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Radioguided Adrenal Surgery

Access in Complex Situations: Technical Notes

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Abstract: The laparoscopic adrenalectomy is considered as the procedure of choice for the treatment of adrenal hyperplasia and tumor lesions. However, some special situations may limit the use of this method due to the difficulty to locate the gland and perform the lesion excision.

We analyze 2 patients of a left adrenal tumor, explaining how they have overcome the difficulties in both situations. The first case was a patient with a history of intra-abdominal surgery and the other patient suffered from severe obesity.

We performed with the use of the gamma probe, and the 2 cases, was of great help to access and glandular localization. The help of gamma probe test was achieved in the surgical bed, that removal was complete.

The use of the portable gamma probe facilitated the access to the left adrenal gland as well as conducting the glandular excision without delay, despite the difficulties due to the intra abdominal surgery caused by the previous surgery, and in the case of severe obesity.

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Abbreviations: CT = computed tomography, MRI = magnetic resonance imaging.

INTRODUCTION

The radioguided surgery consists in the endovenous administration of a radioactive isotope or radiopharmaceutical a period of time before the surgery, different depending the radiopharmaceutical needed, which is captured by the affected organ. The radioguided surgery has been used for location of the sentinel node in breast tumors, melanoma, and other neoplastic processes. However, so far, it has not been used for the localization of the adrenal gland, especially in intraoperative surgical complex situations.

The authors analyze 2 patients carriers of a left adrenal tumor who have had the opportunity to treat, explaining how they have overcome the difficulties in both situations. The first

case was a patient with a history of intra-abdominal surgery and bearer of a left adrenal adenoma that caused primary hyperaldosteronism. The other patient suffered from severe obesity, and she was affected by Cushing's syndrome whose origin was a left adrenal adenoma.

CASE 1

It was a 51-year-old patient affected of primary aldosteronism caused by a left adrenal adenoma. His medical history reported that he had a midline laparotomy for diffuse acute peritonitis.

The diagnosis of Conn's syndrome was established based on biological and hormonal studies and imaging procedures as the abdominal computed tomography (CT) scan. The CT was able to demonstrate the existence of a left adrenal adenoma. Furthermore, the performance of an adrenal scintigraphy with ¹³¹I-Iodocholesterol was definite, showing intense radiotracer uptake (Figures 1, 2).

Once established the diagnosis and in the absence of contraindications, it was decided to perform a radioguided laparoscopically left adrenalectomy, using the Gagner technique.

The operation was uneventful, and there were no complications. The use of the portable gamma probe facilitated the access to the left adrenal gland as well as conducting the glandular excision without delay, despite the difficulties due to the intra-abdominal adhesions caused by the previous surgery (Figure 3).

The postoperative period evolved without complications, and the patient was discharged uneventful. The diagnosis of the excised piece confirmed that it was a Conn adenoma of 2.5 cm in diameter.

CASE 2:

She is a female, obese (100 kg weight and 40.1 BMI), 68-year-old patient affected by Cushing's syndrome due to a left adrenal adenoma. The clinical history included subtotal gastrectomy due to gastric ulcer 30 years earlier and cholecystectomy.

The diagnosis of Cushing's syndrome was established based on biochemical and hormonal tests, imaging procedures such as an abdominal CT and magnetic resonance imaging (MRI). All of them identified a mass of 4 × 3 cm in diameter in the left adrenal gland.

Once established the indications for surgery, radioguided laparoscopic left adrenalectomy was made by the Gagner technique, which allowed performing an easy removal of the adrenal gland, despite the extremely obese patient. The use of the gamma probe was of great help to access and glandular localization in multi-abdominal adhesions and considerable fat component. Moreover with the help of the gamma probe test was achieved in the surgical bed, that removal was complete. The pathologic diagnosis confirmed that it was an adrenocortical adenoma 3.2 cm in diameter.

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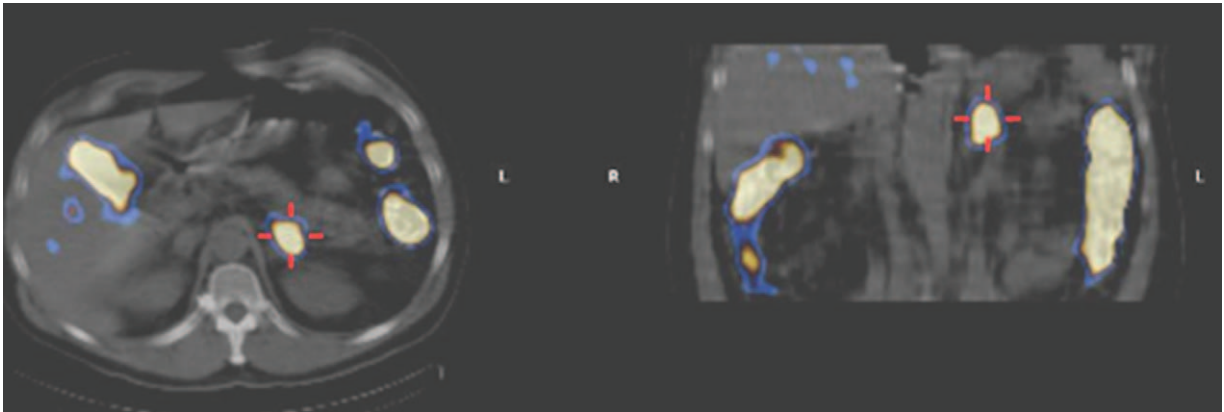


