CASE REPORT

Radioisotope-guided laparoscopy: a case report and description of an alternative surgical technique

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Abstract

Prostate cancer is the second most frequent cancer type among men worldwide. With the development of Radiology and Nuclear Medicine technologies, early diagnosis is increasingly common, and the possibility of using new minimally invasive techniques increases. With a narrative review of the literature, this case report describes an alternative radioisotope-guided laparoscopy technique for tumors in the peritoneal cavity. There may be benefits in associating nuclear medicine techniques in the management of patients with non-palpable tumors that are difficult to locate in the peritoneal cavity, enabling the use of less invasive and safer surgical procedures for diagnosis, staging and treatment.

INTRODUCTION

Prostate cancer is the second most frequent cancer type among men worldwide [1, 2]. In Brazil, it is estimated 65 840 new cases for each year of the 2020–2022 triennium, corresponding to a risk of 62.95 new cases/100 000 men [3]. In the world, there are an estimated 1 100 000 cases annually [1].

The main risk factors for the disease are age over 50 years, first-degree family history, black ethnicity, androgen exposure and a high-fat diet. Most patients are asymptomatic; however, hematuria, obstructive and irritative symptoms may appear [1].

There is no definitive consensus on the best management of localized disease, but therapeutic options can be radical prostatectomy, external radiotherapy and active surveillance [4]. The indication of each therapy varies according to each case [1, 4].

For follow-up, total prostate-specific antigen (PSA) dosage is recommended every 6 months for 5 years and annually after that [2]. Therefore, it is considered a possible relapse if two consecutive dosages with values above 0.2 ng/mL, specifically after radical prostatectomy [2]. It is recommended to investigate by imaging exam to diagnose local recurrence or metastasis [2, 4].

With the development of Radiology and Nuclear Medicine technologies, the diagnosis of small lesions that are difficult to locate in the cavity at the time of surgery, becomes increasingly common. These small-sized tumors make minimally invasive approaches to diagnose or treat them more difficult or impossible. Within this context of approaching or re-approach cancer patients, radio-guided surgeries have become feasible and an option for management [5, 6]. Therefore, it may be necessary to establish a bridge between accurate diagnostic techniques such as positron emission computed tomography – PET/CT images with radioisotopes and minimally invasive surgeries, enabling the exact intraoperative location of small hypermetabolic tumoral lesions [7]. Using equipment such as a gamma probe, the surgeon can identify sentinel lymph nodes and preoperatively occult lesions, confirm preoperative markings, and perform less invasive surgeries [5, 6].

This case report describes an alternative surgical technique, perhaps not yet represented in the literature and little used for locating small occult peritoneal tumors. In addition, the narrative review supports the benefit of associating Nuclear Medicine new technologies with the management of these patients.

CASE REPORT

M.J.A.P.P., 74 years old, male, white, mechanical engineer, presented in 2013 decreased urinary stream and altered
rectal exam associated with a total PSA of 8.03 ng/mL and first-degree family history (father) of prostate cancer. Anatomopathological investigation confirmed usual acinar adenocarcinoma, Gleason 8 (4 + 4). The patient underwent a radical laparoscopic prostatectomy (performed by another team). Postoperatively, the total PSA was 0.08 ng/mL, and, due to involvement of the urethral surgical margin, local adjuvant radiation therapy was performed.

The disease remained stable until 2019, when the second consecutive increase in total PSA appeared, being 0.6 ng/mL on 11/26/2018 and 0.81 ng/mL on 01/07/2019. A Gallium-68 prostate-specific membrane antigen positron emission tomography (PET/CT-PSMA) imaging was performed, which showed a peritoneal nodule in the epigastric region, below the stomach and in front of the transverse colon, measuring 1.0 × 0.7 cm, with a significant increase in the expression of the specific antigen of prostate membrane – PSMA (SUV = 18.9). Due to the condition, suspicion of an implant was raised.

After a multidisciplinary team discussion with clinical oncology, surgical oncology and nuclear medicine followed by the patient’s free and informed consent, it was decided to perform diagnostic and therapeutic laparoscopy guided by the radioisotope. The lesion was marked with 0.5 mCi (18.5 MBq) of the radiopharmaceutical MAA-99mTc (macroaggregated human serum albumin) guided by computed tomography and confirmed by a SPECT image (single-photon emission computed tomography). This last image revealed a focal radionuclide concentration area in the upper left abdomen, measuring 3.5 and 5 cm deep from the skin, which did not change its appearance along with the scintigraphic evaluation (Fig. 1).

The following day, a gamma probe-guided laparoscopy was performed, and complete excision of the lesion was possible and uneventful. The lesion corresponded to two irregular fragments of fatty tissue, the largest being 3.0 × 1.3 × 0.5 cm, with an area of nodular aspect, covered by a thin capsule measuring 1.5 × 1.5 × 1.0 cm and, histological sections, exposed to a heterogeneous surface (Fig. 2). The histopathological result confirmed the lesion as a metastatic adenocarcinoma to peritoneal tissue. The immunohistochemistry showed a favorable immunophenotype for the prostate as the primary site showed positive PSMA and NKX3-1 antibodies and weakly positive MUC2. Currently, the patient is under follow-up, with no evidence of active disease.

