

## Conflict of interest

The authors declare no conflict of interest.

## Approval of the research protocol by an Institutional Reviewer Board

This article was approved by the Nagoya City University Graduate School of Medical Sciences Institutional Review Board (#60-21-0026).

## Informed consent

Written informed consent was obtained from the patient for publication of this article and accompanying images and is available for review by the Editor-in-Chief.

## Registry and the Registration No. of the study/trial

N/A.

## References

- Nadal R, Schweizer M, Kryvenko ON, Epstein JI, Eisenberger MA. Small cell carcinoma of the prostate. *Nat. Rev. Urol.* 2014; **11**: 213–9.
- Palmgren JS, Karavadia SS, Wakefield MR. Unusual and underappreciated: small cell carcinoma of the prostate. *Semin. Oncol.* 2007; **34**: 22–9.
- Aparicio AM, Harzstark AL, Corn PG et al. Platinum-based chemotherapy for variant castrate-resistant prostate cancer. *Clin. Cancer Res.* 2013; **19**: 3621–30.
- Aso T, Sakurai H, Harashima K et al. The synchronization of chemotherapy to circadian rhythms and irradiation in pre-operative chemoradiation therapy with hyperthermia for local advanced rectal cancer. *Int. J. Hypertherm.* 2006; **22**: 399–406.

- Mochi R, Shioya M, Sakurai H et al. Feasibility study of postoperative intraperitoneal hyperthermochemotherapy by radiofrequency capacitive heating system for advanced gastric cancer with peritoneal seeding. *Int. J. Hypertherm.* 2007; **23**: 493–500.
- Ishikawa T, Kokura S, Sakamoto N et al. Phase II trial of combined regional hyperthermia and gemcitabine for locally advanced or metastatic pancreatic cancer. *Int. J. Hypertherm.* 2012; **28**: 597–604.
- Kodama K, Higashiyama M, Okami J et al. Cytoreductive surgery and post-operative heated pleural chemotherapy for the management of pleural surface malignancy. *Int. J. Hypertherm.* 2013; **29**: 653–62.
- Harima Y, Ohguri T, Imada H et al. A multicentre randomised clinical trial of chemoradiotherapy plus hyperthermia versus chemoradiotherapy alone in patients with locally advanced cervical cancer. *Int. J. Hypertherm.* 2016; **32**: 801–8.
- van der Zee J, González D, van Rhooen GC, van Dijk JD, van Putten WL, Hart AA. Comparison of radiotherapy alone with radiotherapy plus hyperthermia in locally advanced pelvic tumors. *Lancet* 2000; **355**: 1119–25.
- Bakker A, van der Zee J, van Tienhoven G, Kok HP, Rasch CR, Crezee H. Temperature and thermal dose during radiotherapy and hyperthermia for recurrent breast cancer are related to clinical outcome and thermal toxicity: a systematic review. *Int. J. Hypertherm.* 2019; **36**: 1024–39.
- Yahara K, Ohguri T, Yamaguchi S et al. Definitive radiotherapy plus regional hyperthermia for high-risk and very high-risk prostate carcinoma: Thermal parameters correlated with biochemical relapse-free survival. *Int. J. Hypertherm.* 2015; **31**: 600–8.
- Takahashi A, Matsumoto H, Nagayama K et al. Evidence for the involvement of double-strand breaks in heat-induced cell killing. *Cancer Res.* 2004; **64**: 8839–45.
- Kokura S, Adachi S, Mizushima K et al. Gene expression profiles of diabetic mice treated with whole body hyperthermia: a high-density DNA microarray analysis. *Int. J. Hypertherm.* 2010; **26**: 101–7.
- Westra A, Dewey WC. Variation in sensitivity to heat shock during the cell-cycle of Chinese hamster cells in vitro. *Int. J. Radiat. Biol. Relat. Stud. Phys. Chem. Med.* 1971; **19**: 467–77.
- Ohtsuka K, Kawashima D, Gu Y, Saito K. Inducers and co-inducers of molecular chaperones. *Int. J. Hypertherm.* 2005; **21**: 703–11.
- Kose S, Furuta M, Imamoto N. HIKESHI, a nuclear import carrier for Hsp70s, protects cells from heat shock-induced nuclear damage. *Cell* 2012; **149**: 578–89.
- Tabuchi Y, Maekawa K, Torigoe M et al. HIKESHI silencing can enhance mild hyperthermia sensitivity in human oral squamous cell carcinoma HSC-3 cells. *Int. J. Mol. Med.* 2012; **46**: 58–66.