FIGURE 1. SPECT-CT. Intense focal radiotracer uptake in the left adrenal adenoma.

The postoperative course was uneventful, and the patient recovered satisfactorily.

This research followed the principles and standards of the Declaration of Helsinki of 1975, last revised in Seoul in 2008. They have respected the principles of confidentiality and patient autonomy.

In both cases, ethical approval by an ethics committee was not necessary. He was not included in any control group and no experimental treatment was performed.

Both patients were informed of his injury, diagnosis, and treatment. Informed consent was given.

DISCUSSION

The surgical aspects of adrenal disease have changed very little for the last years.¹⁻³ Since the 1990s, especially since Gagner presented his experience in laparoscopic adrenalectomy in 1992, it is an accepted fact that the laparoscopic approach is, in principle, the preferred access on adrenal surgery in all of its forms, either abdominal (anterior or lateral) or retroperitoneal surgical procedure.¹⁻⁴ Nowadays laparoscopic or robotic traditional⁵ ways allows the lesion excision in 83/7% of cases.⁶

Moreover, this is possible without increasing the operative risk and getting a good postoperative time as a result.

In our patients, the duration of the operation is shorter because the radio-probe allows a better location, improves security, and consequently produces minor bleeding. Hospitalization is similar over conventional laparoscopy.

In our cases of particular difficulty the surgical time, with radioguided surgery, was 90 minutes. In papers reviewed the surgical time in cases of no radioguided adrenalectomy and without particular difficulty, the operating time was 110, 120, and 160 minutes 7 to 10. We have not found cases like ours.

There is little bleeding, and there are no differences with scientific literature; Berber et al 11 reported little bleeding in their surgical interventions. There is also no difference related to the hospital stay, which was 3 days.

Hence, the performance of laparoscopic adrenalectomy is one of the objectives in the adrenal glands surgery.

Indeed, the advantages of minimally invasive surgery are evident especially in the case of adrenalectomy. However, despite its advantages, the use of the laparoscopic approach may pose some difficulties. In fact, these issues are subject to the lesion size and the nature of the lesion. In this sense, it is accepted that when the lesion exceeds 10 cm in diameter, conventional surgery is advisable because of the difficulty of

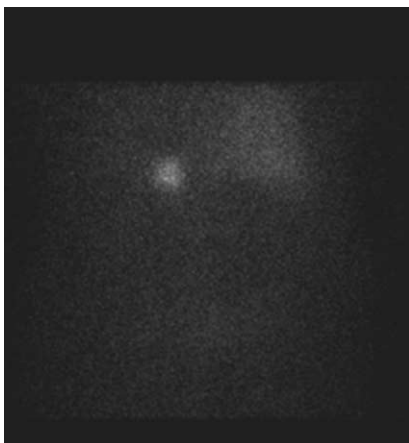


FIGURE 2. Preradioguided surgery planar imaging showing the left adrenal adenoma.

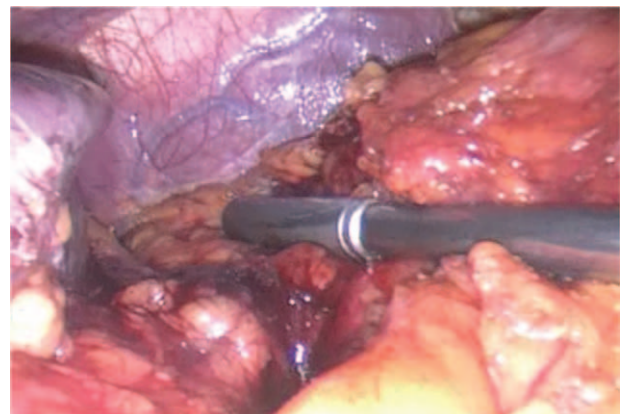


FIGURE 3. Intraoperative image, gamma probe points to the adrenal adenoma.

dissection.²⁻⁶ Moreover, in the case of malignant tumors, the laparoscopic access might be questionable and in any case has to be discussed.²⁻⁶

However, there are situations, mainly technical, hindering laparoscopic surgery and leading to conversion to open surgery. In this regard, the average conversion rate to the complete adrenal surgery varies from 3.8% to 6.7%⁶⁻¹² although certain conditions, as the major lesion size can make difficult the surgery, could increase these rates. In any case, the technical difficulties for laparoscopic access to the left adrenal gland and right adrenal gland differ. In fact, right adrenal gland access does not generally imply difficulties, although previous hepatectomy, mainly of right segments, could make difficult the surgery. In the case of the left gland, however, the existence of prior surgery in the abdominal cavity, as splenectomy or nephrectomy, or extreme obesity can present some difficulties, much considering that the lesion is, often, not usually large.

