Case 13062

Eurorad

Osteonecrosis of the sacrum following pelvic radiotherapy

Published on 17.12.2015

DOI: 10.1594/EURORAD/CASE.13062
ISSN: 1563-4086
Section: Musculoskeletal system
Area of Interest: Pelvis
Procedure: Contrast agent-intravenous
Imaging Technique: MR
Special Focus: Neoplasia Case Type: Clinical Cases
Authors: Meixel A, Jobke B
Patient: 87 years, female

Clinical History:

An 87-year-old female patient presented without symptoms for follow-up imaging after treatment for uterine cervix carcinoma including hysterectomy, radiation therapy with 45Gy (weekly fractionation 5 x 1.8Gy) and intracavitary HDR-Brachytherapy (2 x 5Gy). Lab parameters were unremarkable.

Imaging Findings:

No osseous signal changes are visible in MRI 6 weeks after radiation therapy compared to the previous imaging (Fig. 1). Eight months after therapy, there was a minor focal but also diffuse gadolinium uptake adjacent to the left sacroiliac joint (SIJ) and new, spotted signal changes on the T1w-image adjacent to the right SIJ (Fig. 2).
After 18 months, nearly the entire sacrum showed a massive T1w signal increase following contrast administration with a central hypointense area and a peripheral hyperintense signal on the right side of the sacrum (Fig. 3a). There was also a fine hypointense line parallel to the left SIJ, interpreted as an insufficiency fracture (Fig. 3b).
After 40 months, MRI post-Gadolinium demonstrated decreased signal alterations as well as smaller lesions with a circular hyperintense rim and an iso-/hypointense centre on the right (Fig. 4). On the axial T1w image after contrast there were no visible lines suspicious for persistent fractures.

Discussion:

Adverse reactions in healthy, tumor-unaffected tissues are common side effects in the context of radiotherapy (Dalinka et al 1985). The major adverse event of, usually attenuated, irradiation of healthy bone tissue is osteoradionecrosis (ORN). The incidence ranges from 2.1-34% according to literature (Feltl et al 2006). ORN results, inter alia, by vascular damage and damage in bone remodelling cells such as osteoblasts, which often lead to increased cell death (Burgener et al 1991). The extent of vascular damage, the diminished osteoblastic activity and thus the risk for osteonecrosis depends on several factors. Primary causes are treatment-related factors such as the type of irradiation (external radiation and / or brachytherapy), duration and fractionation of the radiation therapy, the total dose of radiation and finally additional potentially toxic therapies such as chemotherapy. Also, the extent of the radiation response depends on individual patient factors such as the patient's age, comorbidities, already preexisting osteopenia, as well as additional medication such as steroids (Mitchell et al 1998).
One sequalae of ORN in the sacrum, which is most commonly affected, is progressive biomechanical bone instability leading to insufficiency fractures. The extent of insufficiency fracture is often subtle (Howland et al 1975). Differential diagnosis to metastatic disease or reactive changes may be difficult. Insufficiency fractures often present in T1-weighted images as fine hypointense lines parallel to the SIJ. Important points to distinguish benign from malignant lesions or masses are the symmetry and the distribution pattern, both, in the entire body as well as in the

irradiated bone. While metastases generally occur in an asymmetrical distribution and frequently multiple lesions are to be found, ORN demonstrate frequently as symmetrical, often bilateral lesions in the radiation-exposed area of the pelvis (Ugurluer et al 2014). Furthermore, secondary sarcomas are rare after radiotherapy and usually occur after a longer latency period of many years following radiation treatment. These lesions show a progressive osteodestructive pattern. Osteoradionecrosis show both, a morphologically and temporally heterogeneous, individual course due to risk factors (osteopaenia, chemotherapy etc.) and complications such as non-/slow healing insufficiency fractures. Often the necrosis is self-limited. Uniform and/or guideline-related treatments do not exist. In conclusion, the above-mentioned radiological changes such as symmetry, sequelae of reversible osseous signal changes and the absence of metastastic evidence within the context of radiation therapy strongly suggests that the findings are conclusive for a combination of reactive inflammatory bone marrow response, radiation-induced osteonecrosis, insufficiency fractures and increased bone remodelling.
Differential Diagnosis List: Healing osteoradionecrosis with secondary insufficiency fracture., Metastatic lesions, Bone marrow oedema, Insufficiency fractures

