

Early results of spot-scanning proton therapy with hyperthermia in large inoperable sacral chordomas

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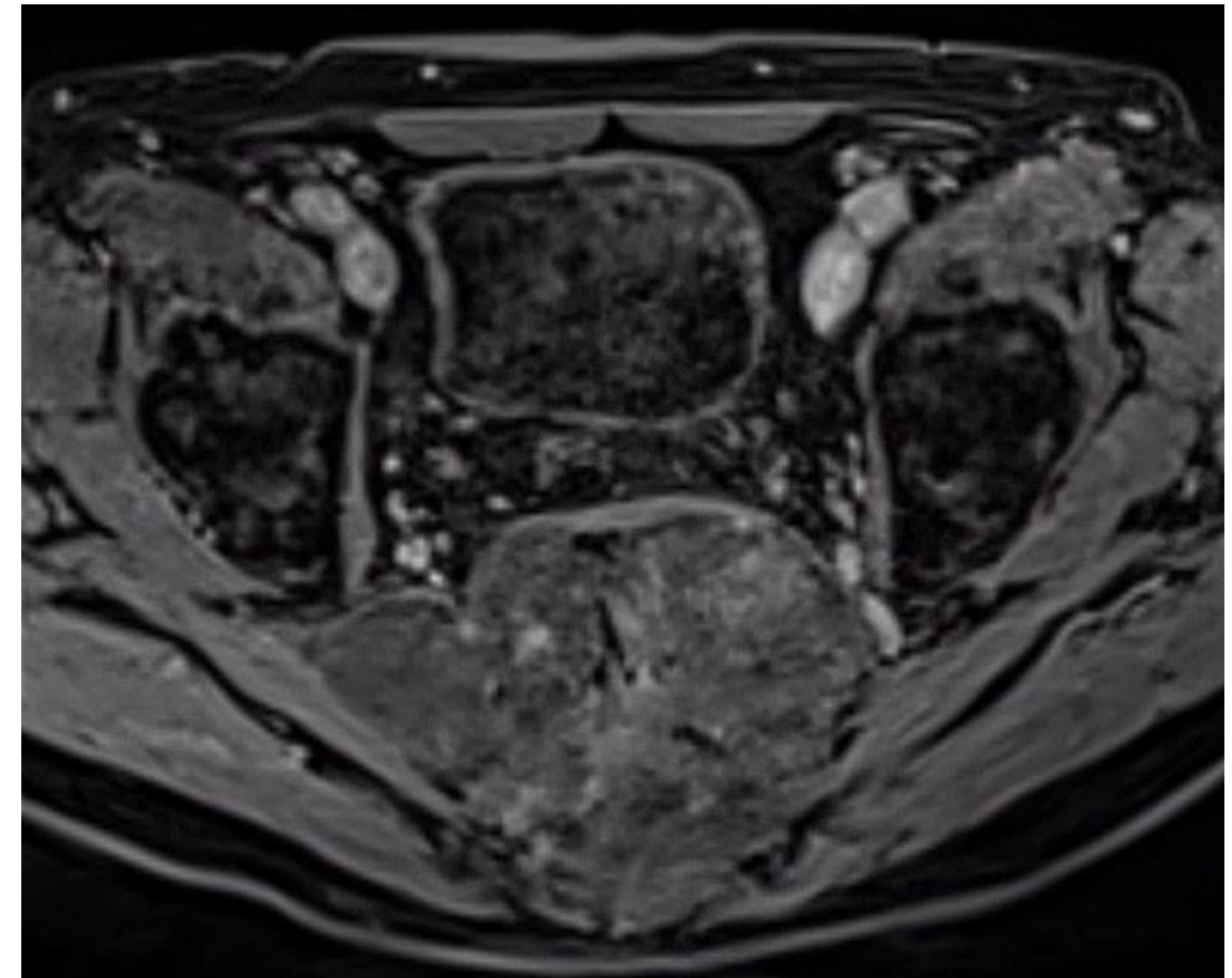
Purpose

Large inoperable sacral chordomas show unsatisfactory local tumor control rates even when treated with high dose proton therapy (PT). The addition of hyperthermia to radiation therapy leads to improved results in the treatment of sarcomas. The aim of this investigation is to analyze the feasibility and early results of a novel treatment in large inoperable sacral chordomas with high dose PT and local hyperthermia (HT).