There are supportive studies such as from Berber et al.¹¹ They suggested retroperitoneal approach in the patients who have previous abdominal surgery. These authors specifically addressed extensive adipose tissue mass as a complicating factor of retroperitoneal approach and suggested the peritoneal approach in the patients who have no extensive previous abdominal operations. Additionally, Hirano et al¹⁰ reported 5 conversion in the transperitoneal approach, bleeding in one, adhesion to periadrenal adipose tissue and the cava vein in 3, and no identification of tumor in the remaining case. However, we do not discuss the surgical approach, but our contribution is that the radioguided surgery is a great help in these cases, regardless of the surgical approach.

Another set of potential problems is that laparoscopic surgery can be conditioned by the fact that in several tumors, such as the paragangliomas, exploration, and access to the place of typical settlement areas may be complicated.¹³

In adrenal diseases, it has been demonstrated the usefulness of certain radioactive isotopes for the scintigraphic detection of some tumors of both, the core and the adrenal cortex. Thus, in this line of facts, meta-¹²³I-iodo-benzyl-guanidine or ¹³¹I-6-beta-iodo-methyl-19-norcolesterol (131I-NP-59) is radiopharmaceuticals of great interest in order to diagnose a tumor or hyperplastic lesions of adrenal medulla and cortex respectively.

Moreover, portable gamma probe has been described as one of the elements of great interest and aid the surgeon to locate a lesion or tumor during the surgery. In fact its usefulness and effectiveness have been proven to be helpful in intraoperative lesion localization in different conditions, both tumor and nontumor lesions, and with different radioisotopes. This is the case of differentiated thyroid cancer with ¹²³I or ¹³¹I, the sentinel node biopsy with ^{99m}Tc-albumin nanocolloid,¹⁴ in neuroendocrine tumors at the enteropancreatic area with ¹¹¹In-DTPAOC or more recently ^{99m}Tc-HYNIC-[D-Phe 1, Tyr 3-Octreotide],^{15,16} in colorectal cancer with ¹⁸F-FDG,¹⁷ in parathyroid adenoma with ^{99m}Tc-MIBI,¹⁸ and many other diseases.^{19,20}

But where the radioguided surgery has had more development is at the technique of sentinel node biopsy in breast and melanoma mainly, and to a lesser extent in other tumors such as gynecological, penile cancer, prostate, and other ones.²¹

Nowadays it has also been described the interest for intraoperative localization of lesions derived from the adrenal medulla,²² although to date it has not been found in the reviewed scientific literature, no reference to the interest of radioguided surgery in adrenal cortical disease.

So, all the evidence available in other indications encouraged authors to consider this possibility in the case of the patients of this work.

During adrenal glands surgery, the usefulness of the gamma probe could be questionable as unnecessary in a patient without extreme obesity or no history of abdominal surgery.

On the other hand, the presence of intra-abdominal adhesions or extreme obesity can create some problems in accessing the adrenal glands, in particular in tumors or lesions located at the left gland, mainly those with a diameter <2 cm, as it usually happens in patients that suffer from primary hyperaldosteronism.

In this fact we have found in both patients, the one affected by an adrenal aldosteronoma and in the patient affected by Cushing's syndrome that the intraoperative use of a handheld gamma probe facilitated the surgery on the detection of the location of the lesion.

However, the technique has not been used in complex surgical situations, like in cases we have presented.

Some authors considered the use of intraoperative ultrasound as a supportive method of lesion location.^{7,10,11,23} But the assistance provided by the portable gamma probe is more accurate because, on one hand its handling is easy and on the other the absence of images from the adhesions and adipose tissue that could be susceptible to cause diagnostic confusion.

Thus, the radioguided surgery can take, according to our experience, a place in laparoscopic access of the adrenal glands, especially in specific situations, such as previous abdominal surgery, extreme obesity, and small tumors. Moreover, it allows us to differentiate the lesion from the physiological activity that is a source of potential artifacts, eliminating false positives. Thereby, with the radioguided surgery it is possible to obtain a precise anatomical location of the tumor and facilitate the laparoscopic approach. It is explained because there is no background uptake that can confuse with the tumor. This is better performed in patients in whom the individual conditions hamper the access to the gland and could excessively extend the operating time. On the other hand, it would confirm the complete resection of the lesion.

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