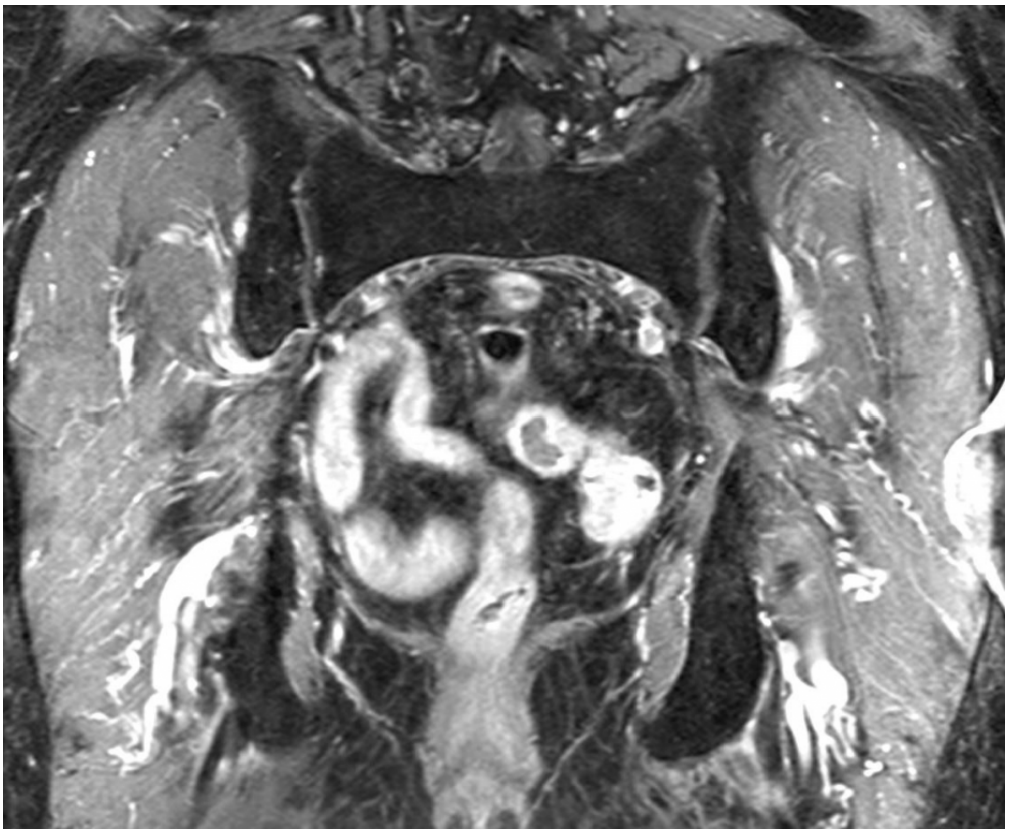
Final Diagnosis: Healing osteoradionecrosis with secondary insufficiency fracture.

References:

Dalinka MK, Mazzeo VP Jr. (1985) Complications of radiation therapy. Crit Rev Diagn Imaging 23(3):235-67 (PMID: 3891233)
Burgener FA, Kormano M (1991) Osteopenia. Differential diagnosis in Conventional Radiology. New York: Thieme Medical Publishers Inc 10-11, 21
Mitchell MJ, Logan PM (1998) Radiation-induced changes in bone. RadioGraphics 18(5): 1125-1136 (PMID: 9747611)
Howland WJ, Loeffler RK, Starchman DE, Johnson RG (1975) Postirradiation atrophic changes of bone and related complications. Radiology 117: 677-685 (PMID: 1188119)
Ugurluer, G., Akbas T, Arpaci T, Oszan N. Serin M (2014) Bone complications after pelvic radiation therapy: Evaluation with MRI. Journal of Medical Imaging and Radiation Oncology 58(3): 334-340 (PMID: 24716673)
Feltl D, Vošmik M, Jirásek M, Stáhalová V, Kubeš J (2006) Symptomatic osteoradionecrosis of pelvic bones in patients with gynecological malignancies—result of a long?term follow?up. Int J Gynecol Cancer Mar-Apr;16(2):478-83 (PMID: 16681714)
Feltl D, Vošmik M, Jirásek M, Stáhalová V, Kubeš J (2006) Symptomatic osteoradionecrosis of pelvic bones in patients with gynecological malignancies—result of a long?term follow-up. Int J Gynecol Cancer 16(2):478-83 (PMID: 16681714)

