumors, lessening the need for sedating narcotics. RFA does not replace conventional therapies for recurrent prostate cancer, but may play a role in addition to standard chemotherapy and radiation. Furthermore, prostate cancer metastatic to bone is often multifocal, thus not always lending itself to this focal treatment. While RFA may have potential for pain control of tumor metastases, further research is necessary to characterize and validate its efficacy and side effect profile when used in the setting of cancer pain palliation.

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Fig. 1. Contrast-enhanced pre-RFA CT scan with the patient in the supine position shows a painful perirectal tumor (arrow).

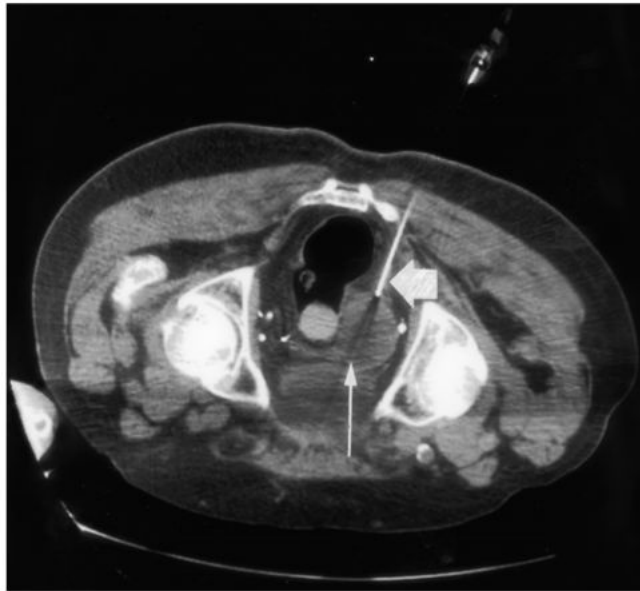


Fig. 2. CT scan with the patient in the prone position during probe insertion. The RFA probe (thick arrow) is on the way to the distal edge of the perirectal tumor (thin arrow). Treatment was performed after deeper insertion to the distal edge of the tumor (thin arrow).

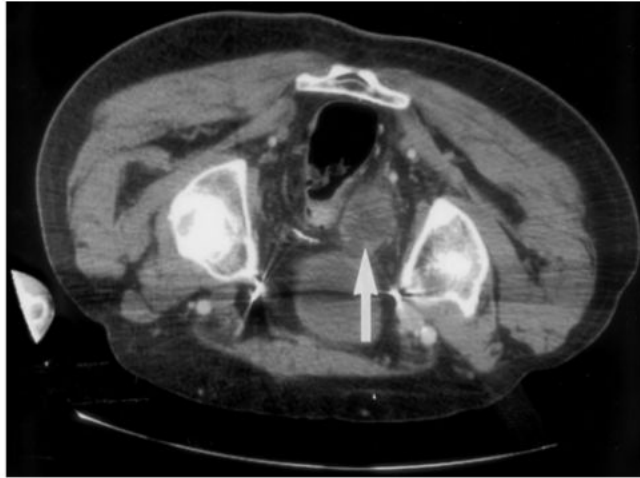


Fig. 3. Contrast-enhanced CT scan immediately after RFA with the patient in the prone position. The necrotic area in the center of the perirectal tumor enhancement post-RFA, but there is minimal residual enhancement at the periphery (arrow). Pain relief occurred despite residual enhancement.

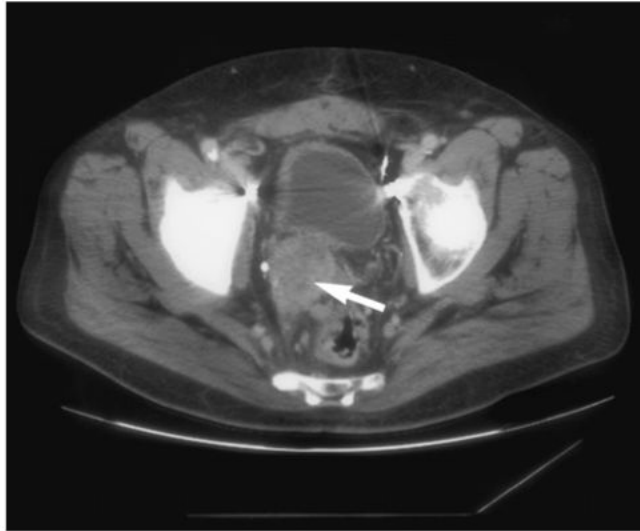


Fig. 4. Contrast-enhanced CT scan 8 months after RFA with the patient in the supine position. The perirectal tumor (arrow) is unchanged in size but there is interval development of enhancement signifying tumor growth.