## Editorial Comment

### Editorial Comment to Combination therapy with radiation and hyperthermia-induced clinical complete response of small cell carcinoma of prostate

Small cell carcinoma of the prostate (SCCP) is usually treated with chemotherapy, such as cisplatin/etoposide, carboplatin/etoposide, docetaxel/carboplatin, and participation in clinical trials. However, it would be difficult to introduce chemotherapy in elderly patients and patients who have other diseases that affect chemotherapy, such as renal dysfunction and heart failure. The authors reported their experience on whole-pelvic radiation therapy with an additional dose administered to the prostate and concurrent 8-MHz radiofrequency capacitive regional hyperthermia for


sensitizing the effect of radiation therapy for an 87-year-old man with SCCP.<sup>1</sup>

As other modalities of hyperthermia for prostate cancer, high-intensity focused ultrasound (HIFU) has been used for whole-gland<sup>2</sup> and focal therapies.<sup>3</sup> HIFU is an extracorporeal ablative technology that delivers ultrasonic energy to pinpoint the foci only millimeters wide, and only minor temperature changes from 70 to 98.6°C are observed in the focal zone.<sup>3,4</sup> The 8-MHz radiofrequency capacitive regional hyperthermia warms the wide part sandwiched between electrodes to 42°C. Due to the present case having bladder invasion and right obturator lymph node metastasis of SCCP, radiofrequency hyperthermia was appropriately used due to the wide heat effect around the prostate. The safety of the surrounding large abdominal vessels during the radiofrequency hyperthermia<sup>5</sup>

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encouraged the treatment for the lymph node near the large blood vessels.

As a result, the authors encountered an effective case of SCCP treated with a combination of radiotherapy and hyperthermia therapy. For patients who have difficulty in receiving chemotherapy, the present treatment has the possibility to be the novel strategy for SCCP. I would like to pay tribute to the authors' attitude toward patients and their challenging spirit.

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## References

- 1 Kawai N, Nagai T, Naiki-Ito A *et al.* Combination therapy with radiation and hyperthermia-induced clinical complete response of small cell carcinoma of prostate. *IJU Case Rep.* 2022; **5**: 113–6.
- 2 Shoji S, Uchida T, Hanada I *et al.* Analysis of oncological outcomes of whole-gland therapy with high-intensity focused ultrasound for localized prostate cancer in clinical and technical aspects: a retrospective consecutive case-series analysis with a median 5-year follow-up. *Int. J. Hyperthermia* 2021; **38**: 1205–16.
- 3 Shoji S, Hiraiwa S, Uemura K *et al.* Focal therapy with high-intensity focused ultrasound for the localized prostate cancer for Asian based on the localization with MRI-TRUS fusion image-guided transperineal biopsy and 12-cores transperineal systematic biopsy: prospective analysis of oncological and functional outcomes. *Int. J. Clin. Oncol.* 2020; **25**: 1844–53.
- 4 Shoji S, Koizumi N, Yuzuriha S *et al.* Development and future prospective of treatment for localized prostate cancer with high-intensity focused ultrasound. *J. Med. Ultrason.* 2022; <https://doi.org/10.1007/s10396-021-01183-2>.
- 5 Kawai N, Kobayashi D, Yasui T *et al.* Evaluation of side effects of radiofrequency capacitive hyperthermia with magnetite on the blood vessel walls of tumor metastatic lesion surrounding the abdominal large vessels: an agar phantom study. *Vasc. Cell* 2014; **6**: 15.