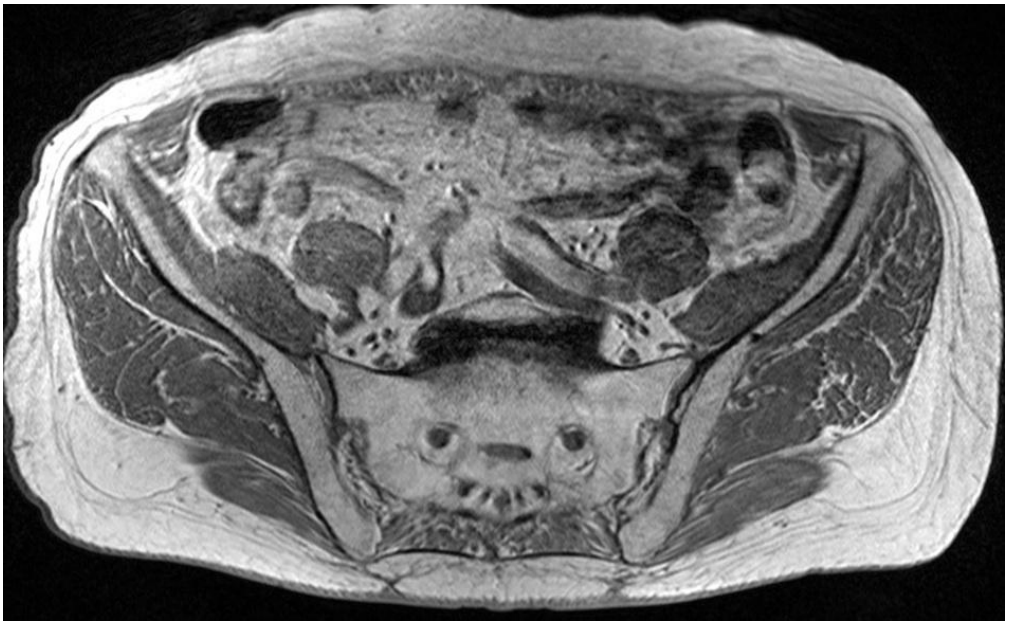
Figure 1

a



Description: T1-weighted TSE fs coronal post Gad: no pathology found in the sacral bone **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germnay

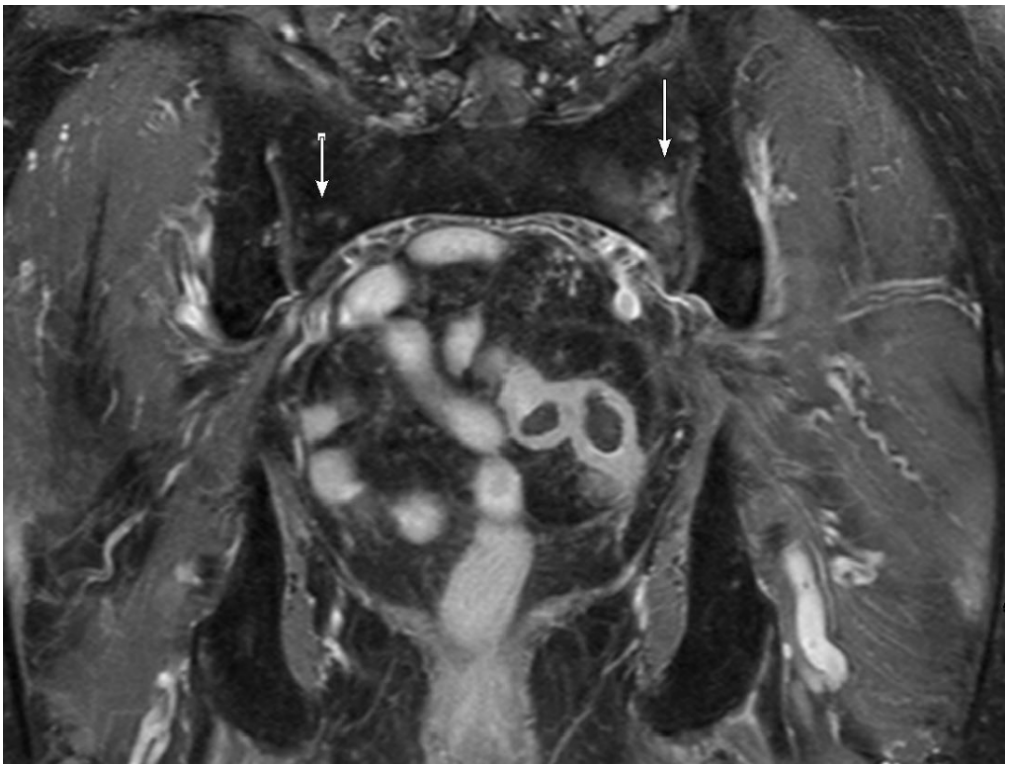
b



Description: T1-weighted VIBE axial: no pathology found **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germnay