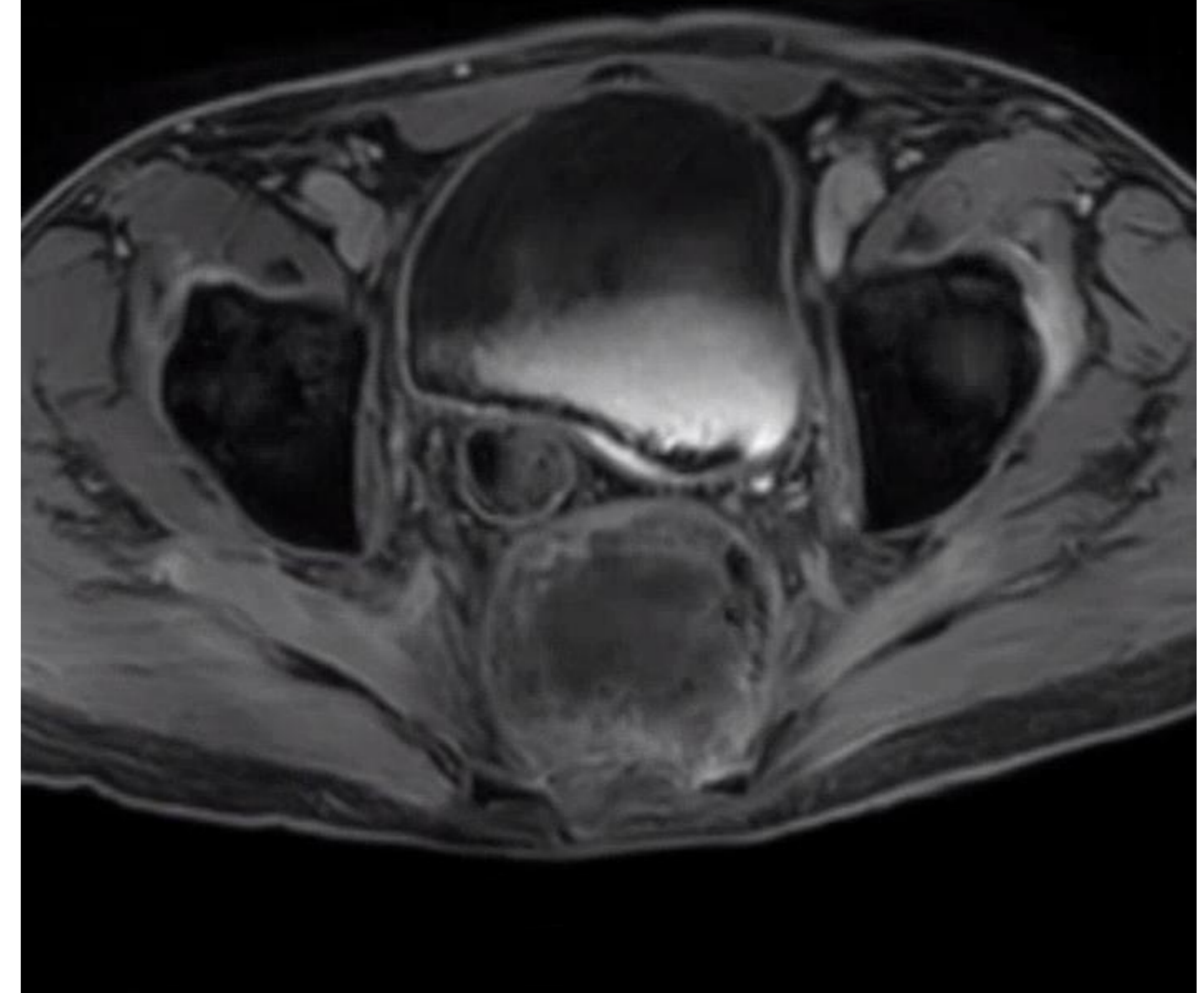
Material and Methods

Eligible patients had histologically proven sacral chordomas. Pencil beam spot scanning proton therapy was delivered with a 250 MeV Cyclotron. Prescribed tumor dose was 70 Gy (RBE) in 28 fractions over 5½ weeks. In 4 (80%) patients, the 70 Gy (RBE) was prescribed to the GTV within a simultaneous integrated boost concept. The PTV, containing the area of possible microscopic disease plus a 7 mm security margin received 56 Gy (RBE). In one patient, the 70 Gy (RBE) was prescribed to the PTV which was the GTV plus 5 mm for CTV and additional 7 mm security margin. Hyperthermia was delivered once a week immediately after proton therapy using the Sigma 60 or Sigma-Eye applicator with the BSD 2000 deep hyperthermia unit. All patients received up to 6 hyperthermia sessions during the proton therapy. Temperature was monitored on the skin, in the rectum, gluteal fold and the urinary bladder. Acute and late toxicity was assessed according to CTCAE v4.

a)



b)



Axial MRI slices of a patient with a sacral chordoma. MRI before (a) and 9 months after (b) proton therapy showing a clear decrease of tumor size.

Results

From June 2016 to October 2017, 5 male patients were treated with PT and HT. Median patient age was 67 years (range, 57-71) and they had a median tumor size of 791 cc (range, 457-1361). Median follow-up (FU) was 6 months (range, 0-9). Median HT session number was 5 (range, 2-6). FU imaging showed slight tumor decrease in 3 patients at 6, 8 and 9 months following treatment. Last MRI showed stable disease in one patient and one patient had no FU imaging yet. Three patients presented initially with pain while two in addition had numbness. Three patients had initial dysuria. All 5 patients developed increased pain during the therapy and needed analgesics. None had ≥ 3 acute or late toxicities. Pain and numbness recovered in all during follow-up.

Conclusion

Early results in patients with large inoperable sacral chordomas undergoing combined treatment of PT and HT are encouraging with no grade ≥ 3 acute and late toxicities. All patients showed a significant reduction in their initial pretreatment symptoms. Early follow-up imaging showed either slight regression or stable tumor size. Initial clinical pretreatment symptoms decreased during FU in all patients. Therapy showed no grade ≥ 3 acute or late toxicities. These results are promising and warrant further confirmation in a prospective trial with a larger number of patients and a longer FU period.