Sentinel nodes in complex areas: innovating radioguided surgery

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Chapter 6

Prostatic lymphatic drainage with sentinel nodes at the ventral abdominal wall visualised with SPECT/CT: a case series

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ABSTRACT

Lymphatic drainage from the prostate is mainly directed towards pelvic sentinel lymph nodes, although presacral and para-aortic sentinel nodes have also been found with lymphatic mapping. In this case series we describe direct lymphatic drainage towards the anterior abdominal wall in three patients with prostate cancer. In one patient the sentinel node at the anterior abdominal wall contained metastasis. Sentinel node sampling provides the possibility to map all nodes on a direct drainage pathway, in contrary to regional pelvic nodal dissection with which some sentinel nodes may be missed.
INTRODUCTION

Sentinel lymph node mapping is used for staging of prostate cancer patients. Several groups have validated sentinel node lymphadenectomy with open as well as laparoscopic procedures.\(^1,2\) Lymphatic mapping with planar lymphoscintigraphy or SPECT/CT can preoperatively detect and localize sentinel nodes.

Lymphatic drainage from the prostate is directed mainly towards pelvic sentinel nodes but drainage towards sentinel nodes outside the pelvic area has also been described.\(^1,2\) Direct drainage towards the anterior abdominal wall however, has not been clearly described before. In this case series we describe three prostate cancer patients with direct drainage towards a sentinel node in the proximity of the medial umbilical ligament. Those three patients have been extricated from a series of 58 patients who underwent sentinel lymph node mapping for prostate cancer.

CASE NO.1

A 54 year old patient with an initial prostate specific antigen (PSA) of 22 μg/ml was diagnosed with cT2 prostate cancer with a Gleason sum score of six. After therapy with high intensity focused ultrasound. The PSA started rising again and with a PSA of 5.3 μg/ml, and negative prostate biopsies, a PET-scan and a bone scan were made. Both imaging procedures did not show evidence of metastases and the patient was scheduled for a laparoscopic sentinel node biopsy to exclude presence of lymph node metastases as a reason for the rising PSA.

The radiotracer (196 MBq of 99mTechnetium-nannocolloid) was injected transrectally in the all prostate quadrants, guided by ultrasonography. Preoperative planar lymphoscintigraphy in combination with SPECT/CT showed drainage to a sentinel node at the anterior abdominal wall. Figure 1 shows the location of this sentinel node on a SPECT/CT fusion image. Sentinel nodes in the obturator fossa on both sides were also visualised.

During laparoscopy, all sentinel nodes were harvested including the one at the abdominal wall, which was found in proximity of the right obliterated umbilical artery (plica umbilicalis medialis). No nodal metastases were found on pathological examination and the patient received regular follow-up with periodical PSA checks.
CASE NO. 2

A 66 year old patient with a PSA of 20 μg/ml was diagnosed with T3 prostate cancer with a Gleason sum score of seven. The patient was scheduled for a laparoscopic sentinel node biopsy.

The radiotracer (239 MBq of 99mTechnetium-nannocolloid) was injected. Preoperative planar lymphoscintigraphy in combination with SPECT/CT showed drainage to a sentinel node at the anterior abdominal wall (as shown in figure 1), as well as drainage to a left para-iliac sentinel node and a right para-iliac sentinel node.

During laparoscopy, all sentinel nodes could be harvested. The anteriorly visualised sentinel node was located inside the abdominal wall, at the right obliterated umbilical artery. On pathologic examination the sentinel node inside the abdominal wall and the sentinel node

Figure 1 | Patient 1: Fused SPECT/CT image showing the sentinel node located on the right side near the anterior abdominal wall (A). Another sentinel node is observed in the laterodorsal area of the pelvis. Patient 2: Fused SPECT/CT image showing the sentinel node located near the right anterior abdominal wall (B). Activity at the central area of the pelvis is also visualised, corresponding to the injection side of the radiotracer.
located in the left para-iliac area contained metastasis. The patient received radiotherapy to the prostate as well as the pelvic area in combination with three years of hormonal treatment.

**CASE NO. 3**

A 67 year old patient was initially diagnosed with T3 prostate cancer (PSA 3.3 μg/ml, Gleason sum score eight). A bone scan and CT-scan did not show suspicion of lymphatic or distant metastases. To evaluate the lymph node status a sentinel node biopsy was performed.