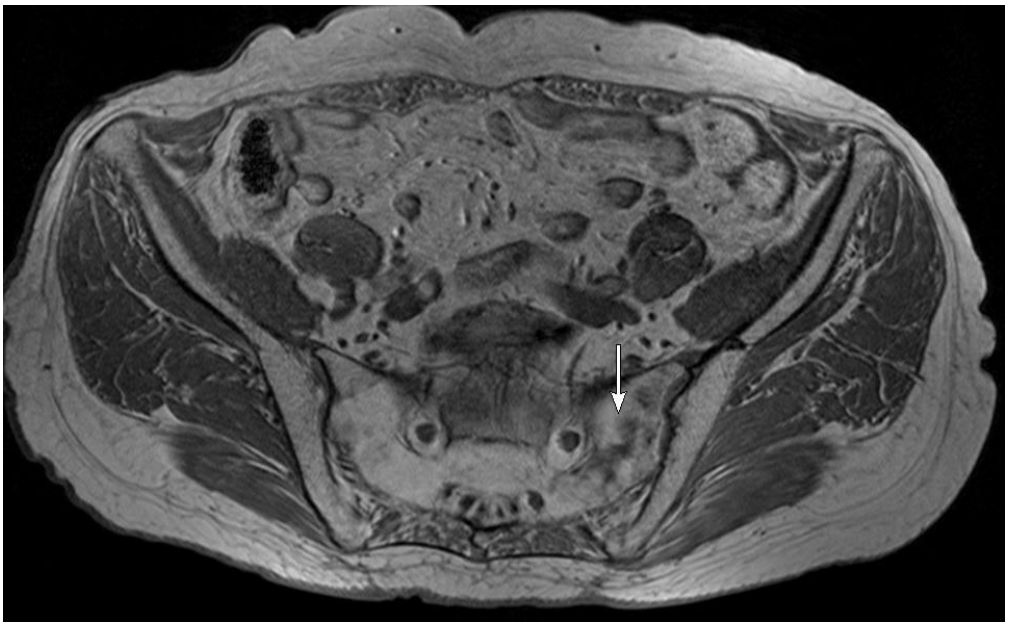
Figure 2

a



Description: T1-weighted TSE fs coronal post Gad: slightly increased focal and extensive diffuse signal increase in the left sacrum adjacent to the SIJ, less evident on the right side. **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germany