**DISCUSSION**

Radio-guided surgeries are a reality to several anatomical sites and organs, but they are still not well established for managing tumors of the peritoneal cavity. Sentinel lymph node techniques, for example, are well documented for breast cancer [8] and have also come to be suggested for other types of cancer [9]. These procedures usually consist of techniques using radioisotopes, followed by surgery with lymph node biopsy. They can result in the adequate staging of tumors and surgery with preservation of function [10].

Nowadays, the radioguided occult lesion localization (ROLL) is being used more frequently. In this technique, the lesion is marked with a radiopharmaceutical, such as technetium-labeled albumin macroaggregate, using an image-guided injection, followed by scintigraphy to analyze this marking. Intraoperatively, the lesion is identified with a gamma probe, and the marked tissue is removed [9, 11–14].

Radio-guided surgeries have some advantages over other techniques. Reduces surgical morbidity, can speed up the return to work. It can also make possible biopsies that cannot be performed by different approaches and facilitate the excision of the lesion by precise delimitation associated with the possibility of guided surgery during the procedure, avoiding location errors [15]. As these techniques improve, other clinical applications begin to emerge, making this approach an alternative tool for...
Radioisotope-guided laparoscopy

Figure 2. (A) The probe is localizing the lesion outside the abdominal cavity. (B) The arrow is pointing to the probe inside the abdominal cavity and the dotted circle shows the lesion. (C) Lesion seen by laparoscopy. (D) Removed lesion.

locating primary and metastatic tumors of different origins and various anatomical sites [9].

As noted, these techniques have the potential to establish themselves as a less invasive and safe alternative for diagnosis, staging and treatment that can also be used for peritoneal cavity tumors.

CONFLICT OF INTEREST STATEMENT
None declared.

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REFERENCES
1. Nayara R, Chaves NR, Santos M, Morbeck IAP. Diretrizes Oncológicas Câncer de Próstata [Internet]. 2019 (Cited 23 December 2021). Available from: https://diretrizesoncologicas.com.br/wp-content/uploads/2019/10/Diretrizes-oncologicas_separata_Prostata.pdf.
2. Tanaka T, Yang M, Froemming AT, Bryce AH, Inai R, Kanazawa S, et al. Current imaging techniques for and imaging spectrum of prostate cancer recurrence and metastasis: a pictorial review. Radiographics 2020;40:709–26.
3. Estimativa 2020: incidência de câncer no Brasil [Internet]. INCA - Instituto Nacional de Câncer. 2019 (cited 6 December 2021). Available from: https://www.inca.gov.br/publicacoes/livros/estimativa-2020-incidencia-de-cancer-no-brasil.
4. Schaeffer E, Srinivas S, Antonarakis ES, Armstrong AJ, Bekelman JE, Cheng H, et al. NCCN guidelines insights: prostate cancer, version 1.2021. J Natl Compr Canc Netw 2021;19:134–43.
5. Sajid MS, Parampalli U, Haider Z, Bonomi R. Comparison of radioguided occult lesion localization (ROLL) and wire localization for non-palpable breast cancers: a meta-analysis. J Surg Oncol 2012;105:852–8.
6. Lovrics FJ, Cornacchi SD, Vora R, Goldsmith CH, Kahnamoui K. Systematic review of radioguided surgery for non-palpable breast cancer. Eur J Surg Oncol 2011;37:388–97.
7. García JR, Fraile M, Soler M, Bechini J, Ayuso JR, Lomeña F. Protocolo de cirurgia de resgate guiada por PET/TAC. Resultados con técnica ROLL y sonda PET. Rev Esp Méd Nucl 2011;30:217–22.
8. Duraes M, Guillot E, Seror J, Pouget N, Rouzier R. Ganglion sentinel et chimiothérapie néoadjuvante dans le cancer du sein. Bulletin du Cancer 2017;104:892–901.
9. Bitencourt AGV, Lima ENP, Pinto PNV, Martins EBL, Chojniak R. New applications of radioguided surgery in oncology. Clinics 2009;64:397–402.
10. Sentinel lymph Node Biopsy [Internet]. National Cancer Institute. Cancer.gov; 2019 (cited 6 December 2021). Available from: https://www.cancer.gov/about-cancer/diagnosis-staging/staging/sentinel-node-biopsy-fact-sheet.
11. Frank H, Hall F, Steer M. Preoperative localization of nonpalpable breast lesions demonstrated by mammography. Med Int 1976;295:259–60.
12. Khare S, Singh T, Santosh I, Larioya I, Singh G. Wire- and ultrasound-guided localization: a novel technique for excision of nonpalpable breast tumors. Breast Cancer Basic Clin Res 2020;14:4–7.

13. Samara E, Williams M, Howlett DC. Current applications of ultrasound-guided wire localization in head and neck surgery. Int J Oral Maxillofac Surg 2019;48:443–6.

14. Zaveri S, Rastatter JC, Carter JM, Kim S, Maddalozzo J. Preoperative ultrasound guided wire localization for recurrent or persistent thyroid disease: a series of four cases. Int J Pediatr Otorhinolaryngol 2018;113:67–71.

15. Vidal-Sicart S, Fuertes Cabero S, Danús Lainez M, Valdés Olmos R, Paredes Barranco P, Rayo Madrid JI, et al. Update on radioguided surgery: from international consensus on sentinel node in head and neck cancer to the advances on gynecological tumors and localization of non-palpable lesions. Rev Esp Med Nucl Imagen Mol 2019;38:173–82.