The radiotracer (170 MBq of 99mTechnetium-nannocolloid) was injected. Preoperative planar lymphoscintigraphy in combination with SPECT/CT showed drainage to a para-iliac sentinel node on both sides in the obturator fossa. Furthermore, a para-aortic sentinel node was found and SPECT/CT revealed an additional sentinel node in the anterior abdominal wall. The results of preoperative imaging in this patient are shown in figure 2.

During laparoscopy all sentinel nodes were harvested and were tumour free. The anteriorly located sentinel node was found in the paravesical area.

The patient received post-operative radiotherapy to the prostate in combination with six months of hormonal treatment.

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**Figure 2** | Planar images after fifteen minutes (A) and two hours (B) show distinct drainage to sentinel nodes in both obturator fossa as well as drainage to an intense para-aortic mid-abdominal hotspot. On the lateral image after two hours (C) also a weak hotspot ventral of the prostate is visualised (arrow). On SPECT/CT this hotspot appears to be a sentinel node located just lateral of the bladder, anteriorly of the prostate (arrow). The three-dimensional volume rendering reconstruction of the fused SPECT/CT (E) shows an anatomic overview of the pelvic sentinel node as well as the anteriorly located sentinel node (arrow).
DISCUSSION

Lymphatic drainage from the prostate appears to follow variable pathways. Several authors have reported that higher rates of positive lymph nodes will be found when the area of pelvic lymph node dissection is enlarged.

Lymphadenectomy studies, as well as lymphangiography have been used to analyse the lymphatic drainage in the past and showed primary lymphatic drainage towards the obturator fossa, external and internal iliac area, presacral regions and hypogastric area. A recent study by Mattei et al. also describes the primary prostatic lymphatic landing sites. In this study all radioactive lymph nodes, as seen with SPECT/CT or SPECT/MRI one hour after injection, were regarded as primary lymphatic landing sites, while no difference was made between sentinel nodes and secondary tier. In this series, 8% of the radioactive nodes was found in the presacral / perirectal regions and 12% of the radioactive nodes was found in the para-aortic / para-caval regions. No nodes near the anterior abdominal wall were found.

In studies regarding sentinel node lymphadenectomy, substantial amounts of sentinel nodes were found outside the area of limited dissection (obturator fossa and region around external iliac artery). In 1055 prostate cancer patients, Weckermann et al. found sentinel nodes outside the obturator fossa in 63% of all patients and therefore advise to do either sentinel node biopsy or extended pelvic lymphadenectomy. In this study, some sentinel nodes were also found in the presacral, pararectal and paravesical area, although numbers and exact location were not specifically mentioned. The paravesical sentinel nodes might reflect direct drainage towards the abdominal wall as seen in our three patients. Jeschke et al. found sentinel nodes outside the obturator fossa in almost half of their laparoscopic sentinel node procedures. In this study, presacral sentinel nodes were found in eight patients (5.7%) and sentinel node not localized on pelvic sidewalls were found in six patients (4.3%), though the exact localization was not mentioned. In our previous series of sentinel node mapping in prostate cancer patients, we also found sentinel nodes outside the obturator fossa and even outside the region of extended pelvic lymphadenectomy in a substantial amount of patients, especially when a SPECT/CT was performed. In this last study we showed one patient with a sentinel node near the abdominal wall. So far, direct drainage towards the anterior abdominal wall has also been observed in three other patients at our institute. Those other three are presented in this case series. A reason why direct drainage towards these nodes has not been described before may be the fact that they are easily missed on planar images. On anterior planar images the radioactivity within the node is overprojected by the injected
radioactivity in the prostate. SPECT/CT however, clearly shows these nodes as well as their exact anatomic localization. The fact that in one patients the sentinel node in the abdominal wall contained a metastasis confirms the relevance of sampling of these nodes, which is only possible if lymphatic mapping is performed instead of routine regional dissections.

CONCLUSION

Lymphatic drainage from the prostate shows substantial interpersonal variation and direct drainage outside the pelvic area is observed frequently. We report on three cases of direct drainage towards sentinel nodes in the anterior abdominal wall; one of these sentinel nodes was tumour bearing. With lymphatic mapping followed by sentinel node biopsy, sentinel nodes outside the area of routine dissection can also be sampled.

REFERENCES