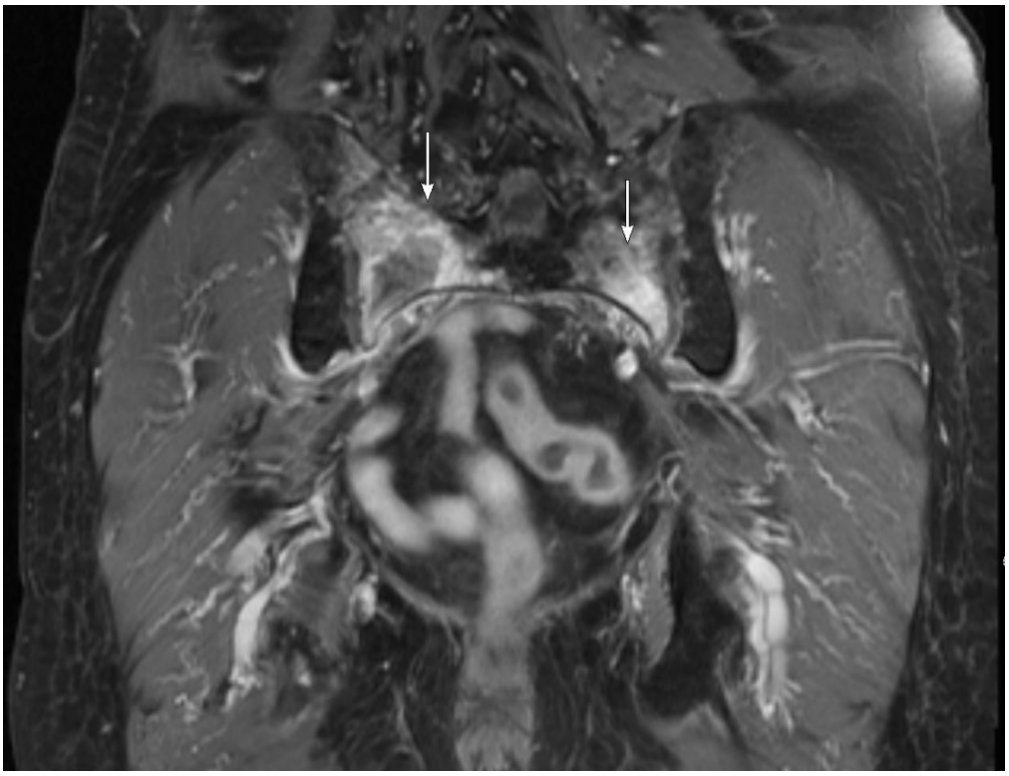
b



Description: T1-weighted VIBE axial: decreased signal intensity within the left massa laterale. **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germany

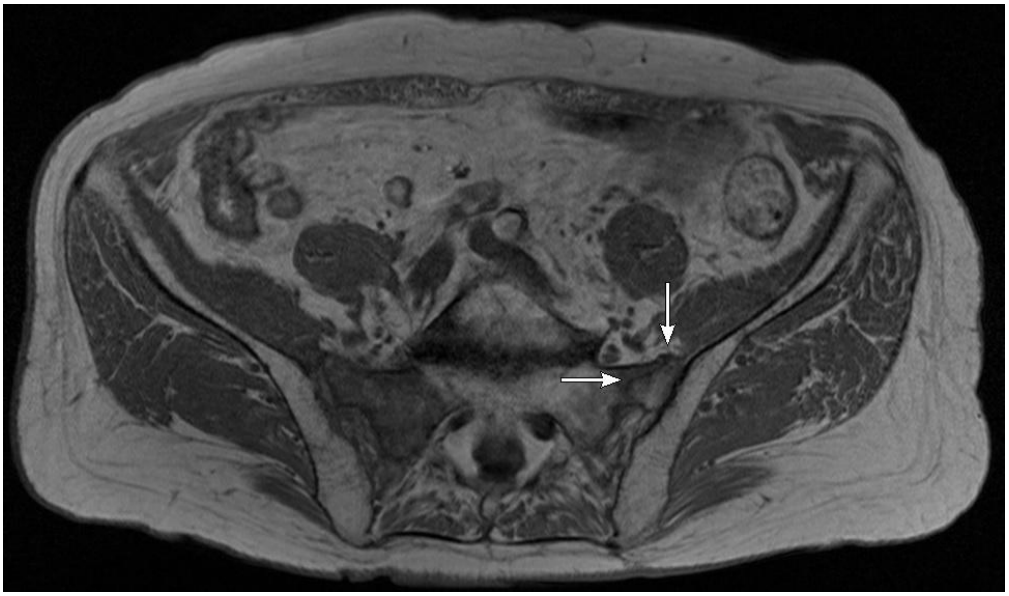
Figure 3

a



Description: T1-weighted TSE fs coronal post Gad: diffuse signal increase in the sacrum bilaterally with a centrally decreased signal area on the right side compatible with osteonecrosis. **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germany

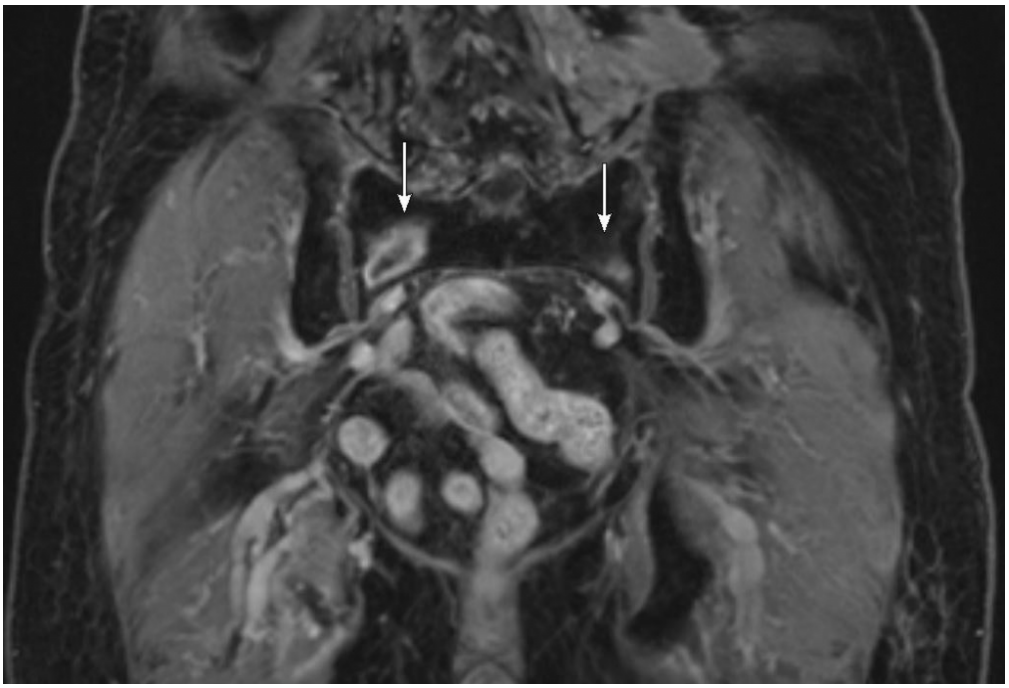
b



Description: T1-weighted TSE axial post Gad: subtle hypointense line in the left anterior massa laterale parallel to the SIJ, compatible with an insufficiency fracture. **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germany

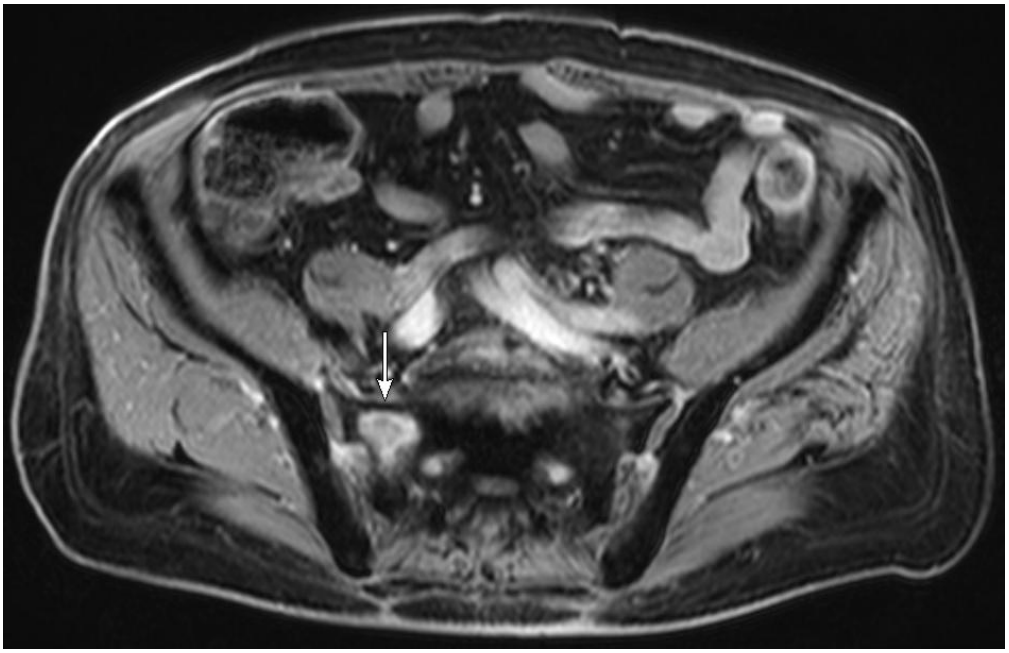
Figure 4

a



Description: T1-weighted vibe fs coronal: decreased signal intensity in comparison to previous imaging; circular hyperintense signal in right massa laterale, subtle hyperintense signal in the left massa laterale. **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germany

b



Description: T1-weighted vibe fs axial post Gad: enhancement in right massa laterale and small residual focal enhancement in left massa laterale. **Origin:** German Cancer Research Center (DKFZ), INF 280, 69120 Heidelberg, Germany